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Volume 24 Number 1
FEBRUARY / MARCH 2017

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From The Editor

At the start of the new administration, 66 percent of Americans say they do not trust the government to protect consumer interests and rights, according to the 2017 Consumer Voices Survey from Consumer Reports. The survey uncovered key consumer issues, including healthcare, higher education, privacy, and yes, food safety. The survey found that six out of 10 Americans are either slightly (30 percent) or not at all confident (30 percent) that the country's food supply is safe, free of contamination, and produced without unnecessary antibiotics.

These findings preceded President Donald Trump's recent signing of an executive order that is being described as "two out, one in," meaning that for each new federal regulation, two existing rules are to be cut. The executive order is in keeping with one of Trump's campaign promises of rolling back federal regulations to control regulatory costs and benefit large and small businesses.

But how will this impact Americans' already shaky view of the government's capability to protect them from the dangers of foodborne diseases?

As reported by Consumerist "...not all regulations are reflexively opposed by the businesses affected by them," says Michael F. Jacobson, executive director at the Center for Science in the Public Interest. "Certainly in the food safety world, responsible business leaders supported the Food Safety Modernization Act, which required the writing of new regulations that keep produce, packaged foods, and imports safe."

Indeed, many are left wondering if Trump is too rash when it comes to regulations designed to protect consumers, such as rules in the food industry. A federal hiring freeze imposed on the USDA isn't helping matters as this will undoubtedly delay FSIS lab tests. As a result, food contaminants may not be discovered in time, putting consumers' health at risk.

The Consumer Voices Survey from Consumer Reports sought to benchmark whether Americans are confident that the government is looking out for consumer interests. According to the organization, regardless of their political leanings, all consumers are wary about the future of specific consumer protections and rights.

Marian Zboraj
Editor

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FARM TO FORK SAFETY

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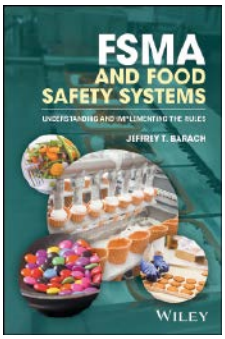

New Food Safety Resource

"FSMA and Food Safety Systems: A Guide to Understanding and Implementing the Rules" is a book that provides guidance for small- to mid-sized businesses on how to design, implement, and maintain a world-class Food Safety Plan that conforms to FSMA regulations. With practical and up-to-date advice, the author Jeffrey T. Barach offers a straightforward approach for readers to successfully migrate into FSMA. The inclusion of fully developed Food Safety Plans as well as examples of hazards and preventive controls make this book ideal for those who are new to the regulations and also those with a plan already in place. Go to http://ow.ly/Quxq307GQfr for more information.

New Food Quality & Safety Blog!

Launched in January 2017, the monthly Food Quality & Safety blog written by industry expert Judy Sebastian shares insights on a variety of hot topics relevant to professionals in the food and beverage industry. Subscribe to the blog feed at www.foodqualityandsafety.com/food-quality-safety-blog/.

ISO Specification for Animal Welfare

Consumers are increasingly concerned about the treatment of animals and the well-being of farmed animals is strongly associated with the quality, and even the safety, of food. The demand for products complying with animal welfare standards is growing, giving producers who maintain these high standards a competitive advantage. The new ISO technical specification ISO/TS 34700:2016, Animal Welfare Management—General Requirements and Guidance for Organizations in the Food Supply Chain, will help the food and feed industry develop a plan that is aligned with the principles of the World Organization for Animal Health's Terrestrial Animal Health Code and ensure the welfare of farm animals across the supply chain.

Toxic Chemicals in One-Third of Fast Food Packaging

A new U.S. study suggests fast-food packaging may be harmful, reports Reuters. The study found one-third of fast food packaging contain per- and polyfluoroalkyl substances (PFASs) that give it stain-resistant, water-repellant, and nonstick properties. But these fluorinated chemicals have also been linked to an increased risk of certain cancers, hormone problems, high cholesterol, obesity, and immune suppression in human and animal studies. For the study, researchers tested for PFASs in more than 400 samples of paper wrappers, paperboard, and drink containers from 27 fast food chains. The man-made chemicals have been used for decades in products ranging from food wrappers to clothing, nonstick cookware, and fire-fighting foams. People may be exposed to PFASs from direct contact with these products, through the air they breathe, the food they eat, and the water they drink. Serving food in wax paper instead of grease-resistant wrappers typically used in food packaging might be one way to reduce contact with the chemicals.

Demand for Gluten-Free Foods Expected to Increase

As awareness of celiac disease continues to increase, the demand for gluten-free foods is expected to dramatically rise, according to a new report released by the Canadian Celiac Association and the Allergen Control Group. The "2016 Gluten-Free Stakeholder Update & Planning Session" report contains key findings, observations, and future plans. Though 1% of Americans are thought to have celiac disease, nearly 83% go undiagnosed. It is expected that methods of accurate diagnosis will increase and, combined with increasing awareness spurred by marketing and activist consumer groups, will create new avenues of growth in the market. To download the complete report, go to http://gfstakeholdersession.com/#/.

EFSA Re-Examines Palm Oil Health Risks

As reported by Reuters, the European Food Safety Authority (EFSA) will re-examine its warning on health risks stemming from palm and other vegetable oils, a spokeswoman at the European body said in light of a recent study expressing less concern than EFSA. Food producers across Europe are closely monitoring independent authorities' indications on health risks related to palm oil, a low-cost ingredient that is used in a wide range of products from biscuits to chocolate spreads. Last May, the Italian-based EFSA said palm oil generated more of a potentially carcinogenic contaminant than other vegetable oils when refined at temperatures above 200° degrees C. However, it did not recommend consumers stop eating it. In Italy, the warning triggered a consumer backlash against foods containing the oil, pushing the country's largest supermarket chain Coop to boycott it. Barilla, Italy's largest producer of baked goods, eliminated palm oil after EFSA's opinion, but Nutella maker Ferrero mounted an advertising campaign to defend its use.

In FDA News...

The U.S. FDA issues guidance for industry entitled, "Third-Party Certification Body Accreditation for Food Safety Audits: Model Accreditation Standards." This final guidance contains FDA recommendations on third-party certification body qualifications for accreditation to conduct food safety audits and to issue food and/or facility certifications under the voluntary third-party certification program established under FSMA. In creating the model standards, FDA looked to existing standards for certification bodies to avoid unnecessary duplication of efforts and costs.

The agency also issues for public comment a draft guidance to help sprout operations meet new standards to keep sprouts free of contamination. Sprout operations have new requirements under the Produce Safety Rule mandated by the FDA FSMA. Sprouts present a unique risk because the conditions under which they are typically produced are also ideal for the growth of bacteria that cause foodborne illnesses.

The Produce Safety Rule requires, among other things, that covered sprout operations take measures to prevent the introduction of dangerous microbes into seeds or beans used for sprouting; test spent sprout irrigation water for the presence of certain pathogens; test the growing, harvesting, packing, and holding environment for the presence of the *Listeria* species or *Listeria monocytogenes*; and take corrective actions when needed. The draft guidance will be available for public comment until July 2017 at www.regulations.gov.

In addition, FDA completes its evaluation of a variety of pineapple genetically engineered by Del Monte Fresh Produce (DMFP) to have pink flesh, concluding that there are no unresolved safety or regulatory questions about the pineapple. DMFP submitted information to the agency to demonstrate that the pink flesh pineapple is as safe and nutritious as its conventional counterparts. DMFP's new pineapple has been genetically engineered to produce lower levels of the enzymes already in conventional pineapple that convert the pink pigment lycopene to the yellow pigment beta carotene. Lycopene is the pigment that makes tomatoes red and watermelons pink, so it is commonly and safely consumed. DMPF plans to identify the food as "extra sweet pink flesh pineapple" on tags attached to the crown of the fruit.

Research Identifies Food Influencers Setting Trends

Using a research methodology called digital ethnography, "Inside the Minds of Influencers: The Truth About Trust" from the Center for Food Integrity (CFI) identifies influential consumer groups and the motivations that not only dictate food trends, but drive conversations that impact the decisions of others as they make choices at the grocery store or form opinions about the products, processes, people, and brands that define today's food system. Research provides deeper insights into influencers including unspoken motivations, values, top-of-mind issues, emotional triggers, preferred social channels and sources, behaviors, and trusted brands. The research goes beyond surveying what people say they do to demonstrating what they are actually doing. Digital ethnography pinpoints *why* consumers form beliefs and develop behaviors around food, and the "why" speaks to what they value. CFI says communicating with values is three-to-five times more important to earning trust than simply communicating facts and science. These insights are aimed to help food companies build trust by meeting consumers' expectations for transparency and engaging in a meaningful conversation about the food they buy. To download a summary of research, go to www.foodintegrity.org.

Business Briefs

ZFS Ithaca's new soybean processing plant in Ithaca, Mich., expects to boost state's emergent agribusiness industry.

Bunting Magnetics expands its global operations with the acquisition of U.K.-based Master Magnets Ltd.

Synerlink, supplier of packaging technology for the food industry and fresh dairy products, acquires **Sogameca,** a manufacturer of precision machines and cutting tool technology based in Le Mans, France.

Agilent Technologies opens new $14.7 million, 53,000 sq.-ft. Technology Center in Folsom, Calif., which includes a customer applications laboratory and collaboration space, as well as facilities for providing the company's scientific consumables and supplies.

ITP, an Italian manufacturer of polyolefin films for food and industrial packaging, opens its first U.S. sales office and warehouse in Pine Brook, N.J.

Hygiena acquires **DuPont Nutrition & Health's** global food safety diagnostics business, which includes the BAX and RiboPrinter Systems and associated test kits; a global and technically trained sales, R&D, and manufacturing organization; and in-house production capacity.

Lloyd's Register (LR), a global engineering, technical, and business services organization, acquires **Acoura,** the U.K.'s compliance and safety specialists for the food and drink industry, to strengthen LRQA's food safety assurance services. LRQA is a member of the LR group.

TruTag Technologies enters into a strategic partnership with **PT. Carsurin,** Indonesia's private inspection and testing company.

MilliporeSigma acquires BioControl Systems to open growth opportunities in the food and beverage space, particularly in the U.S.

Cargill opens two major R&D facilities in North America and one in China that focus on investing in the future of food to meet shifting consumer expectations.

Members of the restaurant industry, including **National Restaurant Association,** form the **Restaurant Law Center,** which provides legal advocacy on behalf of the industry to fight against overregulation on a local, state, and federal level.

NSF International completes acquisition of food safety and water testing experts **G+S Laboratory** in Rheda-Wiedenbrück, Germany.

Washington Report

Public-Private Sector Working In Harmony

Efforts are underway to recognize private certification schemes like GFSI as equivalent to compliance with FSMA

BY **TED AGRES**

As the global food chain becomes more intertwined and as pressures to enhance food safety grow, government regulators in such diverse countries as the U.S., China, Canada, and Mexico are seeking to strengthen and streamline their inspection activities by leveraging private-sector audit and certification activities.

The presumption is that private certification schemes, such as those recognized by the Global Food Safety Initiative (GFSI) or developed by the International Standards Organization (ISO) can help food facilities meet or exceed national food safety laws. Thus, food companies that have been audited and certified by organizations such as the SQF Institute, BRC Global Standards, or FSSC 22000 are highly likely to be in compliance with government food safety requirements. This would allow regulators to focus their limited inspection resources on unaudited companies, considered more likely to have food safety problems than audited and certified firms.

Canada is in the process of implementing a new certification policy that would tailor inspection and oversight activities to private audits. "Where companies are certified to be in good standing to a scheme that we've assessed, we will give them credit," said Mark Burgham, senior director for program policy integration at the Canadian Food Inspection Agency (CFIA).

The audit credit would be entered into an algorithm that CFIA created, which also includes the firm's compliance history, its inherent product and process safety risks, international intelligence, and other factors. Outputs from the algorithm "will influence the level of inspection, the frequency of inspection, or how we target specific direction to our inspectors," Burgham told a GFSI-convened briefing in Washington, D.C. in November 2016.

In a pilot project, GFSI benchmarked schemes "met or exceeded" Canadian food safety standards for preventive controls, Burgham said. While CFIA will neither endorse nor recognize any specific private certification scheme, "there is recognition of great things going in industry that we need to understand better and ensure that we leverage," he added. "So we will be looking at matching the highest risks with how we respond to them."

Convergence with FSMA

"If you have a GFSI-benchmarked certification, you are very close to being compliant with FSMA [Food Safety Modernization Act]," said Mike Robach, chairman of GFSI's board of directors and vice president for corporate food safety and regulatory affairs at Cargill Inc. "That's the way we've prepared for it both with Cargill in the U.S. and in our facilities outside of the U.S. that export to the U.S.," he told conference attendees.

In July 2016, Robach and other GFSI officials met with Stephen Ostroff, MD, FDA deputy commissioner for foods and veterinary medicine, to discuss a pilot project that would compare GFSI's benchmarking requirements against FSMA regulations. As part of this effort, GFSI commissioned The Acheson Group, founded by David Acheson, MD, former FDA associate commissioner for foods, to conduct a side-by-side comparison of FSMA's final preventive controls rule with GFSI's new Version 7, due to be issued in January 2017. GFSI had planned to discuss the results of that analysis with the FDA in early 2017, Robach said.

"We hope and believe that given the alignment between GFSI and FSMA that there is a role for GFSI to play in demonstrating compliance with the new law as one of several risk-based criteria in compliance, just as we've seen with Canada," Karil L. Kochenderfer, GFSI's North American representative, tells *Food Quality & Safety* magazine.

The preventive controls rule (Current Good Manufacturing Practice and Hazard Analysis and Risk-Based Preventive Controls for Human Food) requires U.S. and foreign firms that manufacture, process, pack, or hold food to have written plans that identify hazards, specify steps to minimize/prevent those hazards, identify monitoring and recording procedures, and

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specify actions that will be taken to correct problems that arise. FDA has the authority to evaluate these plans and inspect facilities to ensure the plans are being followed.

"GFSI Version 7 meets or exceeds all of the requirements in the FSMA preventive controls rule," Dr. Acheson said. "GFSI sets you on an extremely good trajectory to be ready [for an inspection], and puts you in a very good place as to FSMA compliance," he told the conference.

In some cases, GFSI Version 7 contains requirements that are not reflected in FSMA, such as for food safety management, responsibility, and resource management. Other GFSI elements, such as for traceability and food defense, are included in other FSMA rules. Dr. Acheson compared several GFSI schemes, including SQF, BRC, and FSSC, with FSMA. "All match up well and are essentially either comparable or exceeding FSMA," he said.

For example, in a 2013 analysis, FSSC 22000 "often exceeds FDA requirements, either by being clearer about the specific expectations or by applying the requirements more broadly within a facility," Dr. Acheson said. "A facility that has FSSC 22000 certification is in an excellent place with regard to compliance with PC rules as currently written."

FSMA, like the Safe Food for Canadians Act, includes provisions that allow regulators to take into account private certification when evaluating compliance with the law. For example, FSMA's preventive controls rule states that companies certified by GFSI or a similar system do not need to duplicate their existing records when certification requirements "mirror" FSMA's. Similarly, facilities can use GFSI-compliant food safety plans when such plans meet the requirements of rule.

"We expect that many existing plans will need only minor supplementation to fully comply with these requirements," the preventive controls rule states. "Relying on existing records, with supplementation as necessary to demonstrate compliance with the requirements of the human preventive controls rule, is acceptable." Nevertheless, FDA also makes clear that GFSI certification does not automatically guarantee compliance with the law.

"We have no plans to endorse certification under GFSI (or any other standard setting organization) as satisfying the requirements for validation," the preventive controls rule states. "However, to the extent that scientific and technical information available from GFSI or another standard setting organization provides evidence that a control measure, combination of control measures, or the food safety plan as a whole is capable of effectively controlling the identified hazards, a facility may use such information to satisfy the validation requirements of the rule."

As Dr. Acheson interprets this, "The FDA is saying that you can and should leverage all that you've done. If you are GFSI-certified you've done a lot of this; don't do it all over again. Use it, leverage it to build your food safety plan. Rely on existing records and supplement them as necessary. Then be ready to show the FDA inspector your food safety program, when asked. You are going to heavily leverage your GFSI-certified programs in answer to that question," he said.

Growing International Interest

Mexico and China appear to be following Canada's lead, and officials from nearly two dozen other countries are at least exploring the possibility of incorporating private certification into their regulatory mechanisms. GFSI and Mexican officials are discussing a possible memorandum of understanding that would align GFSI certification with compliance to a new risk assessment and management norm proposed by Mexico's National Service for Health, Food Safety and Agricultural Food Quality (SENASICA), GFSI officials tell *Food Quality & Safety*.

In November 2015, GFSI and China's Certification and Accreditation Administration announced that Chinese Hazard Analysis and Critical Control Points were "technically equivalent" to the technical requirements of GFSI Version 6. Technical equivalence is a new category specifically for government-owned schemes, and is comparable to GFSI recognition for commercial schemes. "The Chinese government [is] the first government to approach GFSI and submit their national certification scheme to be assessed against the GFSI requirements," GFSI announced at the time.

During last year's Global Food Safety Conference (GFSC) in Berlin, Canada co-chaired a side meeting with representatives from 19 other nations to discuss the role of private certification in regulatory oversight. "We are going to continue this conversation and have another round of government-to-government meetings" during the February 2017 GFSC in Houston, Burgham said. Regulators in Canada and other countries have "a great opportunity to leverage the investments that private companies are making toward certification," he added. "There are real opportunities for those parties to work together."

Building Food Safety Capacity

As global markets expand, small food suppliers and processors in less developed countries will become more prominent. Helping them to become certified will enhance the safety of the overall food chain. To advance this effort, GFSI and the United Nations Industrial Development Organization (UNIDO) agreed in June 2016 to develop a program to help small or less-developed food companies become certified, allowing them to potentially gain access to worldwide markets. The joint project is based on GFSI's Global Markets Program, in which companies that lack or have underdeveloped food safety systems can gain market access through certification to one of the 10 GFSI-recognized schemes.

"This is not a small task. We want to enable the smaller or less developed companies and help them to build that food safety pathway within two years," says Cindy Giang, senior director, global food safety and supply chain compliance for McDonald's Corp. USA, and a GFSI board member. "We do not want to have any redundancy around food safety audits. We want to leverage resources, so once audited, once certified, then they are recognized by everyone. That's our goal."

Pilot projects have been established in China, in Southeast Asia, and Africa. "The World Health Organization estimates that up to 600 million people fall ill every year after eating contaminated food," comments Philippe Scholtès, managing director, Program Development and Technical Cooperation, at UNIDO. "Our collaboration with GFSI will further strengthen and promote multiple benefits of safe food for social inclusiveness, sustainability, and industrial development." ■

Agres is an award-winning freelance writer based in Laurel, Md. Reach him at tedagres@yahoo.com.

Innovative Tech

Soft Robotics' tools can delicately pick and pack food products, such as bagels.

got bots?

Robots are contributing to productivity in the food chain with increasing regularity | BY **LINDA L. LEAKE, MS**

How do you feel about working side by side with a robot? If the thought scares you, consider this: It is now becoming safe enough for robots to work alongside people. This development is one of hottest phenomena trending in the world of robotics these days, according to Ai-Ping Hu, PhD, senior research engineer, Georgia Tech Research Institute (GTRI), Atlanta, Ga.

"Most industrial robots are surrounded by expensive guard fences and safety features," Dr. Hu says. "A new breed of robot, called a collaborative robot, or co-robot, now has sensors in each joint that can detect physical contact. Similar to an airbag in a car, a co-robot can react to a human presence and stop within a fraction of a second to prevent harm to people."

Universal Robots USA, Inc.'s (UR) co-robots (also widely called cobots) are being employed in the food and agriculture industries along the supply chain, including production, processing, and distribution, says Douglas Peterson, MBA, general manager at UR, Ann Arbor, Mich.

UR sold the world's first commercially viable cobot in 2008, long before the term for this emerging robot class was widely used. A newer model followed in 2012, then a tabletop cobot was introduced in 2015.

"A tremendous benefit of UR co-robot arms is that they free up workers from repetitive and dangerous or unpleasant tasks in harsh environments," Peterson says. "As a result, UR cobots help to reduce physical strain and accidental injuries, while making human operators available for qualitatively higher tasks. And relative to food safety, the outer casing of the cobots is specifically designed to be washdown capable."

Axium Foods, Inc., South Beloit, Ill., a mid-sized salty snack food manufacturer, made a transition from fixed automation to flexible in early 2016 with the purchase of two UR collaborative robots.

"We have deployed these robots in several unique applications," says Jerry Stokely, MBA, Axium's president. "In each application, the robot is the center of the total work cell performing either tasks at higher speed than humans or tasks that, over time, lead to repetitive trauma injuries, such as carpal tunnel syndrome."

Axium's UR robot deployment includes packing finished flexible snack food bags into shipping cartons at high speed. "This has been a cost-effective solution for us compared to the fixed automation case packers we were previously using," Stokely says.

Food Safety Features

FANUC America, Rochester Hills, Mich., has been ahead of its time relative to preventing food safety hazards, according to Nishant Jhaveri, MS, the company's manager of small robots and applications.

"The Food Safety Modernization Act's regulations are now shifting food companies' focus from responding to contamination to preventing hazards in first place," Jhaveri points out. "But FANUC has been investing heavily in research and development efforts since 1982 in order to bring the best-in-class robotic products for food manufacturers to the marketplace. Because of these extensive efforts, FANUC has continuously expanded food-grade robot models to handle a variety of primary (unwrapped) and secondary (wrapped) food handling applications, all of which allow food manufacturers to realize the highest possible uptime and consistent quality, while minimizing hazards.

"The newest edition in the FANUC portfolio, introduced in November 2016, includes the M-20iB/25C food/clean model that offers a fully enclosed design, a stainless wrist flange with IP67 protection rating for the entire unit to withstand harsh environments and provide adequate chemical resistance in most cleaning processes," Jhaveri continues.

Jhaveri says all FANUC food-grade robots, including the new M-20iB/25C, offer NSF-H1 grade lubricants for enclosed gearboxes in robot joint axes. "This minimizes potential food safety risks and toxicity hazards in the event a grease leak or contamination may be introduced in the food products when robots are installed directly

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above, or robots move over, food products during packaging operations," he relates.

Robots are being integrated with other equipment to enhance food manufacturing and packaging operations.

"One of our clients, a major U.S. nut processor, reports that they are achieving goals for customer acceptance and labor savings utilizing Delkor's MSP Series casepacker, a system that uses FANUC M-3iA and FANUC M-710iC robots to collate pouches of nuts on a packaging line and then case pack them at speeds up to 150 pouches per minute," says Rick Gessler, MBA, director of marketing and strategic account management, Delkor Systems Inc., St. Paul, Minn., which is an integrating partner of FANUC. "The six-axis M-710iC is able to easily load Delkor's Cabrio Case, a case recently named in Walmart's Retail Ready Packaging Guide as one of four acceptable case formats for pouch packaging," Gessler says.

No Uniformity? No Worries!

Another groundbreaking and rapidly advancing development, Dr. Hu says, is that robots are now able to function successfully in unstructured environments.

"Unlike traditional robots in an automobile factory that handle identical-sized parts all day long, robots are now able to function in biological systems where you can't expect uniformity," Dr. Hu relates. "To that end, we are implementing human senses in robots, replicating senses to the greatest degree possible."

One of GTRI's major research projects, the Intelligent Cutting and Deboning System (ICDS), taps into the senses of sight and touch for processing poultry.

UNIVERSAL ROBOTS

Collaborative robot arms from Universal Robots belong to an emerging new class of industrial robotics that can operate outside of safety enclosures alongside employees.

© FANUC

FANUC's line of collaborative robots are equipped with highly-sensitive contact detection allowing them to share workstations with people.

"With this technology, a bird is positioned in front of a vision system prior to making a cut, and next, the vision system makes three-dimensional measurements of various features on the outside of the bird," Dr. Hu says. "Then, using these features as inputs, custom algorithms define a proper cut by estimating the positions of internal structures, most notably bones and ligaments."

The initial ICDS endeavors are focused on severing the tendons and joints on bird front halves in preparation for removal of the wings and breast meat, which is called the butterfly cut in the industry. "The key goal is to make cuts that both maximize yield and eliminate bone chips in cut meat," Dr. Hu emphasizes. "So we can definitely say our ICDS enhances food safety, since bone chips are a hazard in boneless breast fillets.

"Since deboning is one of the toughest jobs in poultry processing, often with 100 percent employee turnover in some plants in just one year, it's reasonable to envision robots revolutionizing meat processing in the not-too-distant future," he continues, noting that the GTRI team expects to have its deboning system operating in commercial plants soon.

HCR

HCR was awarded $225,000 to use in continued research and development of its robotic strawberry picker.

Produce Applications

The GTRI researchers are also developing cobots with capabilities for early detection of plant diseases using the sense of smell. The technology focuses on volatile organic compounds (VOCs), which all plants emit.

"If you can smell a plant, you can tell something about its health, be it good or bad," Dr. Hu says. "After a plant gets disease, it's easy to smell. The trick is early detection."

To that end, Gary McMurray, MS, GTRI's division chief of food processing technology, is leading work on a robotic sensor to determine the early correlation between VOCs and plant disease, using peanuts and green peppers as the models.

"With these advances, robots are now useful for dealing with living things and more variations in the field," Dr. Hu emphasizes.

Relative to picking and packing in unstructured environments, Soft Robotics Inc., Cambridge, Mass., designs and develops grippers and control systems that offer a firm, yet softer, gentler touch than previous technology, or even human hands, have provided.

"Thanks to advances in the science of soft robotic actuators, it is now possible to automate facilities that have traditionally depended on manual labor for bin picking, order fulfillment, and other complex pick and place tasks," says Dan Harburg, PhD, Soft Robotics' director of business development.

Dr. Harburg emphasizes that conventional robotic grippers are expensive and incapable of operating successfully in warehousing, manufacturing, and

food processing environments where items being handled vary in weight, size, and shape.

"To resolve this problem, we have developed a fundamentally new class of robotic grippers that are adaptive, inexpensive, and simple to use," he says. "Our customers are using our grippers to package products like fresh pizza dough, greenhouse tomatoes, and chocolate snacks."

A gentle touch is also paramount to a robot's success in both indoor and outdoor venues, Dr. Harburg points out. "Robots hold promise for picking fruits and vegetables, but handling peaches or apples in the field without damaging them and at a sufficient speed is still a big problem," he notes. "Automating harvesting operations for farms will require further advances in machine vision, autonomous robots, and gripper technologies."

Strawberry Fields Forever

On Dec. 13, 2016, the National Science Foundation awarded a grant worth up to $1 million to Harvest CROO Robotics (HCR), Tampa, Fla. To be administered in two phases, the National Science Foundation Small Business Innovation Research Program Phase I award provides HCR $225,000 to use in continued research and development of its innovative robotic strawberry picker.

The company plans to develop a fully autonomous strawberry picking platform, according to Mark Brown, HCR's CEO. "Phase I begins Dec. 15, 2016 and will continue through Nov. 30, 2017," Brown relates. "During that time, we will investigate and develop software and hardware tools to orchestrate a team of robotic subsystems."

"While Phase I is a problem solving stage of our project, during Phase II, expected to begin about Dec. 1, 2017, we will focus on actually creating the robotic harvester and getting it to the commercial marketplace," says Gary Wishnatzki, HCR's co-founder.

HCR's strawberry picker prototype was created in 2013, Brown notes. "The prototype can, in an actual working strawberry field, identify, select, and pick only ripe strawberries while leaving unripe strawberries and plants unharmed," he relates. "The use of this technology will improve the quality of the berries picked, reduce energy usage, and increase strawberry yields by at least 10 percent."

Wishnatzki explains that the machine in development will have 16 robotic pickers mounted under a mobile platform system, enhanced with GPS (global positioning system) and LIDAR (light detection and ranging) technology.

"In our system, GPS will guide the vehicle, and the robots will be independently GPS positioned over every strawberry plant with a secondary GPS system," Wishnatzki relates. "The plants will be mapped down to less than .5 inch accuracy. We will be using LIDAR for collision avoidance, like self-driving cars will use in the near future." ■

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For bonus content, go to February/March 2017 issue on FoodQualityandSafety.com and click on "Robots Help Boost Food Chain Productivity."

Industry Insights

Beware of Product Packaging Pitfalls

Mistakes on physical packaging and nutrition labels can lead to litigation from regulators and plaintiffs' lawyers

BY **SHAGHA TOUSI**

It is no surprise that in today's times, when healthy eating and fitness regimens have taken on increased popularity, litigation involving food and beverage companies and the claims they make on their product packaging have also seen a rise. According to a 2015 Nielson study, 80 percent of North American respondents surveyed said they would be willing to pay more for foods with health attributes. With greater public scrutiny from consumers on food and beverage manufacturers also comes greater scrutiny from regulators and plaintiffs' lawyers, leading to an increase in class actions focused on these issues. So how can food and beverage manufacturers avoid litigation targeting their product packaging? To understand the answer to that question, it is beneficial to understand the types of cases that can be brought and the claims made in those actions.

Potential Sources of Litigation

Regulators and plaintiffs' lawyers pose dual threats as potential sources of litigation to food and beverage companies based on their product packaging and labeling. In regards to regulatory action, the FDA and the Federal Trade Commission (FTC) share overlapping jurisdiction on the labeling of food and beverage products, with the FDA responsible for enforcing regulations on the content of product labeling. Meanwhile, the FTC handles instances of allegedly false and deceptive advertising. The FDA will typically send a Warning Letter as an enforcement tactic, which serves as official notice to the company. FDA can seek court remedies from that point, including injunctions, recalls, seizures, civil penalties, and criminal prosecutions. Through its Division of Advertising Practices, the FTC can bring administrative action, which can result in cease and desist orders. From there, the FTC can initiate court action to seek remedies, such as injunctions and civil monetary remedies.

In addition to avoiding regulatory action, food and beverage companies should be wary of a consumer class action by the plaintiffs' bar. These claims can vary from product liability claims alleging physical harm to false or misleading advertising claims that resulted in a plaintiff (or plaintiffs) purchasing a product he or she may not otherwise have bought. A company may be in full compliance with FDA and FTC regulations, but plaintiffs' lawyers can examine the packaging and advertising for any particular product, identify a single lead plaintiff who allegedly was misled into buying the product, and initiate expensive and prolonged litigation that the company will either have to settle or commit resources to fight. Certainly, if a company is the subject of an enforcement action by the FDA or the FTC, it is likely to draw the attention of plaintiffs' lawyers.

Steps to Prevent Regulatory Action or Litigation

The best way to avoid being the subject of a regulatory action is to make sure your food and/or beverage company is in compliance with all FDA regulations, including by obtaining appropriate certifications from their suppliers and working with co-packers to ensure all appropriate standards are being met. Certain claims—such as nutrient content claims (e.g.,

"low fat," "a good source of protein") and health claims ("diets low in sodium may reduce the risk of high blood pressure")—are strictly regulated by the FDA and can only be made in certain specified circumstances. Food and beverage companies should work with their regulatory counsel to ensure they are in compliance with these regulations.

As to product-specific marketing claims made directly on the product packaging, companies should avoid making claims that go beyond scientifically proven attributes of their products or ignore data supporting the opposite conclusion. In many instances, the FDA has issued formal guidance on certain product attributes; careful food and beverage manufacturers (or their counsel) should be familiar and up to date with the FDA's guidances and ensure compliance. For example, the FDA issued a guidance in May 2016 on the use of the term "evaporated cane juice," stating that it found the term to be false or misleading.

Food and beverage manufacturers should also be sure to have concrete evidence supporting any marketing claims on their packaging in the event that regulators come calling. For example, if a product's label claims that "two out of three doctors recommend including X as part of a balanced diet," there should be clear and convincing survey data supporting the claim. While many FDA regulations apply specifically to the product's nutrition label, the remainder of the product's physical packaging as well as all of the company websites, television ads, social media platforms, and other materials touting the product are subjected to the scrutiny of regulators (and plaintiffs' lawyers, for that matter). Even an action as simple as "re-tweeting" another's praise of the product can be deemed to have been adopted by the company.

Generally speaking, well-meaning food or beverage manufacturers can follow this rule of thumb: If your marketing team is spending significant time and resources to develop a clever alternative to statements or claims that you know are over the line, it's best to avoid those claims—and any crafty versions thereof. Following these general guidelines will help food or beverage manufacturers avoid both FDA and FTC investigations.

Don't Pique the Interest of Plaintiffs' Lawyers

Unfortunately, plaintiffs' lawyers are not bound by the same regulations as the FDA or FTC to limit the cases that they can bring against food and beverage companies. While manufacturers can look to prior cases filed as a guide to subjects that are the current focus of the plaintiffs' bar, there is no guarantee your tagline or marketing theme will not be the next target. One way to avoid piquing the interest of plaintiffs' lawyers is to make sure your product packaging and marketing is well within the boundaries of FDA regulations or guidances. FDA warning letters and FTC investigations are a matter of public knowledge after formal action has been taken. The companies targeted in these actions may find themselves on the receiving end of demand letters and legal complaints by plaintiffs' lawyers.

Definitive statements such as "proven to improve health" and "proven to cause weight loss," as well as undefined terms like "pure" and "wholesome," can also be traps. There has been a significant amount of debate and legal action focused on the meaning of the term "natural," and variations thereof. This is partly due to the difficulty in defining these terms and also the fact that, to date, the FDA has declined to take a position on the interpretation of the term "natural." Thus, companies whose marketing strategy heavily relies on the use of these terms would be prudent to stay informed on recent litigation on this topic and the theories pursued by plaintiffs' lawyers.

Another related area of interest in food and beverage litigation in recent years is the use of genetically modified organisms ("GMO") in the manufacturing process. In late July 2016, President Obama signed into law a bill that puts in place the framework for the development of a national standard for the labeling of GMO food products. While the specifics of the labeling requirements to be developed by the Department of Agriculture over the next two years remain to be seen, particularly with the new presidential administration, it is clear that the labeling of products containing GMOs will be an area of focus by plaintiffs' attorneys. Manufacturers whose products incorporate genetic engineering should work with their food and beverage counsel to ensure their packaging and marketing strategies do not unduly increase their exposure. ■

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Evolution of Food Laws

FSMA Points to a Successful Food Safety Program

Highlighting the revolutionary aspects of the first rule and the revised cGMPs | BY **LIBBY THOMA**

Editor's Note: *This second article in a three-part series reviewing the history of food laws focuses on FSMA's revised GMP requirements.*

According to the CDC, "about 48 million people (1 in 6 Americans) get sick, 128,000 are hospitalized, and 3,000 die each year from foodborne diseases." The FDA viewed this significant public health burden to be largely preventable and as a result, launched the Food Safety Modernization Act (FSMA)—the first major regulatory overhaul in 70 years. The regulations went into effect on Nov. 16, 2015 and are found in 21 CFR Part 117—current Good Manufacturing Practice (cGMP), Hazard Analysis, and Risk-Based Preventive Controls for Human Food (PCHF). The body of legislation defines a dramatic shift in the agency's approach from reaction to prevention by requiring facilities to develop documented food safety plans that identify all potential hazards associated with the process or product and to implement risk-based preventive control measures that minimize or prevent the identified hazards. The FDA has also revised the requirements of the cGMPs, which have been relatively untouched for the last 30 years.

Compliance dates to FSMA are staggered over the next three years. On Sept. 19, 2016, larger companies with greater than 500 full-time employees were required to be in compliance with the PCHF Final Rules and revised cGMPs, and animal food facilities were required to be in compliance with the cGMPs. Small companies with fewer than 500 employees have until September 2017 to comply with the regulations. Businesses regulated by the Pasteurized Milk Ordinance and very small businesses averaging less than $1 million per year in sales have until September 2018 to implement the new rules.

FSMA encompasses the revised cGMPs and the body of the legislation contained in the following seven foundational rules: Preventive Controls for Human Food Final Rule; Preventive Controls for Food for Animals Final Rule; Accredited Third-Party Certification Final Rule; Foreign Supplier Verification Programs (FSVP) Final Rule; Produce Safety Final Rule and Environmental Impact Statement; Sanitary Transportation of Human and Animal Food Final Rule; and Mitigation Strategies to Protect Food Against Intentional Adulteration Final Rule.

cGMPs

Since 1986, the cGMPs in manufacturing, packing, or holding human food have been located in 21 CFR Part 110 Subparts A through G, which cover general provisions, buildings and facilities, equipment and utensils, production and process controls, and defect action levels.

The revised and expanded cGMPs are now found wholly in 21 CFR Part 117 Subpart B and include the below nine sections:

1. 117.10 Personnel
2. 117.20 Plant and Grounds
3. 117.35 Sanitary Operations
4. 117.37 Sanitary Facilities and Controls
5. 117.40 Equipment and Utensils
6. 117.80 Processes and Controls
7. 117.93 Warehousing and Distribution

8. 117.95 Holding and Distribution of Human Food By-Products for Use as Animal Food

9. 117.110 Defect Action Levels

Significant changes to the modernized cGMPs include stricter requirements for allergen control, clarification of definitions, and the inclusion of requirements for section 117.95. Recommended practices have either become required practices or been removed (for basic safety practices that should already be in place). Production and sanitation processes must be explicitly designed to prevent the cross-contact of food products and food packaging with allergens. Since allergens are an inherent part of food and not a contaminant, the term "cross-contact" is used to define the unintentional transfer of allergenic proteins to foods that do not contain like proteins. "Cross-contamination" now refers to foods that have been intentionally or unintentionally adulterated with bacteria, chemicals, or foreign materials. The word "shall" has been replaced with "must," and definitions of terms are now aligned with the definitions established by Codex and the National Advisory Committee on Microbiological Criteria for Foods.

Emphasis is on food packaging as a food-contact surface and controls must be in place for its protection. The regulations no longer include recommended practices by use of the word "should" and some previously non-binding sections, including employee education and training, are now mandatory. In addition, section 117.95 Holding and Distribution of Human Food By-Products for Use as Animal Food specifies new requirements for proper labeling and handling of by-products to prevent cross-contamination of human foods. On Sept. 17, 2018, once compliance is implemented for operations of all sizes, the cGMPs in 21 CFR Part 110 will be removed from the legislation and will no longer be valid.

PCHF

The PCHF, or Preventive Controls for Human Food, Final Rule is the cornerstone of FSMA and is contained in 21 CFR Part 117 Subpart C—Hazard Analysis and Risk-Based Preventive Controls. The rule requires facilities to develop comprehensive food safety systems that focus on prevention-based controls throughout the food chain with the intent to prevent or significantly minimize the likelihood of problems occurring. This involves the development and implementation of a documented food safety plan that includes an analysis of hazards and risk-based preventive controls.

Significant changes to the modernized cGMPs include stricter requirements for allergen control, clarification of definitions, and the inclusion of requirements for section 117.95.

The food safety plan must be developed and/or overseen by a preventive controls qualified individual (PCQI). The PCQI is a person who, through proper training and job experience, is thoroughly qualified to develop, implement, and maintain a food safety program. The PCQI is directly responsible for the development of the food safety plan, overseeing the validation of the established preventive controls, and performing record reviews of the food safety plan documentation. This role is now required through FSMA.

The food safety plan is in many ways similar to the development of a Hazard Analysis and Critical Control Points (HACCP) plan which includes conducting a thorough hazard analysis to identify all potential biological, chemical (including radiological), and physical hazards associated with each step in the process. These hazards may be naturally occurring, unintentionally introduced, or intentionally introduced for economic gain. The primary difference between HACCP and the PCHF plan is that in HACCP, critical limits are mandatory only at CCPs whereas preventive controls include implementing control limits at CCPs and/or at any other point in the process where controls are appropriate for food safety. Preventive controls must be established for each identified hazard to ensure it will be minimized or prevented.

Much like CCPs in a HACCP plan, each preventive control must have established corrections and documented corrective action procedures that prevent the food from entering commerce. Preventive controls must also be routinely monitored and verified as effective. Verification activities may include product testing and environmental monitoring for pathogens or indicator organisms, but only as deemed appropriate to the nature of the food and the preventive control. For example, environmental monitoring would be required if contamination of a ready-to-eat food with an environmental pathogen is a hazard requiring a preventive control. Lastly, the rule mandates that certain preventive controls, like CCPs, be scientifically validated to ensure that they are adequate to control the hazard.

It is important to note that the PCHF Final Rule mandates preventive controls be developed for four elements of the food safety plan: food allergen controls, sanitation controls, the recall plan, and the supply chain program. However, these four programs do not need to be validated. Other preventive controls may not require validation either if the PCQI provides documented justification that validation is not applicable based on the hazard and its corresponding preventive control.

In August 2016, the PCHF draft guidance for the industry was published (available at FDA.gov). It is a work in progress but provides good insight on the agency's current thinking on how to approach implementation of the regulations. Overviews of the remaining six FSMA rules will be covered in the final article of this series that will appear in the April/May issue. ■

Thoma, a food safety and quality professional with nearly 20 years of experience in food manufacturing and food safety auditing, has worked for NSF International for four years as both a GFSI certified auditor and as a technical specialist in the Supply Chain Food Safety group. Reach her at lthoma@nsf.org.

FOOD INDUSTRY UNPLUGGED

The Internet of Things is allowing a more seamless way to solve operational challenges

BY **KEITH LORIA**

The Internet of Things (IoT) has been one of the most exciting advancements in the 21st century, and something that lets us believe that the futuristic world we saw in "The Jetsons" is starting to become reality.

Jim Cerra, CEO of PlanetTogether, notes in the not-so-distant future, all technologies will be integrated and will cooperate to create a smarter, efficient whole.

"To the manufacturing world, that means that facilities will become smart factories," he says. "When all aspects of the plant—from shop floor to sales—are interconnected digitally, the data gained from IoT creates transparency into manufacturing operations. Management and IT departments work in harmony within blended data and production areas, transforming the manufacturing process from a complex of isolated silos into a seamless production environment."

Tech research firm Gartner has predicted that by the end of 2017, there will be nearly 5 billion "things" connected to the Internet, and that number is expected to increase to more than 25 billion in 2020.

IoT is moving from customer applications into professional industries with one heavy adaptor being those in the food industry, be it food manufacturers or those who work in food service or retail.

Steven Kronenberg, an attorney for The Veen Firm, San Francisco, Calif., who focuses his practice on food safety, notes food manufacturers, distributors, and retailers are increasingly implementing IoT to promote food safety and quality.

"IoT products can improve food safety because critical data like storage temperature can be accessed on-demand from anywhere," he says. "This helps companies prevent and respond to problems before they become health risks."

Some examples of how IoT can assist in food safety include an IoT refrigerator door sensor that can send an alert when the door is left open, which minimizes the food safety risk of temperature abuse and saves energy; and IoT temperature sensors that can monitor and record data to confirm that hot buffet foods and cold salad bars stay within safe temperature ranges.

Werner Linders, global director for food safety at Diversey Consulting, notes the data and insights the IoT provides will revolutionize how companies clean and perform food safety tasks.

"Many employees, especially millennials, are not only accustomed to, but also expect user-friendly mobile technologies at their fingertips to aid in their daily work tasks," he says. "The use of technology is also a matter of being agile and increasing productivity to be more competitive. Therefore, employing digital mobile technologies for staff is a necessity and not a luxury anymore."

Diversey Care's food safety innovations are geared toward retail/food service rather than manufacturing. For instance, its IntelliDish solution, a cloud-based monitoring system that makes a customized, connected approach to industrial dishwashing across industries a reality, is powered by the IoT and used in restaurants.

The 411 on IoT

Although it's a phrase that's thrown around quite a bit these days, not everyone understands exactly what the "Internet of Things" really means. In its simplest definition, IoT is defined as devices

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that collect and transmit data via the Internet. These devices could include everything from cellphones to wearable devices to coffee makers. The term is closely linked with RFID as the method of communication, although it also may include other sensor technologies, wireless technologies, or QR codes.

The IoT helps companies utilize data to understand and improve their work processes. Analysts at International Data Corp., or IDC, predict the proliferation of advanced, purpose-built, analytic applications aligned with the IoT will result in a 15 percent productivity improvement for manufacturers in terms of innovation delivery and supply chain performance.

Cold Chain Stays Cool

One specific area in the supply chain where IoT is gaining in popularity is in the cold chain.

Matt Moulton, marketing director of Monnit, a Salt Lake, Utah-based IoT solutions company, says the food industry can see a number of benefits from the IoT thanks to devices like temperature sensors and monitoring devices inside walk-in refrigerators and freezers.

"When you go to the IoT, you reduce the human error factor and you get consistent, timely, and reliable data," he says. "Connected devices provide the ability to receive alerts so if it's after hours or people aren't keeping track of things appropriately, you can see if something is wrong. This could make or break a company by preventing product spoilage."

Today's food supply chains extend around the world. As the demand for locally produced food increases, these newly emerging supply chains are layered over the global networks, thus creating even more complexity. Additionally, consumers do not consider food to be seasonal and expect greater variety and availability year round. These food chain complexities have led to a need for tight temperature controls to ensure continuous food safety within distribution centers, during transport, and at final point of sale.

"A critical innovation that has enabled monitoring of the cold chain is the in-transit temperature control system," points out Linders. "Sealed Air's proprietary TempTRIP solution provides temperature-monitoring services for the cold supply chain that inform companies about their temperature performance throughout the entire supply chain while giving them the ability to easily monitor, track, and analyze the results."

(Continued on p. 22)

Its cloud-based information structure is at the heart of the system and its tracking ability is especially relevant for food retailers because in addition to managing food safety, it also helps to guide merchandizing and reduce food waste.

When it comes to quality control, Kronenberg notes that since many fresh products must be maintained within a specified temperature range, a processor can utilize IoT data to prove that its products were stored properly throughout the supply chain.

The beauty of the digital technology is its user-friendliness and its capacity to seamlessly pair tasks with complementary information.

These products may also have a longer shelf life, which makes them more valuable.

For example, chicken must be stored at or below 40 degrees Fahrenheit and not below 26 degrees for food safety, so companies that can objectively verify that their fresh-labeled chicken has been stored in this temperature range may be able to command a premium price for their product.

Bountiful Benefits for Food Industry

Food safety issues consistently appear on the front pages and sadly not for positive reasons. Millions of Americans get sick every year due to foodborne illness. Annually, foodborne illnesses cost the U.S. economy more than $15.6 billion, according to the USDA. And most food safety experts say the average cost of a food recalls is around $10 million.

The IoT can improve this situation because knowledge is power. The beauty of the digital technology is its user-friendliness and its capacity to seamlessly pair tasks with complementary information.

"On-the-job training is an excellent illustration. For example, digital food safety HACCP (Hazard Analysis and Critical Control Point) systems can offer video and interactive online training embedded in the HACCP checklists so that employees can brush up on information as they perform their daily tasks," Linders says. "Empowering staff with knowledge is an important step in increasing food safety culture through understanding why cleaning and sanitation is essential."

Another example of how technology can improve your food safety culture is access to data. With the help of the modern digital systems, teams can learn more effectively and managers can access operational data 24/7 on secure digital cloud storage. Up-to-date, easy-to-access systems enable managers to take corrective actions proactively when necessary. Risk-based customizations, such as alerts via texts or emails, further enable active oversight and teamwork.

"Applied to food safety and compliance processes and tasks, digitization leads to a simpler and smarter working environment and empowers you to manage risk, ensure ongoing compliance, and ultimately enhance end consumer satisfaction as well as protect and build your brand," says Linders.

Think about temperature monitoring. Temperature monitoring is primarily about protecting investments. Maintenance of the cold chain is a legal requirement in many countries; however, it is also an investment that maximizes the shelf life of food, thus positively impacting logistics, and ultimately customer satisfaction. Refrigeration and freezer failures can therefore be costly in terms of loss of stock, operational performance and brand reputation.

The way air temperature has been monitored in refrigerators and deep freezers has changed significantly in the last two decades. A task traditionally executed by using classic thermometers and paper logs has now evolved to automated digital systems using wireless technology and digital temperature capturing.

"Manual recording and associated documentation can now be replaced by fully automated methods and 24/7 access to reporting at your fingertips, allowing you to achieve important productivity gains: from 1 hour a day for a quick service restaurant to 6 hours a day for a hotel resort," explains Linders.

IoT devices can also automate data recording to facilitate compliance with the Food Safety Modernization Act (FSMA). This can help determine responsibility for problems like temperature abuse that affect product safety and quality.

Additionally, IoT data can more precisely identify the products that need to be recalled and be used to expedite food recalls because searching electronic records usually requires less time than paper-based ones.

"Sooner than later, many consumers will expect all levels of the food distribution chain to implement an IoT-based risk management program," Kronenberg says. "This will help them confirm that a product has been produced and stored properly throughout the supply chain for optimum safety and quality."

Keeping Transportation on Track

Whether over the road, on the rails, in the air, or on the sea, IoT can help monitor and track inventories around the world. GPS devices can let dispatchers know via satellite exactly where on earth any given shipment is located and what the status is at any given moment.

FSMA's Sanitary Transportation of Human and Animal Food rule, which requires companies to have documentation pro-

Trending: Precision Agriculture

According to Verizon's "State of the Market: Internet of Things 2016" report, the agriculture industry is proof that soon, every company will be an IoT business. The report says that one of the biggest trends in farming is precision agriculture, the practice of sensing and responding to variable soil, moisture, weather, and other conditions across different plots. Farmers are deploying wireless sensors and weather stations to gather real-time data about things such as how much water different plants need and whether they require pest management or fertilizer. The expected size of the digital precision agriculture market by 2020 will be $4.55 billion.—*FQ&S*

cesses in place to prevent food safety risks, becomes enforceable as early as April 2017. "Implementing new technology can help those affected not only meet but also exceed the FSMA/transportation rule requirements and ensure food safety best practices—all while improving return on investment," says Angela Shue, senior vice president/general manager at PeopleNet, which offers a host of IoT solutions for the food industry.

PeopleNet has extended the IoT concept to create the Internet of Transportation Things, or IoTT, platform that integrates enterprise and mobile technologies with real-time predictive analysis, helping carriers make more impactful decisions.

"Fleets involved in transporting food throughout the supply chain journey are working to ensure products are moved safely and efficiently," remarks Shue. "The right combination of technology products can help fleets reach this goal through improved traceability, efficient route planning, and better connectivity, helping to ensure that retailers and consumers are confident in the safety and quality of their food."

Fleets can subscribe to specific data based on their needs, view messages, and keep tabs on their hours of service totals to meet requirements for the electronic logging device mandate, among other functions. The platform can also integrate with third-party direct-store-delivery functions so drivers and managers can monitor delivery progress in relation to customer commitments and shipper information, resulting in greater levels of safety and compliance and reduced costs.

Security Concerns

Food companies need to also understand how to protect the business from problems that could occur. With so many devices connected to each other, one bug could wipe out multiple functions at once and bring operations to a halt.

IoT food safety devices are just as vulnerable to hackers as consumer devices. That's why manufacturers need to worry about are cyber criminals—hackers who try to shut down your company, steal classified information, or just cause havoc to operations. A big problem is that many IoT devices were designed for convenience, not security, so many are sans the safeguards that would make a company's IT leader feel safe. A company needs to really evaluate its systems and see what sort of risks there are.

Russel C. Van Tuyl, security analyst, Sword & Shield Enterprise Security, says some security issues an organization should be concerned about when implementing IoT or Operations Technology include insecure wireless communications, data transport over an unencrypted communication channel, firmware/application updates, proper segmentation, and weak or hardcoded passwords.

"Physical security of the device is also an important factor to consider," he says. "These are common vulnerabilities that create risk which impacts confidentiality, integrity, and availability of devices and subsequently the business."

A sound IoT security program consists of policies and technical controls that fit with a business and that implement publicly vetted and supported frameworks, such as the Center for Internet Security Critical Security Controls—a prioritized set of cyber practices created to stop today's most pervasive and dangerous cyberattacks. ■

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Special Report

Handling Food Safety Issues in Paradise

Popular vacation destinations boast an ever-increasing focus on food safety in order to ensure the well-being of their residents and visitors | BY **LINDA L. LEAKE, MS**

The Caribbean, Central America, and Oceania comprise some of the world's top tourist destinations. But behind the beautiful beaches, ancient ruins, and unique landscapes, each region is hard at work improving their food safety initiatives to be on par with the rest of the globe.

The Caribbean

The Food Safety Modernization Act (FSMA) is among the most prominent food safety issues currently impacting Caribbean exporters, according to André Gordon, PhD, CFS, managing director of Technological Solutions Limited (TSL), a Kingston, Jamaica-based company that provides food product development, auditing, laboratory, training, and other food safety consulting services.

"Compliance with the FSMA requirements that have come into force or are approaching their implementation dates is a concern for food manufacturers on the Caribbean islands," Dr. Gordon says. "Specifically, the Preventive Controls for Human Foods Rule, the Produce Safety Rule, traceability requirements, compliance with the Foreign Supplier Verification Program requirements, and conformance with the allergen management and labeling requirement are all in the fore front."

Ongoing inspection of Caribbean food and ingredient exporters by the FDA is another issue, Dr. Gordon notes. "Meeting the food safety and quality systems requirements of buyers from the European Union (EU) and Canada, including for proof of compliance with allergen, labeling, residue, and other limits, is a constant challenge," he mentions. Dr. Gordon says the ability to access the kind of technical and analytical support required to comply with importing country and buyer requirements can be financially challenging for some Caribbean stakeholders, as the persons with the knowledge to assist, though growing, are few.

"The increasing insistence of buyers of Caribbean export products in the U.K., EU, and North America that firms must have at least a certified, compliant Hazard Analysis and Critical Control Points (HACCP) system in place or have HACCP certification from a recognized entity compound some companies' challenges," Dr. Gordon relates. "This is because it both costs and takes time to get the system implemented, during which time the firms' access to the market may be curtailed. And many importers of our products are insisting on Global Food Safety Initiative (GFSI) certification in order to continue to do business with Caribbean exporters."

Caribbean food purveyors also need to comply with requirements of major buyers from the hospitality and food service sector for a compliant and/or certified food safety system. "There are increasingly mandatory requirements from transnational quick serve restaurant customers that supplier firms must be able to pass food safety audits to their proprietary standards," Dr. Gordon says. "Some of these include the need for GFSI certification."

In the plus column, Dr. Gordon points out, several Caribbean countries have been very involved in exports to developed country markets for many decades and, thus, have already developed systems to ensure the safety of their food supply. "This covers both food for domestic consumption, as well as for exports," he says. "Also, because much of the region is dependent on tourism, this has provided additional incentives for each Caribbean country to ensure that the food being offered for sale to visitors is safe."

Central America

Most Central American governments are not conscious of food safety issues, notes Lauriano Figueroa, PhD, the regional technical director for food safety for the San Salvador, El Salvador-based Organisation Internacional Regional de Sanidad Agropecuaria (OIRSA), the international regional agency for plant and animal health.

"In most of the Central American countries there is no official integrated food safety system, rather just isolated action from both agriculture and public health ministries,"

Dr. Figueroa relates. "Food safety is seen as an important issue for export products, but not for those for local consumption, especially animal origin products. The organized private sector has developed its own system, unfortunately with weak governmental participation, to ensure their commercialization in the markets.

"The exceptions to some extent are Costa Rica, Honduras, and Panama, where there exists more governmental support to protect both export and local consumption products," Dr. Figueroa continues.

Panama, for example, boasts the Panamanian Food Safety Authority (Autoridad Panameña De Seguridad De Alimentos, its Spanish title, abbreviated AUPSA), a governing body to ensure compliance and enforcement of food laws and regulations for imported products. In March 2016, the National Assembly of Panama approved a Best Practices and Agricultural Traceability Program, which regulates the raw products from plant origin to the final destination. This follows the country's National Livestock Traceability Program, which was implemented in October 2013.

During 2015 and 2016, OIRSA, in a strategic alliance with the San Jose, Costa Rica-based Inter-American Institute for Cooperation on Agriculture (IICA), developed and implemented Train the Trainer courses on Good Agricultural Practices, Good Livestock Production Practices, and food safety auditing. "These courses included both face-to-face and virtual courses that addressed a diverse audience, including technicians from government, private, and academic sectors," Dr. Figueroa notes.

On May 24 and 25, 2016, IICA and the University of Nebraska-Lincoln (UNL) held a training course on food safety auditing, which was attended by some 30 academics, technical personnel of official inspection services, and IICA specialists from Central America and the Dominican Republic. Convened in Lincoln, the event was part of the collaborative activities of the Regional Virtual Food Inspection School for Central America and the Dominican Republic (ERVIA), the IICA initiative that seeks to improve public health and facilitate trade by providing training in modern and harmonized inspection procedures.

"UNL is preparing all the curriculum for the ERVIA School for Auditors (under development), including online videos, lectures, activities, and reading materials," say UNL food scientists Andreia Bianchini, PhD, and Jayne Stratton, PhD. Implemented by IICA in 2013, ERVIA was financed by the Geneva, Switzerland-based Standards and Trade Development Facility.

"The ultimate goal of ERVIA is to provide training for all inspectors in Central America and the Dominican Republic, in the area of food safety inspection and food safety auditing," says Ana Marisa Cordero Peña, a specialist with IICA's Agricultural Health and Food Safety Program.

"ERVIA's Academic Council, which includes one academic institution from each participating country, has been providing technical support for the virtual course by administering tests and issuing diplomas," Cordero Peña mentions.

"Within ERVIA's Virtual Inspection School, two installments of virtual Food Inspection Training have been delivered, with about 400 inspectors from Central America and the Dominican Republic trained," she relates. "Food auditing training in English and Spanish will be available in the IICA virtual platform at the beginning of 2017, which is the training being developed by the UNL group."

Oceania

Comprised of more than 300 islands, Fiji is home to approximately 896,000 people. Many Fijian food businesses lack good quality refrigeration or packaging, record keeping, or a basic knowledge of hygiene and food preservation, says Ian Sayers, MBA, head of sector development for the International Trade Centre (ITC), the United Nations agency for trade and private sector development.

"This means that, despite a bountiful supply of excellent fresh produce, most international tourism resorts and hotels are forced to import most of their food items from abroad, usually from either Australia or New Zealand, to the detriment of Fijian farmers and entrepreneurs," Sayers elaborates. "Until 2014 there were no internationally qualified food safety or quality advisory services available in Fiji that were affordable to small to medium-sized enterprises, and therefore, no way for them to get out of the import competition trap."

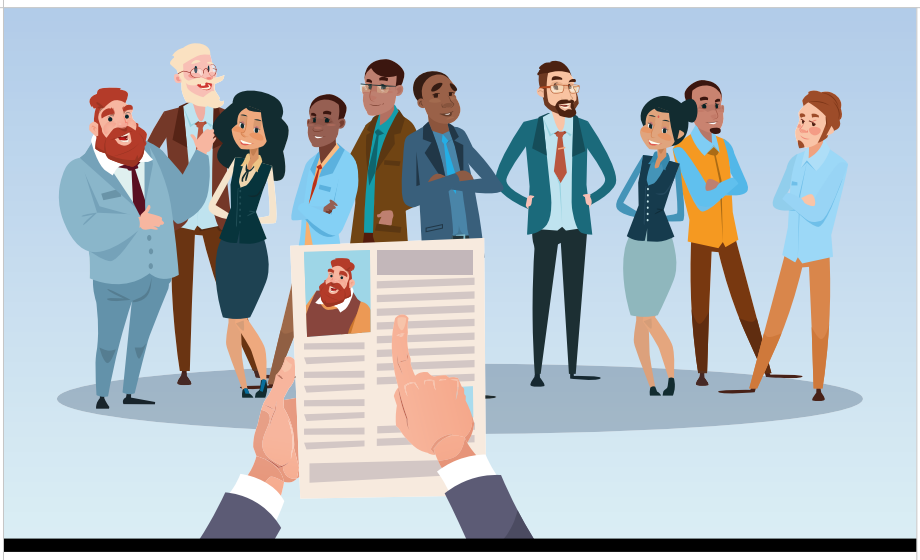
This is where the EU-funded, ITC-managed Improvement of Key Services to Agriculture Project (2012-2016) and a group of dedicated Fijian professionals have been able to make a difference, Sayers emphasizes. "After a year of tough and intensive 'on-the-job' training, international examinations, and qualifying work in real enterprises, the not-for-profit Fiji Food Safety Association (FFSA) was established in May 2015," he relates.

"FFSA is a hub for sharing ideas, viewpoints, and best practices due to the diverse experiences of members acquired through quality management, consultancy, research, and training in the general quality infrastructure, food safety, agriculture, agribusiness, subject matter expert development, value addition, and operational capacity building," says Deepa Lal, FFSA president and group quality assurance manager for FMF Foods Limited.

"Fiji's Ministry of Industry, Trade, and Tourism wishes FFSA to help it adopt ISO 22000 standards for Fiji and has invited FFSA to be part of the committee to facilitate this transition," Lal relates. "Moreover, FFSA members have conducted several food safety workshops for Fiji's all-important hotel and tourism groups with excellent feedback."

"There is a general lack of awareness of both food safety issues and cost-effective local ways to ensure compliant, safe, and healthy nutritious food in the South Pacific region," Sayers says. "There is still a lack of harmonization of export-import protocols and standards across the Pacific countries despite regional trade agreements. More

(Continued on p. 44)



Choosing a Food Safety Consultant

All experts are not created equal, but how can you tell the difference? | BY **PATRICIA WESTER**

The preventive control rules place great emphasis on the use of outside expertise. A quick look at the preventive controls qualified individual role shows that FDA wants you to get help in areas that may be beyond your scientific skill level, such as designing and performing validation studies, rather than attempt to do something that is not in your area of expertise.

While FDA does provide information on resources such as those available via universities, extension offices, and other major resources, a great many of you will end up in the private sector for help, which brings to light the challenges involved in selecting a competent consultant. Someone who knows everything there is to know in one sector may not know nearly enough to advise in another. Some, sadly, probably should not be advising anyone, but there is no grading system out there to help you choose between the good, the bad, and the ugly.

The FDA regulated industry covers an amazing spectrum of products, from applesauce to zagnuts. Finding an expert that knows everything about anything would be nearly impossible, so avoid anyone that claims to know it all. The first step is to identify experts in your arena, then you can begin the selection process from within that pool. Beyond the trade associations though, what else can be done to quantify experience in a given product mix?

This is an area where the auditing industry can be used as an example. There are several places in this sector where groups have attempted to create general product categories that might help distinguish experts in one area versus another, such as GFSI recognized schemes. However, even those illustrate the diversity of the food industry; some have as many as 30 product groups, others as few as 18—so perhaps this is not the most valuable help after all.

Before joining the food safety testing arena, I worked in the meat industry. As the meat industry underwent the challenging period of the '90s, *E. coli* and *Listeria* emerged and the industry entered the world of microbiologically driven food safety. I had the good fortune to work among some of the icons of that period and was exposed to the landmark events of the time. Key lessons learned include:

- Make food safety a non-competitive issue;
- An environmental monitoring program (EMP) works better than end-product testing;
- Targeted, operational sampling works better than randomized, pre-op sampling;
- Incentivize testing, don't "punish" a plant for finding environmental positives; and
- Sanitary design—plant and equipment—is critical to micro food safety.

If wanting to identify examples of broad experts capable of working with high-risk products across multiple industry sectors, then the best approach is to find one with a background in the meat industry. Much of what we know works today comes from the school of hard knocks that is the meat industry. Previously ignored, there is new emphasis on the skills/experience from that sector.

The preventive control rules require an EMP for ready-to-eat products exposed to the environment prior to package closure, unless there is a post packaging treatment. An EMP requires a well thought-out plan that includes gathering baseline data to support sampling plan design, as well as addressing the regulatory challenges that surround pathogen testing of contact surfaces. When a sample tests positive for a pathogen, the plan should include steps to prove the effectiveness of the corrective actions. The industry has seen the potential for criminal prosecution for inadequate programs, so this is not an area to skimp on outside support.

Rules of Thumb

Below is a summary of five basic rules to keep in mind when searching for a qualified food safety consultant.

Rule #1: There are experts that have "been there, done that." Use the expertise gained from the learning arc of the meat industry in critical areas, such as environmental monitoring.

Beyond technical skill, a good expert/consultant must have a solid grasp of the regulatory requirements necessary for compliance. Once again, the meat industry can be used as a guide. After all, the USDA's implementation of the Hazard Analysis and Critical Control Points is a small-scale version of the regulatory juggernaut that is the Food Safety Modernization Act (FSMA). As much as you strive to do all you can in the food safety arena, it starts with achieving the minimum legal requirements for compliance. For every manufacturer, meeting the compliance requirements is priority, only then can you look for ways to expand your food safety horizon.

Remember that FSMA compliance extends well beyond preventive controls. There are a wide range of rules, guides, updates, and proposed rules still under development that cover the full spectrum of compliance. FSMA does not start and end with preventive controls.

Rule #2: Make sure you choose an expert that fully understands the entire scope of regulatory compliance requirements for your products and situations.

As the industry was adjusting to the globalization of the supply chain and the impact of imported foods, industry and regulatory thought leaders understood the need to move away from physical inspections and repetitive and simple audits, and into a system of risk ranking for inspected goods and standardized audits that verified the effectiveness of an overall food safety management system as a predictor of continuous food safety success. As a result, we have the supplier verification requirements in the preventive control rules and Foreign Supplier Verification Programs.

But the supplier verification components included in the final rules require technical experience and regulatory knowledge beyond your products and into the potential hazards of your supplier. This introduces another category of skills where you can use outside support—those needed for auditing. The auditing component is expanded further when you consider the recently finalized rules and guides surrounding the FDA's Model Accreditation Standards and Voluntary Qualified Importer Program. This adds yet another layer of expertise you may need outside support on. Like many areas of FSMA, a complete understanding of the requirements is a work in progress, do not hesitate to say outside support is needed.

Rule #3: Don't underestimate the full scope of compliance requirements, outside resources may be needed in areas not currently expected.

The food industry is a cost sensitive sector. Pennies matter, and QA/QC are still considered an overhead department with pressure to reduce costs whenever possible. While some of that culture is changing, the lowest possible price is still used as the primary selection criteria far too often.

The adage that says "Pick two out of the three: good, fast, and/or cheap; you can't get all three," applies in food safety. If it's fast and cheap, it's likely not very good. If it's good and fast, it won't be cheap. If it's good and cheap, it probably will not be fast.

Plan ahead and discuss implementation costs early. Identify where outside support is needed and arrange it as early as possible in the process to prevent a last-minute crisis. Avoid using the lowest price as the final selection criteria for your outside expertise.

Rule #4: You get what you pay for.

One of the best things I learned is no one is an expert at everything, we all need to ask for help every now and then. Often, the difference between good consultants/experts and great consultants is how well they know their own limitations, and whether they consider it a strength or weakness to ask for help when necessary.

Recently, Stephen Ostroff, MD, FDA's deputy commissioner for foods and veterinary medicine, participated in a plenary panel on the use of audits in FSMA. When describing the most frequent questions he is asked about the topic, he used one of my favorite answers in food safety: "It depends." And it does. It depends on the goal, the product, the situation, and the details. The same applies to selecting the right expert.

There are no hard and fast rules in food safety. Objectives can be achieved in a range of methods and there are usually various approaches that can be used. But all come with hard choices that have to be made along the way, and trade-offs may be necessary.

Rule #5: If it was easy, anyone would do it. No one knows it all. ■

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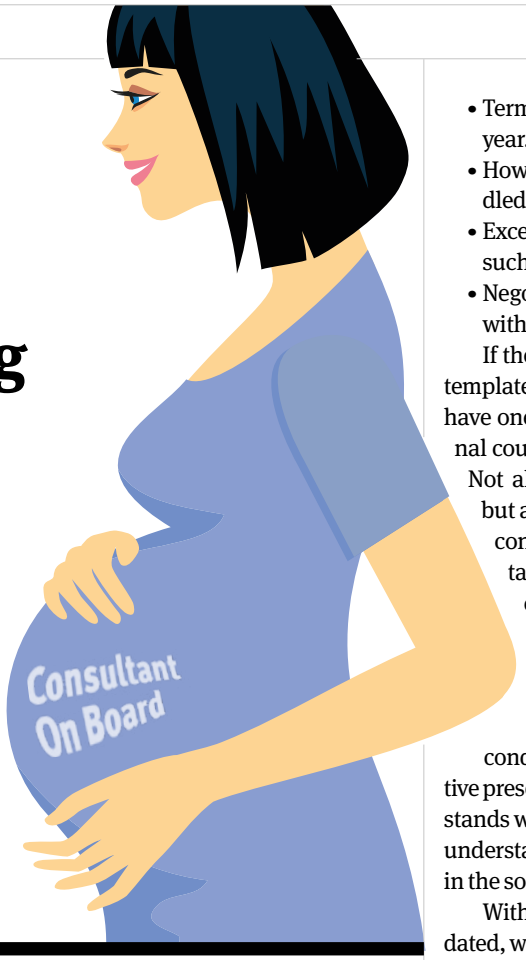
What to Expect When Expecting a Consultant

Expectations before, during, and after a food safety consultative visit

BY **VIRGINIA DEIBEL, PHD,**
AND **KARA BALDUS**



You have completed your checklist for hiring a food safety consultant. You:

- ✓ Asked your colleagues,
- ✓ Reviewed qualifications,
- ✓ Interviewed, and
- ✓ Hired.

Now, what can you expect before the consultant shows up at your door, when he/she is visiting, and after he/she leaves? There are some key deliverables that should be expected of a consultant despite a myriad of backgrounds, educations, and approaches. This article focuses on the deliverables for a harborage site investigation, but the concepts can also apply to a sanitation or food safety program review.

Preliminary Paperwork

Quote. Before any travel is planned or documentation shared, obtain a detailed quote of services. Having a signed quote is a good way to start off a relationship with expectations laid out from the beginning. The following is what to expect.

- Timelines for each service or service type.
- How and who plans travel and how the expenses are charged. How service fees are charged. Some consultants charge extra for weekends, holidays, or hours in excess of 8 per day. Some will charge a lump sum, others a fee per hour. When lump sums are quoted, determine if an accounting of the hours is desired and if so, communicate this up front. If a fee per hour is quoted, ask what happens to the bill if more or less hours are needed for the services.
- Terms of agreement, usually a quote is applicable for 60-90 days from issue.

Non-disclosure agreement (NDA). It is important to know, from both sides, the rules for communication. A mutual NDA is often used to protect both the consultant and the company. Expect the following.

- Categories within the NDA may include a description of what information is considered "confidential," such as clients, financial documents, employees, HACCP (Hazard Analysis and Critical Control Points) plans, photos, and recipes.
- Term of the agreement, typically one year.
- How confidential information is handled and who handles the information.
- Exceptions during legal situations, such as receipt of a subpoena.
- Negotiations not to subcontract work without written consent.

If the consultant does not have a NDA template, then the company may wish to have one drafted by its legal firm or internal counsel and have it available for use.

Not always addressed within an NDA, but a helpful discussion to have with a consultant is with whom the consultant can communicate. For example, can the consultant contact external suppliers, such as a contract sanitation firm or lab? It is best if all communication between the consultant and outside firms are conducted with a company representative present. That way, the company understands what transpired and the consultant understands that the company is engaged in the solution.

With the quote and NDA signed and dated, work can begin. It is most often helpful if the consultant can obtain copies of the HACCP plan, plant diagram, and regulatory correspondence prior to a plant visit. General production room and equipment photos are also helpful. That way, a preliminary glimpse into the process, products, and equipment can be studied. Additionally, a review of existing documentation related to any contaminations, such as environmental monitoring data, corrective and preventative actions, customer complaints, or market withdrawals and recalls, can be done prior to the site visit and allows the consultant a glimpse into any recent past or ongoing issues.

Agenda. Ask for an agenda including the personnel needed. Often the agenda will not be followed precisely because tasks can take longer than anticipated, but usually the first day or specified tasks (equipment tear down, sanitation) are the most critical. The agenda will allow for personnel and production scheduling. The agenda should also include a group debrief at the end of each day so the company's food safety team who were not present during the day's events are updated on discoveries and the next day's priorities and agenda.

Harborage Site Investigation

A harborage site investigation involves looking for a source of microbiological contamination in the plant facility. Expect the following during an investigation.

Site visit. In most cases a site visit is needed. Only in rare instances may an investigation take place without the consultant being on site. In this case, exchange of photos is a necessity. Ask the consultant what he/she will be viewing. It is most instructive to see the equipment moving as it does in production and also to view the sanitation crew from dry pickup through cleaning. If production is still running, viewing pre-operation setup, operations, and shift changes are instrumental to piecing together root causes.

Swabs. Microbiological sampling of the equipment and site will be needed to determine the harborage point. Ask the consultant if he/she will be taking the samples or if the company's QA team can or should assist. It is always helpful to have a few people handy to label swabs, fill out lab request sheets, note swab descriptions, and, if permissible, take photos. A photo is truly worth a thousand words and comes in handy during team debriefing at the conclusion of each day. As a company outsider, it is often difficult to name equipment in the same terms as the company. Even similar equipment is named something different by each company. Some slicers are named, aptly, "slicer" while others term their slicer a "flux capacitor." Also, the name of the room can be confusing for someone who is new to the area. Yet these are important aspects to identify swab locations, especially when a swab is positive.

Maintenance. It is *always* helpful to have someone from maintenance available to remove side panels, motor housings, chain guards, and open electrical panels. Discuss how equipment runs and the maintenance events that may have impacted bacterial harborages. Rare is the case that there is no need to see inside equipment so having those areas accessible for swabbing is an important investigative tool. These sites are the areas where soils can accumulate and bacteria will thrive.

Lab. If the lab is onsite, have available the method of testing, lab employee training, and lab audit documentation. If a third-party lab is used, show the consultant the ISO 17025 certification and show that the methods used for the swabs taken on site are contained within the ISO certification. This is a good double check for the company. Make sure the lab understands there will be an increased sample volume and discuss with the consultant the courier pick-up times so swabbing can be completed each day in time for sample pickup or shipment.

Dry runs. Once a harborage site has been identified through testing and renovations enacted, conducting dry runs to validate that the activities have been successful are a component of the harborage site process. A minimum of three dry runs will be necessary to verify effectiveness of the removal process. Keeping in mind that after each dry run, sponges are taken as a scientific verification, the test times need to be considered. The dry run process alone can add a week to the investigative process.

Time. It takes a number of days to get familiar with the processing environment and equipment. Often swabbing is not completed within the first day and there may need to be multiple swabbing events if the first round was unsuccessful in uncovering the harborage site(s). If samples are shipped then there is usually a day delay, and testing can take up to 48 hours additional to a negative result. Determine beforehand if testing will stop at presumptive or if the testing will be confirmed, which may take an additional 5-7 days.

Expected outcome. Discovery of the root cause and any secondary sites is expected. Oversee the harborage site(s) removal and verification that the production environment is free of the pathogen.

Documentation.

- Program review and/or development. During the course of a visit, the consultant will likely ask to see programs germane to the production environment. Program revisions and development are to be expected. One program that is likely to be developed is a Corrective Action/Preventative Action plan that describes and documents practices that immediately correct and further prevent/mitigate a harborage (or other situation) from occurring in the future. This program can, and should, be applied to all other departments as well.
- During the testing phase while waiting for microbiological results is a good time to reassess the HACCP plan. The entire HACCP team will need to be available for this portion of the process.
- The end result of any project is a detailed written report provided by the consultant. In lieu of a report, a letter to the FDA or USDA answering a 483 or Notice of Intended Enforcement/Notice of Suspension, respectively, may be written by the team. If a report to the company is written, it should include background, scope, and outline the findings and next steps of the project. The report, generated in a timely manner, would be expected to include procedures and policies developed or reviewed by the consultant. These documents become the property of the company, which will approve programs, train employees, and implement the procedures. The documents are to align with the company's current document control policy.

With the Food Safety Modernization Act regulations underway, some companies are seeing gaps in their current programs, especially related to their food safety, sanitation, and HACCP plans. Having a set of fresh eyes look at systems may be of tremendous value. Consider having a food safety professional visit the company. However, setting expectations before, during, and after the visit will improve the outcome of the exercise and experience. ■

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Pass Up the Salt

Strategies for achieving great-tasting products while reducing sodium levels

BY **MELODY FANSLAU**

Salt has many attributes and uses when it comes to food. It has the ability to enhance desirable flavors in food and recipes, while also diminishing the ability to detect undesirable flavors. For example, adding a small amount of salt to baked goods enhances their sweetness and adding a sprinkle of salt to a grapefruit can mask the bitter grapefruit note. According to the National Academy of Sciences, salt also promotes the perception of product thickness and rounds out overall flavor while improving flavor intensity. However, even with all the positive attributes, there is still a demand to reduce salt use in food due to its contribution to the amount of sodium in a diet.

The CDC states that as sodium intake increases, so does blood pressure, which in turn increases an individual's risk for heart disease and stroke. For this reason, sodium intake has been on the radar of health professionals, the food industry, and consumers for quite some time. Despite this awareness, the CDC reports that in 2016 the average daily sodium intake among individuals aged two years and older in the U.S. was more than 3,400 milligrams (mg) per day. This is significantly higher than the 2,300 mg per day recommendation in the 2015-2020 Dietary Guidelines .

Today, the main source of sodium in the American diet comes from salt found in restaurant and processed foods. Salt has a positive impact on how food tastes while also being a relatively inexpensive ingredient to use. This makes using salt an easy preference when developing products. Restaurant and processed foods provide a convenience factor to the consumer who does not always have time to prepare meals at home; consumers prefer something that is quick and easy, but also tastes great. This, of course, will lead product development teams throughout the U.S. attempting to balance between providing a great tasting product and providing a healthier food option to its consumers.

However, due to the consumer push-back, alternatives need to be considered. Fortunately, there are ways that product developers can reduce the use of traditional salt and in turn reduce sodium levels while still creating a flavorful product.

Tactics for Reducing Sodium

Incremental formulation changes. One of the simplest ways to reduce the level of sodium in a product is to remove a portion of the salt from the food product at a rate that would not likely be detected by a typical consumer. This idea can be used for an existing product in the marketplace. For instance, studies have shown that consumers were not likely to detect a difference when sodium was reduced by 10 percent in their bread. However, they were able to detect a difference when sodium was reduced at 20 and 30 percent. Manufacturers can use this information and the knowledge of their product to make a one-time formulation change to reduce the salt to a level consumers may not notice.

Another way to use the reduction concept is to reduce salt in a product gradually over a period of time. For example, if a company has a goal to reduce sodium in its product by 30 percent, it likely would not want to make the entire 30 percent reduction with one formulation change as regular consumers could detect a difference. To minimize the likelihood of consumers detecting a difference while still meeting the goal of a 30 percent reduction, the manu-

Funding for Sodium Reduction Research Needed

In written comments submitted to FDA in December 2016, the Institute of Food Technologists (IFT) called upon the federal government to increase public funding of research for developing reduced-sodium foods to help meet the new voluntary sodium reduction goals. Although food scientists have been able to achieve reductions in various food products through innovations, it continues to be a challenging endeavor.

Scientists are also faced with the obstacle of simultaneously lowering salty taste preferences while developing acceptable salt substitutes. "Clean" labeling is important to many consumers, and substitutes such as potassium chloride are considered "unfriendly." This is why IFT also pushed for consumer education about processing advancements related to sodium reduction.—*FQ&S*

facturer can first launch a product with 10 percent less salt and let the consumer acclimate to the new salt level. After a period of time, it can move forward with another 10 percent reduction and continue this process until it hits the desired salt reduction goal.

Salt substitutes. A second approach product development teams can use to reduce sodium in their product is to use a potassium-based salt instead of a sodium-based salt. Potassium chloride has been successfully used in many food applications to reduce the amount of sodium. Potassium chloride delivers a similar salty perception and functionality when compared to sodium chloride. Unfortunately, potassium chloride cannot typically be used as a 1:1 replacement for sodium chloride as it often comes across as bitter or metallic to consumers. In order to successfully use potassium chloride in a sodium reduction project, product development teams will need to determine the level of potassium chloride that can be used to replace sodium chloride in their formulations to achieve both a sodium reduction and an acceptable flavor.

The bitter taste of potassium chloride has been an issue the food industry is working to address; there are several technologies on the market that can be added to formulas that will mask the bitter taste of potassium chloride and enable a manufacturer to replace more sodium chloride with potassium chloride.

Salt enhancers. Instead of replacing salt with a non-sodium salt, ingredients that are known to enhance a salty perception are an option when reducing sodium in a formula. Salt enhancers typically deliver an umami taste sensation that is known to enhance the overall flavor and fullness of a product. Umami is one of the five basic tastes, along with sweet, salty, sour, and bitter. The umami taste can be described as meaty or brothy and is perceived as the savory characteristic in food. Umami's savory taste is attributed to the presence of glutamates and nucleotides in a food. Ingredients such as monosodium glutamate, disodium inosinate, and disodium guanylate are all food additives that have been traditionally used to bring out this umami flavor in foods. These ingredients contain less sodium than salt and are typically used in smaller quantities, which make them a good alternative to salt. Yeast extracts and hydrolyzed vegetable proteins also contain glutamates and can be used to enhance the salty characteristic of a product. Note that sodium is usually found in these ingredients as well, so product development teams must make note of how much they can add the enhancers to achieve the sodium reduction they are targeting.

As the industry continues to focus on clean labels, ingredients such as monosodium glutamate, disodium inosinate, disodium guanylate, yeast extracts, and hydrolyzed vegetable proteins may not be as desirable. If this is the case, there are several other options on the market that naturally contain glutamates and nucleotides, like mushrooms, soy sauce, miso, hard cheeses, tomatoes, seaweed, and more. Umami blends are also available from several manufacturers, which have been developed to assist with natural sodium reduction and flavor enhancement applications.

Replacing salt with natural ingredients. In years past, one of the major focuses of the food industry was to provide consumers with a product that had a good value. To do so, manufacturers turned to lower-cost ingredients such as salt, sugar, and unhealthy fats to deliver desirable flavors consumers prefer. Unfortunately, the natural flavors of products often suffered during this time of value focus. As the negative effects of salt, sugar, and fat in the diet are being learned, the food industry may find itself shifting focus from value to flavor. Consumers will always want food that tastes good—it will be up to the food industry to identify ways to satisfy that need with healthy alternatives.

One approach to adding flavor back when reducing ingredients such as salt is to simply increase the use of natural flavors, like spices, garlic, onion, citrus juices, vinegars, and vegetables. These ingredients don't necessarily enhance the salty perception of a food, but they add flavor and provide consumers with an alternative enjoyable experience.

Salt has been the go-to ingredient for product developers to help deliver the flavor desired by consumers. However, there are many options for creating great tasting products that contain lower sodium levels. With a little work and persistence, developers can provide flavorful products that deliver a lower impact on the amount of sodium consumed in the U.S. diet. ■

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The Sugar Rush Hits the Brakes

Once a popular ingredient due to its taste and texture, manufacturers are now searching for sugar substitutes that do not compromise on sweet flavor

BY **JOHN BUCKLEY AND JESSICA VOGEL**

Sugar has been used for centuries to make foods and beverages more satisfying. Sugar doesn't just add sweet taste—it's also used to give some of consumers' favorite foods and beverages the structure, texture, and overall mouthfeel that they love while also acting as a powerful flavor potentiator. Whether primarily used for taste or for functionality, sugar plays a key role in making foods and beverages delicious. Sweetness is one of our basic tastes and is closely aligned with pleasure and indulgence. Sugar is what keeps consumers coming back for more.

Of all the sweeteners available, sugar is considered the gold standard because it delivers a clean sweet taste without any undesirable aftertaste. Beyond its sweetening properties, sugar provides structure and texture to many traditional foods, such as bakery products, syrups and jams, and beverages. Sugar helps to create crispness and texture in cookies and enhance the creaminess of ice cream. Because of its importance in delivering taste and functionality, the food and beverage industry continues to look for solutions that can reduce sugar content without sacrificing function. And with growing consumer demand for better nutrition and cleaner labels, the task of sugar reduction becomes even more paramount.

A Call for Less Sugar

Nutrition and what consumers consider "healthy foods" has been a moving target. In the 1980s, the "low fat" and "fat-free" trend peaked with consumers. While fat became the enemy, formulators needed to replace the fat with other ingredients, and sugar became the winning ingredient. Over the past 30 years, Americans have steadily consumed more added sugars in their diets, which has contributed to the obesity epidemic. According to USDA estimates, Americans consume on average 94 grams of sugar per day. The American Heart Association recommends consuming 25 grams and 36 grams of sugar for women and men respectively. Additionally, the U.S. government and World Health Organization recommend that sugar should account for 10 percent or less of daily energy intake.

With growing attention on sugar from the government, health organizations, and the media, consumers are turning their attention away from fat reduction and to sugar reduction. New fad diets focus on removing added sugars, making consumer awareness of sugar at an all-time high. In 2016, Google Trends announced "low sugar" had surpassed "low fat" in consumer search trends. As consumers choose to reduce their sugar consumption, they are looking for brands and products that will fill this nutritional need. Adding to the challenge, more consumers are asking manufacturers to reduce sugar while maintaining taste and keeping the label clean. Today's consumers now demand simpler, more transparent, and less processed ingredients. They are checking labels, self-diagnosing, eliminating certain ingredients, and going back to the basics.

And manufacturers and government organizations are listening. Mintel GNPD shows a 30 percent increase in reduced sugar claims on new products in 2016 over 2015. It's not just sugar content consumers are scrutinizing. Many consumers are reading labels and are aware of high intensity sweeteners such as sucralose, natural sweeteners such as honey, and artificial sweeteners and making their own personal decision on what is best for them. Many of the high intensity sweeteners previously used to reduce sugar are now on consumer "no-no" lists and have been flagged by consumer advocates and bloggers. As consumer awareness of sugar content, its health impacts, and non-sugar sweeteners grows, manufacturers are pressured to reformulate products and also provide more transparency.

Recently, the U.S. FDA finalized new labeling requirements and nutrition facts panels that will present consumers with a clearer picture of how much added sugar is in the products they buy. This will help consumers make the distinction between naturally occurring sugars like lactose in milk from added sugars and sweeteners. The proposed changes will make it easier for consumers to be informed on the amount

of added sugar they are consuming while making it more difficult for many manufacturers to hide behind the current label that allows them to lump together added and naturally occurring sugars.

Factors for Industry

For most products, sugar is delivering far more than sweetness alone. Sugar is balancing the overall flavor, adding texture, and even delivering preservation in certain foods. While most high-intensity sweeteners and taste modulators can bring back perceived sweetness, they cannot deliver the lost functionality, taste, and mouthfeel of sugar. Many also bring with them undesirable off-notes and aftertastes. For example, stevia-based sweeteners are considered a good replacement for the sweetness lost when sugar is reduced. However, many times stevia-based products leave consumers with a bitter or metallic off-note. They also cannot deliver the lost mouthfeel or richness that sugar can. No single ingredient can replace sugar in all products and replicate its many functions at the same time. Consequently, reducing sugar often requires the use of several additional ingredients and additives to offset the loss of function.

For manufacturers to find success in sugar reduction, it's crucial they work closely with their flavor houses and ingredient suppliers to find the optimal solution specific to the final product and application. According to Larry Engel, senior flavorist at Kerry, Beloit, Wis., "It's important to understand our customer's reduction target, what ingredients are acceptable, the end consumer's needs, and also the country in which the product will be made and sold. It's critical to work closely with the regulatory team to ensure our solution is acceptable for the both the end consumer and the country of sale guidelines." Working closely with regulatory doesn't end with ingredients. Depending on what front-of-package claim companies want to make can impact reformulation. "Whether a customer wants to go reduced sugar, sugar-free, or no added sugar is a major determining factor in which tools we have available," notes Engel.

Consumer taste preferences are another component that cannot be ignored. When working on sugar reduction projects, the value that a consumer sensory group can bring to the project is key to success. Depending on life stages, the perception of sweetness and sweetness preferences greatly vary. If a sugar reduction project is specifically for kids, the level of sweetness will be different than if the product is targeted to adults. Consumer sensory testing is a valuable tool to ensure the optimal sweetness level and texture are achieved.

If a sugar reduction project is specifically for kids, the level of sweetness will be different than if the product is targeted to adults.

Case In Point

An example of a solution to help fill the gaps in sweetness, temporal profile, taste balance, and mouthfeel caused by the reduction of sugar is Kerry's TasteSense. TasteSense can help customers deliver nutritionally optimized products while still providing consumer-inspired, signature tastes.

TasteSense is derived from Kerry's heritage in plant extracts. This flavor modulation technology uses flavor solutions that interact with the taste receptors in the mouth, modifying the overall taste perception. The company leverages TasteSense to optimize the sweetness and overall flavor of reduced sugar drinks and foods, masks any off-notes or bitterness, and builds back mouthfeel lost from removing sugar.

TasteSense modulates flavor as well as sweetness. The primary effect of TasteSense is not a sweetness impact, it is compliant to flavoring status and provides a flavor modifying effect. It is not used to replace sugar, it builds back the sweet profile that is lost when sugar is removed.

Within the dairy category specifically, Kerry has had success reducing sugar in chocolate milk while maintaining the taste and mouthfeel kids love. Chocolate milk is a popular product often targeted by consumers for sugar reduction. The average glass of chocolate milk has 14 grams of added sugar in addition to 11 grams of naturally occurring lactose sugar from the milk. Ben George, dairy applications scientist at Kerry, Beloit, Wis., says the most common hurdles when reducing sugar in chocolate milk are maintaining the overall richness and cocoa flavor. Sugar does a lot to boost cocoa notes in chocolate milk. Also, because the product is primarily consumed by children, high-intensity sweetener options are limited. Milk is also a tricky application because of the standard of identity for milk. Dairies are not permitted to use stevia in chocolate milk and continue to label the product "milk" on front of pack.

Working with Kerry's flavor applications team, George was able to reduce the added sugar content in chocolate milk by 30 percent using TasteSense combined with Kerry's clean label dairy beverage texture solutions and Simply Nature cocoa extracts. The reduced sugar chocolate milk was formulated to match the sweetness and richness of full sugar products currently in the market.

Sugar reduction is not an easy task for the food and beverage industry. Manufacturers and suppliers need to work hand in hand to develop solutions that will satisfy consumers' sweet tooth while meeting their nutritional demands. While consumers are very concerned about sugar reduction and looking for solutions, taste will always be their top deciding factor. Doing due diligence on regulatory considerations and sensory testing, manufacturers can develop products that satisfy the consumer desire for both taste and nutrition. ■

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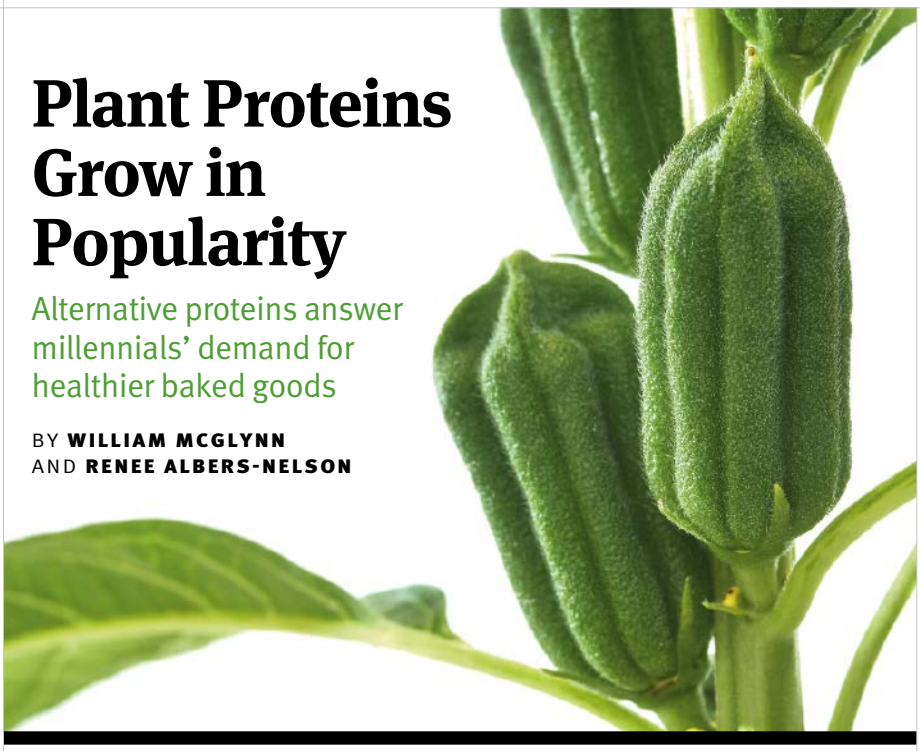
Plant Proteins Grow in Popularity

Alternative proteins answer millennials' demand for healthier baked goods

BY **WILLIAM MCGLYNN**
AND **RENEE ALBERS-NELSON**



For several years now, consumers, young and old, have had instant access to the World Wide Web and its content. Never before in history has such a quantity of information been available to inform consumers' purchase decisions. As fast as electronic data can travel, ingredient and food reviews, as well as related news and science articles, are available to potential customers. One of these potential customers is the millennial generation, the nation's largest living generation, surpassing the baby boomers. They are also the first "digital natives"—a generation brought up in the age of digital technology. As such, it is completely normal for them to use the Web to instantly research anything of interest. When investigating food products, millennials often ask: Where is it grown? How does it affect my health? And is it sustainable? Millennials tend to keep up with exercise trends and dedicate time and money into eating what they believe to be healthy. In addition, the millennials are beginning to reach their prime "purchase power" years. Their concerns and questions about food are reshaping the food sector.

Protein Power

The high protein trend has been around for several years and shows no signs of plateauing. It is driven by scientific studies indicating a high protein diet curbs appetite, which helps curb weight gain, and slows lean muscle loss, especially in middle-age and older adults. In fact, in the article, "Protein: Why it's so popular right now," written in The Washington Post, 71 percent of consumers want more protein in their diet. This is partly due to the millennials. According to BakingBusiness.com article, "Millennials shake up snacking," millennials matured in an era of concern over obesity and are naturally predisposed to choose healthier food options. Purchasing choices made by millennials have prompted retailers to increase high protein products.

Protein Alternatives

As "gastronomy" has become familiar to consumers, they have been seeking out other sources of protein besides those from meat and dairy. Soy, peanut butter, quiona, chi, and hemp have been around for years. Lately, pulses have caught consumers' attention as they are good for the environment and can serve as a gluten-free flour. (Pulses are types of leguminous crops that are harvested solely for the dried seed.) In fact, the United Nations declared 2016 the International Year of Pulses, bringing to light that most developing countries derive their main source of protein from a variety of pulses. Plant and pulse flour protein additions are the hot new bakery trend of 2017.

Pulses are available to the bakery industry as flours or powdered protein concentrates or isolates. When in the form of a flour, they are considered "variety flours." Incorporating pulses into bread, cookies, or even pizza crusts not only increases the protein content but increases the available fiber, vitamins, and minerals. However, pulses are not considered a complete protein. According to Margaret Hughes with Best Cooking Pulses in the article, "Pulse flours to the fore" for Food Business News, when incorporating pulse flour into a formulation with a cereal grain flour, roughly 80 percent of the flour component should be the cereal flour and 20 percent the pulse. Pulse protein concentrates or isolates are used around the 10 percent level.

Sunflower lecithin and oil have been used the past few years as "clean label alternatives." Now, sunflower protein is becoming a plant protein alternative, especially since it is a complete protein. Sunflower protein is lower in lysine than soy; however, it is superior to most vegetable proteins in digestibility (90 percent). According to a 1979 article in Cereal Chemistry written by F. Sosulski and R. M. Mahmoud, wheat bread fortified with sunflower protein, ranked higher than soy-fortified bread when replacing 12 percent of the wheat flour; vital wheat gluten replaced 2 percent of the wheat flour.

Sesame protein (concentrate and isolate) was tested by T.A. El-Adawy in 1995 for ability to incorporate into wheat bread. Results indicated that up to 18 percent sesame protein isolate and up to 16 percent sesame protein concentrate could replace wheat flour without unfavorable bread sensory results.

In addition, the December 2016 edition of Culinology magazine predicts seaweed "to make waves" in 2017. According to a 2014 article published in the Journal of Food Science and Technology, researchers working with C. Fitzgerald, et al., in Ireland and the U.K. were able to add up to 4 percent red seaweed protein hydrolystate to bread made from wheat flour.

FAPC's Top 10 Food Trends for 2017

Oklahoma State University's Robert M. Kerr Food & Agricultural Products Center has selected the following hottest food trends for the upcoming year.

1. Reducing Food Waste. According to the FAO of the United Nations, approximately 33% of food in the U.S. is wasted. Foods previously considered "too ugly" to eat and the "scraps" from fruits and vegetables will be used instead of discarded.

2. Cook and Connect. Apps and websites are connecting strangers over a home-cooked meal. They provide a network for people to sign up for meals in various places. People who enjoy cooking can show off their skills, while those who enjoy eating can embrace the ambiance and not have to worry about making dinner.

3. Wake and Cake. Life is short, eat dessert first. You may be eating dessert as the first meal of the day. Syracuse University research found eating dark chocolate improves reasoning, memory, and focus—all of which help prepare for the workday. Tel Aviv University research also suggests dessert for breakfast promotes weight loss.

4. Natural Foods. Consumers are seeking all-natural food options for the home and at restaurants. According to a Packaged Facts survey, 60% of people who eat meat and poultry at restaurants consider all-natural important in their selection process.

5. Butcher-to-Table Dining. Combining restaurants and butcher shops into one location gives consumers the option to purchase fresh, locally produced meat to cook at home, or they can select meat to enjoy a meal at the restaurant.

6. Drone Delivery. While this trend is still in the early phases of adoption, it's not entirely farfetched. On the Virginia Tech campus, drones are delivering burritos, New Zealand has a drone to deliver Domino's pizza, and drones in Reno deliver 7-Eleven slurpees and sandwiches.

7. Local Foods. Almost 50% of consumers are willing to make an extra effort to buy local produce and meat. Chefs are also incorporating locally grown products into their meals to support local producers and meet demands for transparency.

8. Plant-Based Protein. Chefs are composing meals made entirely from vegetables. Consumers don't want to eliminate meat, they want to add plant-based protein in their flexitarian diets.

9. Healthier Vending Machines. Snack options for vending machines include hummus and granola bars. These machines take traditional vending a step further by displaying nutrition information and offering suggestions for pairing food and drinks.

10. Soda Tax. More cities are voting to impose a tax on sugar-sweetened beverages. These taxes are designed to decrease soda consumption to combat obesity and encourage selecting more nutritional drinks.

Formulation and Labeling Challenges

Formulating a high protein, wheat-based, bakery product is not easy. Gluten is formed in dough with the addition of water and mixing. Workable, soft dough is created when gluten is fully hydrated and developed. Added non-gluten proteins will compete for water with the gluten proteins and also interrupt the dough matrix. Usually, to reach a developed dough, an increase in water absorption is necessary, as well as mix time and speed. Jay Fernandez, regional baked goods specialist for Reiser, suggests autolysing of the cereal flour may be necessary to allow all proteins the ability to become fully hydrated. The volume of high protein bakery products will most likely be reduced. This is sometimes counteracted by addition of vital wheat gluten or possibly increasing the yeast. One also needs to bear in mind that some pulse flours may affect the product's sensory profile.

Another consideration when substituting plant proteins for animal proteins, or even when substituting one plant protein for another, is the potential for introducing a new allergen into a food product. Wheat, soy, peanuts, and tree nuts are well-known plant-based allergens that are identified by regulation. Manufacturers should understand that adding wheat gluten, soy protein, or almond flour, for example, into a product will introduce a known allergen and consumers will need to be alerted to that fact through proper allergen labeling.

An additional concern that may be overlooked is allergen cross-reactivity, which occurs when a person who is allergic to one protein has an allergic reaction to similar proteins from other sources. Many of the novel sources of alternative plant protein that are being investigated are legumes. These include chickpeas, lentils, peas, beans, and lupin. Soy and peanut are also legumes and scientists have documented instances of cross-reactive allergic reactions between different legumes. In particular, individuals with a peanut allergy may be at greater risk of having an allergic reaction to chickpeas and lentils. In fact, researchers have suggested lentils and chickpeas may be almost as allergenic as peanuts and soybeans.

There is no requirement for allergen labeling of plant-protein ingredients that are not derived from wheat, soy, peanut, or tree nuts. However, given the possibility for cross-reactivity, manufacturers may wish to consider voluntarily labeling products, particularly if they contain other legume-based proteins. For example, a manufacturer could voluntarily add a label statement such as, "Contains chickpea. Chickpea is a legume related to peanuts and soy." Manufacturers should note that because such a label statement is voluntary, it would not be considered part of any required allergen labeling by the FDA. Thus, it would be best to add it to the label as a stand-alone statement and it should be located on the label such that it would not be considered disallowed "intervening material."

Although the use of alternative plant-based proteins may present food manufacturers with challenges related to formulation, functionality, and possible allergen concerns, clearly they can also offer many advantages and opportunities in creating products that attract millennials. Existing products can be enhanced with proteins that consumers see as healthy and sustainable—even exotic. Products can be crafted using only plant-based ingredients to appeal to consumers who want to eat more vegan or vegetarian foods. More broadly, these new plant-based proteins offer product developers novel palettes of flavors, functional properties, and amino acid profiles. By so doing, they open up additional avenues for creating healthy, appealing, and innovative foods made from a variety of crops with long and varied histories of cultivation across the globe. It's likely the recent rise in use of plant-based proteins in the U.S. is no mere fad, but rather a natural fit for an increasingly interconnected world. ■

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Testing

INGREDIENTS

The DNA Approach to Botanicals

Improving quality control for dietary supplements in order to reduce mislabeled products on store shelves

BY **GARY SWANSON**

For many years in the food and dietary supplement industries, no ingredient group has been more scrutinized by regulators or been the subject of economic adulteration than botanical ingredients. In recent years, certain regulators have taken an extreme interest in this topic; and while we all share and applaud the goal of manufacturing products with better quality, the use—and in some cases the misuse—of cutting-edge DNA analytical techniques has made DNA science the "hot topic" in the world of quality control for dietary supplements. The specter of potentially mislabeled botanical products has raised questions about product quality and safety and led to a decrease in general consumer confidence in dietary supplements.

With this increased scrutiny, regulators have concluded, both appropriately and unjustly, that traditional botanical analysis is no longer adequate and that DNA testing is the only solution for confirming authenticity of a botanical ingredient. This technology can play an important role in quality control in the dietary supplement industry, but only when embedded in a complete quality control program and not in isolation. For example, botanical ingredients that go through an extraction process have significantly reduced DNA content, and analysis of DNA in botanicals for foods and dietary supplements can be extremely difficult and costly. When the expertise needed to properly interpret the results is absent, the data can result in wrong interpretations and lead to wrong decisions.

Why DNA Testing Can be Problematic

DNA, or deoxyribonucleic acid, is known as the genetic blueprint for building cells. Friedrich Miescher first isolated DNA in 1869, and James Watson and Francis Crick identified its molecular structure, the famous double-helix, in 1953. In the past quarter century, DNA analysis is much more accessible and can now be used for crime solving and genetic mapping, among other things.

Employing DNA testing to ingredients used in the supplement industry presents some challenges because processing techniques such as heating, grinding, or extracting botanical materials, degrades DNA quality.

Genomic sequencing quality is partially determined by the variable size of the DNA fragments, measured in units called base pairs. The largest fragment found in human genome is approximately 220 million base pairs. By comparison, a leaf has 20,000 to 150,000 base pairs. This fragment length size enables a relatively easy evaluation of DNA. However, when the leaf is ground into a powder, the fragment size in the leaf DNA sequence can be reduced. If that powder leaf is further processed, fragment size can be reduced to 100 base pairs or less. The DNA testing becomes more difficult the smaller the fragment length. Further compounding this issue is that DNA methodologies can detect the presence of ingredients in minute quantities resulting from incidental contact, but the analytical result is not quantifiable. Therefore, those minute ingredients are registered as "contaminants" or "adulterants," and interpreting the presence of "incidental DNA" requires genetic expertise and the support of other analytical testing to make an appropriate conclusion.

Growing Pressure

Quality minded companies in the food and dietary supplement industry have been focused on making continually better products over the years, but there is still growing pressure for companies to more accurately identify product ingredients, fueled especially by instances when DNA testing has exposed adulteration or mistakes in other segments of the industry. Examples include horsemeat being sold as frozen beef burg-

ers in Irish and British supermarkets in 2013 and issues with adulterated products like fish, wines, and olive oils.

Responding to this growing pressure, in 2015, the New York Attorney General's office used a DNA barcoding technique to analyze select herbal supplement products. The findings showed store-branded, herbal supplement products sold by large retailers either could not be verified to contain the botanicals promised on the labels or were potentially contaminated or substituted with ingredients such as powdered rice and houseplants. Many of the limitations of DNA testing noted above were exposed as part of this investigation. GNC and NBTY eventually reached agreements with the Attorney General's office to research DNA barcoding and other analytical techniques, implement manufacturing reforms, and update their labeling.

DNA Testing Program Example

In 2015, Herbalife Nutrition company focused on developing DNA test methods in-house to better understand the technology. Chemical and analytical testing are still the primary methods used to test the quality and identity of its botanicals. DNA analysis, using the correct methods, can provide fingerprint verification of each botanical source, such as differentiating between Chinese mint and peppermint. On the other hand, DNA will not detect adulterants such as brown sugar that can dilute ginseng.

As a result, Herbalife uses DNA analysis to complement, not replace, other analytical methods in its toolkit. To conduct the DNA testing, the company uses Sanger sequencing, which is the industry standard. Herbalife is also investing in technology and development for the next-generation sequencing methods.

Testing begins by gathering samples from the raw materials that arrive at manufacturing sites. These raw materials can vary in botanical type, part used, and degree of processing. For downstream DNA testing applications, it is essential for DNA to be of optimum concentration and purity, and dependent on application, these characteristics need to be obtained independent of the type of botanical material. Herbalife developed a high-throughput quality control method to deal with various materials the company uses in its products.

Herbalife's paper on DNA testing methods was the first such paper on this technology presented to the AOAC. Christopher Thompson, an analytical scientist at Herbalife Nutrition, presented "Comparison and Optimization of High-Throughput DNA Extraction Methods for Varied Botanicals" at its International Annual Meeting in Dallas in September 2016.

DNA testing in the nutritional industry is here to stay. University researchers are developing tools to help significantly reduce the cost of DNA tests by 90 percent, and there may soon be a process as simple as sticking a probe into an ingredient container and immediately obtaining the DNA data without extraction or preparation. ■

Swanson is senior vice president, quality assurance and control, at Herbalife. He can be reached at garysw@herbalife.com.

In The Lab

MOISTURE

Moisture Content Determination

A comparison of different thermogravimetric methods that follow the principle of differential weighing

BY **YVONNE APPOLDT** AND **GINA RAIHANI**

Moisture content influences the taste, texture, weight, appearance, and shelf life of foodstuffs. Even a slight deviation from a defined standard can adversely impact the physical properties of a food material. For example, substances which are too dry could affect the consistency of the end product. Conversely, excess moisture may cause food material to agglomerate or become trapped in the piping systems during production. Also, the rate of microbial growth increases with total water content, possibly resulting in spoiled batches that need to be disposed of. However, water is also an inexpensive ingredient adding to the weight of the final product. Hence, obtaining an optimal analytical value for moisture is of great economic importance to a food manufacturer. For these reasons, food analysts engage in the delicate balancing of moisture and total solids to ensure consistent product quality, safety, and profitability.

Legal Requirements

International and national standards define the permitted thresholds for moisture content in commercially sold products. Regulatory bodies such as the BRC (British Retail Consortium), IFS (International Featured Standards), or GFSI (Global Food Safety Initiative) heavily influence the production, processing, and sale of foods. For food manufacturers, this translates into increased workload around quality assurance and the development of efficient and cost-effective solutions. According to the stated legal requirements, methods of analysis and procedures must be clearly described and tested. Many food producers themselves have strict criteria for measurement accuracy, reliability, and traceability to ensure the consistent quality of their products. These standard operating procedures encompass the entire measurement process, including sample volume, number of required measurements, maximum tolerable deviation, and procedures for correcting errors.

Water Properties in Food

As mentioned in chapter 6 of Food Analysis by S. Suzanne Nielsen, official methods and procedures for moisture analysis are important since the method used to determine moisture may lead to varying results for moisture content, depending on the form of the water present in a food. In the simplest scenario, water retains its properties by existing "freely," i.e. it is only surrounded by other water molecules. Free water (also known as bulk water) can be adsorbed on surface particles, held in narrow capillaries, or stored in the pore systems deep within the food material. For instance, dried fruit or meats have complex cellular structures where water is bound by adsorption to the surface or transported deep within the cells by capillary action. Adsorbed water can also become physically bound to other elements present in the food material such as proteins, or exist as chemically bound water (e.g. certain salts such as $Na_2SO_4 \cdot 10H_2O$). In a bound state with other molecules, water most often evaporates at a higher temperature compared to free water molecules. Consequently, physically or chemically bound water takes on varying physicochemical properties, making it very challenging for the food analyst to accurately measure the moisture content.

Technologies for Moisture Analysis

The following technologies are used for moisture determination:

- Thermogravimetric analysis (oven drying, halogen/IR drying, microwave drying, etc.);

METTLER TOLEDO

Table 1. Comparison between drying oven and moisture analyzer.

	Drying Oven	Moisture Analyzer
Advantages	• Large number of samples at same time, thus higher throughput possible • Large sample volumes possible • High accuracy	• Fast measurement (approx. 5–10 min.) • Large sample volumes possible • Easy handling • Reduced risk of error
Disadvantages	• Measurements only available after several hours • Sample material may decompose • Other liquid components such as alcohol, flavors, or acetic acid evaporate • Laborious procedure with several working steps • High risk of error (particularly during manual data entry and calculation) • High risk of error when using hygroscopic sample material	• Sample material may decompose or evaporate • No automation possible • Only one measurement can be performed at a time

- Chemical analysis (Karl Fischer titration, calcium carbide testing);
- Spectroscopic analysis (IR spectroscopy, microwave spectroscopy, proton nuclear magnetic resonance spectroscopy); and
- Other (e.g. gas chromatography, density determination, refractometry, etc.).

This article focuses on thermogravimetric analysis (TGA). Moisture content is derived from the loss of product weight during drying by measuring the change in mass of a sample while being heated at a controlled rate until no more change in weight is observed.

Balance and Drying Oven

The drying oven, commonly used for commercial purposes, is the established reference method for loss on drying (LoD) by TGA. In this procedure, a sample is weighed and subsequently heated to allow for the release of moisture. Following this, the sample is cooled in the desiccator before reweighing. Moisture content is calculated by the difference in wet and dry weight. In this process, measuring accuracy and the resolution of the balance are extremely important. Careful consideration must also be given to maintain identical conditions, where temperature and duration are vital for generating precise and reproducible results. See Table 1 for advantages and disadvantages of using drying oven.

Moisture Analyzer

Moisture results can be obtained more rapidly using a moisture analyzer. The measurement principle does not differ from that of the thermogravimetric method. The main distinction lies with the type of heat source used: In the oven, samples are heated by convection while a moisture analyzer heats samples via the absorption of infrared energy. See Table 1 for advantages and disadvantages of moisture analyzer.

Halogen Technology

The technology of halogen drying can measure moisture content in virtually any substance. Halogen technology uses a halogen heating device in combination with an integrated precision balance for the measurement and recording of sample weight before, during, and after the release of moisture. Thanks to its innovative heating technology, halogen moisture analyzers (HMAs) are capable of producing fast and precise measurements.

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Furthermore, automated moisture determination eliminates transcription and calculation errors. Most HMAs offer a number of predefined methods, which can be stored and easily accessed via the display menu. Some manufacturers also allow users to set individual user rights to ensure that quality criteria are met. The calculated results are stored in the instruments or can be printed out or transferred to PC via USB or other interfaces.

Reference Methods

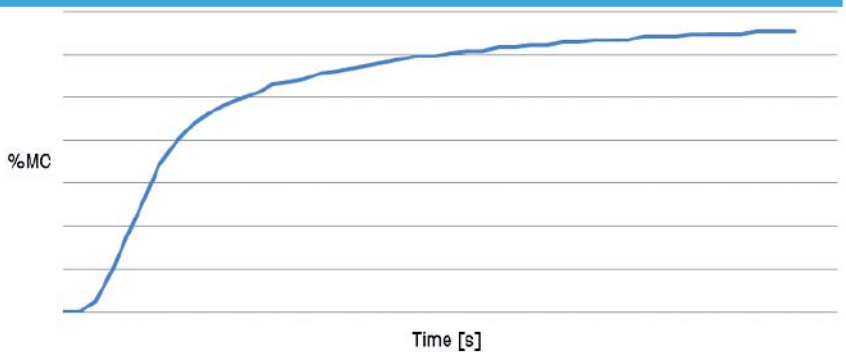
Reference methods are of much use to food manufacturers who must comply with legal requirements for the maximum or minimum amount of water present in diverse foods. Up until now, moisture content determination in a drying oven is the established reference method. Values determined by other methods must, therefore, always be referenced against the LoD method in the drying oven.

METTLER TOLEDO, as an example, has a library of validated measurement methods for over 100 food products saving users time in developing methods for different food specimens. If a substance is not included in the library, it is possible to adapt a method from a comparable food sample. For instance, Table 2 compares procedures and results for moisture analysis in ground hazelnut using a drying oven and METTLER TOLEDO HMA. Based on six measurements, the mean value of the moisture result was calculated. The results reveal that a moisture analyzer produces identical results to a drying oven. In addition, the standard deviation for both methods is comparable and very small.

Conclusions

Moisture content is a critical indicator of food quality, safety, and shelf life, thus moisture analysis serves an important quality control function in various stages of the food production chain, from raw material testing in the laboratory to incoming goods inspection. Several analytical procedures are available to measure moisture content in diverse food samples. Selecting the correct procedure for a particular sample or application is pertinent to the food industry's success since the accuracy of moisture measurements are highly dependent on the analytical method used.

Table 2. Moisture determination in ground hazelnut.

Sample Description		
Analysis	Moisture Content	
Sample	Hazelnut, ground	
Sample Characterization	Powder	
Method Parameters		
	Halogen Moisture Analyzer	**Drying Oven**
Instrument model	HC103	Convection Oven
Sample weight	4 g	5 g
Temperature	130 °C	103 °C
Drying time	SOC (~6 min)	240 min
Drying program	Standard	Not applicable
Switch-off criterion (SOC)	3 (1 mg/50 s)	Not applicable
Sample preparation and procedure	Stir sample, use spatula to distribute evenly on the sample pan.	Dry weighing container with cover in oven (103°C, 1h), allow to cool in desiccator, weigh. Stir sample, add to container, weigh. Dry in oven (2 h), allow to cool down to room temperature in desiccator, weigh. Dry sample two more times in oven (1 h, each time), cool in desiccator, weigh.
Drying Curve		
		
Result (mean)	5.27 %MC	5.27 %MC
Standard deviation (SD)	0.08	0.07
Measurement duration (mean)	6 min	240 min

Compared to the traditional drying oven, faster determination of moisture content via LoD can be achieved using alternative methods. For example, an HMA is straightforward to operate and produces reliable results in just 5-15 minutes, compared to 2-4 hours when using a drying oven. In addition, the automation of weighing measurements and calculations allows for fully compliant and reliable results. ■

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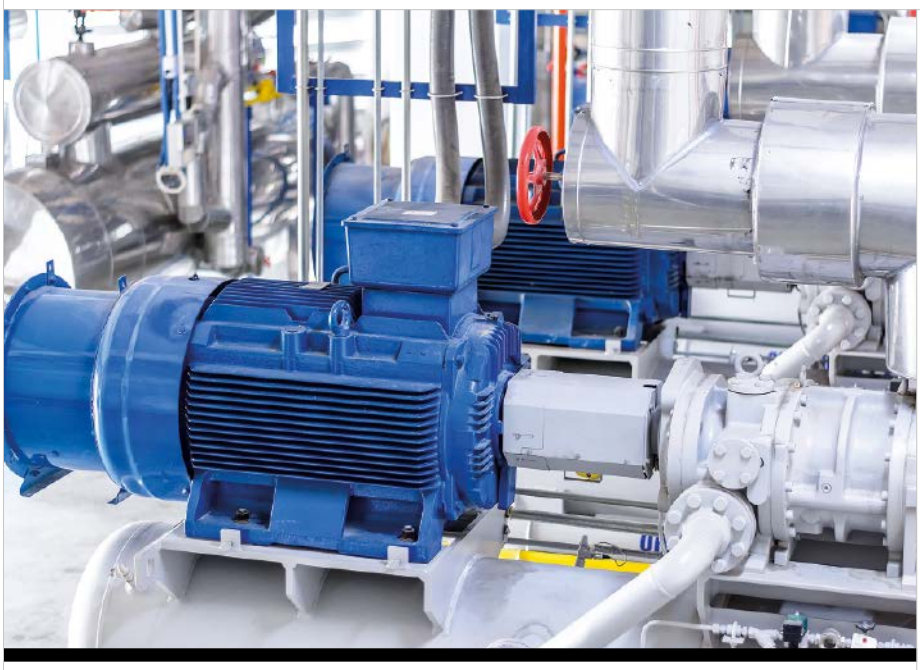

Sanitary Design Principles

FSMA-compliant commercial real estate practices that identify and minimize the risk of microbiological, physical, and chemical contaminants

BY **JASON TOLLIVER, JD**

Commercial real estate strategies often play a critical role in the quality of food and the safety of food production. The key to making food production safer is by ensuring that strategies incorporate sanitary design principles. Whether building manufacturing facilities, expanding or upgrading existing plants, or maintaining operations, the implementation of sanitary design principles is essential to producing higher quality food products in a safe environment.

The preventive control rules for human and animal food are the central pillars of the Food Safety Modernization Act (FSMA). The key requirement of these rules is that covered facilities must establish and implement a food safety system that includes an analysis of hazards and risk-based preventive controls to ensure food safety. Although the preventive control provisions have a strong focus on preventing the presence of pathogens in food, the new regulations also include important food allergen controls. Part of implementing a FSMA-compliant food safety program is recognizing contaminants that can be controlled by an effective prevention-based sanitation process. This means implementing sound commercial real estate strategies to help identify and minimize the risk of microbiological, physical, and chemical contaminants.

Keep It Dry

Microbiological contaminants can depend on the type of product and the processing steps. Pathogenic organisms, like *Salmonella*, *E. coli*, and *Listeria*, can result in sickness, hospitalization, and even death. For this reason, they are of great concern to consumers, the food industry, and regulatory agencies. Because microbiological organisms require water and food to live, one approach to minimize their hazard is to deny them these essentials. This leads to the facility design principle that if a plant is normally dry, keep it dry because removing water once it is present is difficult.

For plants that process liquids and are normally wet, design characteristics should ensure that water does not accumulate and that surface areas can be easily cleaned. In practice, this means designing and constructing floors, walls, ceiling, and supporting infrastructure that prevents the development and accumulation of water. Ensuring that HVAC and refrigeration systems maintain specific room temperatures to control air dew and prevent condensation can also help to control microbial growth. Further, control systems that include a purge cycle (heated air makeup and exhaust) to manage fog during sanitation, and to dry the room after sanitation, can reduce the likelihood of foodborne pathogens.

On the Surface

Frequently food equipment is made of stainless steel because it is resistant to corrosion and can be polished so that food and dirt cannot easily cling to it. It is important to ensure that welds are smooth, corners rounded, and the equipment designed so that it can be taken apart and inspected. These requirements follow from the second essential of microbial life—food. In the course of food processing, many foods form films on surfaces with which they are in contact. These films can harbor microbes. If the surface is rough, the film is difficult to remove and it may be hard to detect whether the surface is clean by inspection. For the same reason stainless steel is used in equipment, it may be chosen for building mezzanines and work platforms. At first,

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this can seem like an expensive proposition but, in the long run, it is often a cost-effective decision. Stainless steel does not require painting, as would carbon steel structures. Further, unprotected mild steel or carbon steel will corrode in a wet atmosphere and the rust could then become a physical food contaminant. Even if thoroughly painted, paint can chip and also become a physical contaminant.

The exact design and building components for a particular food facility will vary according to the circumstances, but making sure that all building components and construction materials are appropriate and conducive to food safety should be a priority. Food safety can be affected by floor surfaces, wall finishes and coatings, and design items such as walk-on ceilings, so consider finishes such as impervious, resinous floors that are easy to clean and allow for improved sanitation in processing and packaging areas. For wall finishes, specify concrete masonry walls with a block sealer and an easily cleaned high-performance coating or insulated metal panel installed in a vertical orientation. Design and install utility systems using appropriate construction materials that are cleanable to a microbiological level and prevent niches or crevices where dirt can accumulate.

Up In the Air

In a dry plant, where dust is a concern, flat surfaces should be minimized. Dust can harbor insects, attract rodents, and even become a potential explosion hazard. Many food dusts from flour, sugar, and starch are explosive in certain concentrations, which can occur in confined spaces, such as ductwork and equipment. A slight spark or static electricity in such an environment can cause significant damage. A good way to combat this is by ensuring that the facility design contains a dust collection system, which is a vacuum pneumatic system with connections to hoods over bag dump stations, mixers, and other locations where dust can be generated. It is important to note that the dust collection system can exceed the explosive concentration limit in its ducts and receivers. As a result, all electrical equipment must be spark-proof and the entire system correctly grounded, so static electricity does not build up and create a spark. As a practical matter, the dust collection system must be inspected and cleaned periodically because dust can build up in ducts to the point that the system is no longer effective.

Controlling the quality and flow of air through a food processing plant is vital to food safety, especially air that flows to the "heartbeat zone" of the plant where the product initially becomes ready to eat. Air quality in this zone must be of the highest quality. Food at its most vulnerable point in the process is where operations need to be the cleanest. Also, air from raw-product zones in the facility must travel in the opposite direction and exit directly from the plant. These requirements can be accomplished by designing and installing HVAC and refrigeration systems that adequately filter air to control contaminants, provide outdoor makeup air to maintain specified airflow, minimize condensation on exposed surfaces, and capture high concentrations of heat, moisture, and particulates at their source.

> Ensuring that HVAC and refrigeration systems maintain specific room temperatures to control air dew and prevent condensation can also help to control microbial growth.

Avoiding Allergens

Chemical contaminants of most concern are allergen proteins. Some of the most common and significant allergen contamination concerns for food manufacturers include eggs, soy, wheat, milk, fish, peanuts, and tree nuts. Proteins are often left behind as residue on production surfaces, which can result in cross-contamination and cause severe allergic reactions. One facility design strategy to minimize this hazard is to establish distinct hygienic zones and maintain physical separation that reduces the likelihood of contamination from one area of the plant, or from one process, to another area of the plant or process. There are also other benefits to this strategy, such as the ability to keep one line operational while another line is down for maintenance or the ability to separate allergens on adjacent lines to diminish cross-contamination concerns. While previously the FDA urged manufacturers to avoid the unintended presence of allergens in food, the industry is now required by FSMA to avoid the unintended presence of allergens in foods through a series of specific preventive controls. If these preventive controls fail, are not followed, or are followed but undocumented, the food may be considered adulterated and misbranded by the FDA and subject to mandated recalls.

Space Out

Finally, one of the most important principles of good sanitary plant design is to incorporate interior spatial design that enables ample space for inspection, cleaning, and maintenance. It is often difficult to justify additional space in the design phase because equipment dimensions are rarely well known; therefore, initial layouts may seem sufficient but frequently as details are filled in, space becomes tight. At the same time, costs almost always rise and the easy way to cut costs seems to be to reduce size. This is quite often a mistake. Incorporating FSMA's rules is likely to require additional costs and could affect project management scheduling. In the long run, however, the up-front cost to ensure FSMA compliance will be less expensive than non-compliance.

FSMA is the first major overhaul of our nation's food safety practices in over 70 years, and includes sweeping new regulations for facilities that process food. This new preventative approach will affect many aspects of food production—including the design of commercial facilities—all of which will mean substantial change for food manufacturers. By understanding the requirements of FSMA and incorporating them into the design and operation of food processing facilities, manufacturers can ensure their commercial real estate strategies are aligned to help them meet the requirements of this new law. ■

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CROSS-CONTAMINATION

Serving Up Gluten-Free Food

Steps to consider before jumping on the gluten-free movement

BY **CYNTHIA KUPPER**

By far the biggest fear for someone with gluten intolerance or a food allergy when dining out is the risk that the served food may have been contaminated. It only takes a crumb to cause a problem. Imagine taking a slice of regular white sandwich bread and cutting it into 2,040 equal parts—just one of those parts could contaminate an otherwise gluten-free meal. That tiny piece can set off a person with celiac disease or gluten sensitivity, making him/her sick.

Approximately 1 percent of the population has celiac disease, and up to 6 percent may have non-celiac gluten sensitivity. Moreover, the appeal of gluten-free products is growing rapidly, in part due to the overall growing interest in ingredient disclosure and "free-from" labeling, as well as general interest in eating foods that consumers perceive to be more healthy.

According to the FDA, "gluten-free" is defined as a food containing less than 20 parts per million of gluten. The FDA treats items labeled "gluten friendly" or "gluten removed" under the same standard, so labels of these kinds do not relax the requirements for a food service.

When customers order food items marked as gluten-free on menus, they are putting a lot of trust in food service operators. In the case of gluten, cross-contamination occurs when a food item comes into contact with another food item containing gluten or a surface or other object on which gluten protein is present. The good news for food service is that there are low- to no-cost solutions that can prevent cross-contamination.

Avoiding Potential for Cross-Contamination

While restaurants and other food service establishments naturally want to respond to the growing gluten-free demands, they need to be extremely careful with food selection, storage, and preparation if they make gluten-free ("GF") claims. When planning menus, it is imperative to be able to assess the gluten-free status of all ingredients and garnishes used in the dish. Once ingredients are verified as GF, close attention must be paid to the preparation and potential for cross-contamination.

Well-meaning food service establishments may know how to prepare a gluten-free dish but may still run afoul of serving it gluten-free as a result of cross-contamination. Below are some examples.

- Cross-contamination can easily occur if a pizza restaurant uses the same cutter for pizzas with a crust containing gluten and for pizzas with a gluten-free crust, even if the utensil has been washed between uses because if it is a hard to clean utensil, it has parts that are not easy to reach or could store food particles.
- If a salad with croutons is mistakenly served to a customer concerned about gluten, the salad should not just be taken back into the kitchen to have a chef remove the croutons. It's those very small crumbs that will cause a person to be sick.
- At ice cream shops, servers will often dip a scoop into water before using it to serve a different type of ice cream. This is a problem when offering a GF ice cream. If the scoop is used for a cookies and cream flavor and then dipped into the water, any cookie left on the scoop is now in the water and can cause cross-contamination problems.
- If pasta is cooked in water, that same water can't then be used to cook GF vegetables or GF pasta.

Similarly, food service staff may be well trained on how to avoid biologic food contaminations, such as bacteria and molds, but not know the best practices for avoiding gluten contamination. Moreover, unlike some biologic contamina-

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tions, a gluten contamination will not be eliminated through cooking or sanitation.

Ongoing staff training on how to properly prepare and handle food to prevent cross-contamination as well as how to answer guest questions accurately is of critical importance when offering GF options. Mistakes, even if inadvertent, can have serious consequences, including patron illness, potential legal or regulatory action, and damage to a restaurant's reputation.

Third-Party Certification

One way for a food service organization to establish successful GF practices and procedures is to work with a third-party gluten-free certification program. A program of this kind works with a food service to set policies and procedures that the food service will implement and follow to assure the safety of food items. It will also include periodic site audits that assure compliance with the policies and procedures. Much like requirements set by a health department, GF certification requirements are designed to provide consistency in GF food safety no matter what type of food service is using the program. Certification is one way to provide the highest assurance to customers of the food services' ability to meet their needs.

A third-party food service certification program can provide the needed expertise and experience to help a restaurant or other food service environment offer proper training and establish and maintain appropriate standards. Established standards are important over time as new employees come on board.

Best Practices are Simple Steps

It is essential to evaluate with a critical eye reasonable steps that can be taken to avoid putting a food service at risk of cross-contamination. A kitchen or service setup often contains unnecessary risks that are simple to eliminate, such as recognizing the need to place pasta at the end of a salad bar to avoid the potential for cross-contaminating other food items, not storing gluten-exposed pans above those used for gluten-free preparations, and not cleaning surfaces with soap and water (which can spread gluten proteins) instead of sanitizers.

Food service operators should not let the concern of cross-contamination stop them from offering GF menu items. Often, the steps to prevent cross-contamination can be taken with minimal cost. An additional shelf may be needed to store things correctly, or more foil may be needed compared to what the food service previously had used. More often than not, new large equipment is not needed.

The following are three guiding principles that every food service should adhere to when providing gluten-free offerings.

Principle 1: Prevention of food safety hazards is favored over reliance on corrective actions after a problem has occurred.

Principle 2: Prevention of food contamination in the production of gluten-free foods must encompass all aspects of procurement, processing, and delivery of gluten-free foods.

Principle 3: Worker hygiene and production and storage area sanitation practices play a critical role in minimizing the potential for contamination of gluten-free foods.

Ensuring best practices is not an insurmountable ordeal—it is comprised of simple steps regarding food placement and kitchen procedures that may not have been considered previously. However, for food service establishments offering GF food items, understanding the risks of cross-contamination and establishing sound, documented procedures for avoiding those risks is crucial to the safety of patrons and ultimately, a food service organization's success. ■

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SPECIAL REPORT (Continued from p. 25)
importantly, not many of the smaller countries recognize other island countries' inspection services, certifications, or processes. This situation is improving, particularly in fresh produce, as a result of a New Zealand and Australian government funded program called Pacific Horticulture and Agriculture Market Access."

Commercial tuna fishing has long been significant in the Pacific Islands region, and tuna canneries, especially those in American Samoa, have been key stakeholders in the industry.

Products from American Samoa can be exported to the U.S. tariff free if the local component is at least 30 percent of the value.

StarKist Co., Pittsburg, Penn., established a tuna processing plant on American Samoa in 1963 in Pago Pago, the capital. With some 2,200 employees, the 329,000-feet^2 plant processes, on average, 430 metric tons of frozen fish per day on 13 canning lines and three pouch lines, according to David Calvin, StarKist's director of quality and safety.

"Food safety for StarKist starts with the fishing vessels," Calvin says. "We contract with vessel owners who have state-of-the-art refrigeration systems for chilling and freezing the harvested wild caught tuna, currently 10 U.S. flagged purse seiners for our light meat tuna supply and 13 U.S. long liners for our Albacore supply."

Because American Samoa is a U.S. Territory, the StarKist tuna plant is regulated by the FDA. "As a result, StarKist's food safety risks are managed by implementing a robust Seafood HACCP program," Calvin relates.

"Other Pacific Island tuna plants are only regulated by the FDA if they export to the U.S. and they may not have similar HACCP programs," Calvin notes. "With our plant being located in a U.S. territory, we have significantly greater external quality and safety oversight than our competitors." ■

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For bonus content, go to February/March issue on FoodQualityandSafety.com and check out the three parts to the "Handling Food Safety Issues in Paradise" special report.

NEW PRODUCTS

Leak Detection for Modified Atmosphere Packaging

MAPAX LD leak-detection system is ideal for packaged meat, poultry, seafood, and prepared foods packaged with tray sealers or thermoforming machines. It tests packages inline and can achieve 100% sampling at speeds up to 120 packages/min. It works by adding a small volume of hydrogen as an indicator to the modified atmosphere mixture at the package sealing stage. MAPAX LD sensor detects for the gas after the sealed packages travel into the leak-detection unit. The company supplies MAPAX modified-atmosphere packaging gases, including nitrogen and carbon dioxide, to the food industry. **Linde LLC, 800-755-9277, www.lindefood.com.**

Hand Hygiene Control

After being in service for several years in Europe, Hand-in-Scan has been evaluated by the FDA and is now available to U.S. healthcare and food services. The hand hygiene scanner clearly identifies un-sanitized areas on the user's hands. This digital technology helps workers learn the technique of proper hand hygiene. The scanner provides immediate feedback related to the quality and thoroughness of handwashing. It can also monitor hand hygiene compliance with its online reporting system. **CleanScan LLC, www.handinscan.com.**

Inventory Management Technology for Food Service

The mobile Inventory Management tool allows workers and managers in the food service industry to take, share, analyze, and react to supply-level data in real time using their smartphones. Users can create as many inventory sheets as they like, whether it be for the bar or the walk-in refrigerator. When orders are received and checked-in at the restaurant, gaps are flagged instantly, and both restaurants and suppliers are alerted via notifications so that necessary replacements can be shipped. According to the company, the Order Check-In function means the end of signing, scanning, and entering invoice data for tracking purposes. Operators no longer need a third-party to perform manual data entry of invoices because the process is now all paperless. **BlueCart, 301-761-3003, www.bluecart.com.**

Corner Canopy Hoods

The Corner Canopy Hood is designed to capture and exhaust corrosive vapors, heat steam, and odors when mounted over areas that have water baths, hot plates, or other lab equipment. One-piece hood is molded of advanced composite resins that have chemical and corrosion resistance, and are flame retardant and lightweight to ensure no rust. Canopy can either be wall mounted or suspended from the ceiling and can be equipped with optional side wall panels to prevent cross drafts from affecting the containment of fumes. **HEMCO, 800-779-4362, www.hemcocorp.com.**

Mass Spectrometer

NexION 2000 Inductively Coupled Plasma Mass Spectrometer can help detect a broad range of elements at ultra-trace levels. The system can handle harsh matrices and rapid changes in sample composition with minimal prep time. Scanning and data acquisition speeds of 100,000 points/sec. combined with proprietary software-based algorithms provide advanced characterization of nanoparticles and single cells. It also has the ability to leverage built-in methods for drinking water, waste water, seawater, and soil with compliance to international regulations and guidelines. **PerkinElmer, Inc., 800-762-4000, www.perkinelmer.com.**

In Other News

Fapas launches a new range of allergen reference materials to enable laboratories around the world to evaluate and compare their methods and capabilities when testing food samples for allergens.

The Gluten Intolerance Group's Gluten-Free Certification Organization program receives ISO/IEC 17065:2012 accreditation from the American Association for Laboratory Accreditation.

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Events

Food Industry CEOs to Gather at GFSI's 2017 Conference

Leadership for Growth is the theme of GFSI's 16th Global Food Safety Conference in Houston on February 27-March 2. Demonstrating that "food safety must come from the top" in a vibrant company food safety culture, seven CEOs of today's food industry heavyweights are set to take the stage at this year's global food safety event.

The following are lined up to speak on the role of food safety leadership through the Global Food Safety Initiative: Dave MacLennan, CEO, Cargill; Emmanuel Faber, CEO, Danone; Doug Baker, CEO, Ecolab; John P. Bilbrey, CEO, The Hershey Company; Irene Rosenfeld, CEO, Mondeléz; Tom Hayes, incoming CEO, Tyson Foods; and Danny Wegman, CEO, Wegman Foods.

The 2017 conference will highlight how GFSI serves as a driver to the food safety ecosystem and how companies can leverage GFSI for growth, no matter where in the supply chain they operate.

With the vast amount of change seen in 2016, from new globally-relevant regulations such as FSMA to the release of several revised scheme standards, the annual conference will focus on the need to cultivate the industry's own leaders during this ever-changing food safety landscape and help them become effective leaders for the future.

MARCH

5-9
Pittcon
Chicago
Visit http://pittcon.org/pittcon-2017/.

7
Dairy Plant Food Safety Workshop
Visalia, Calif.
Visit www.usdairy.com/events.

7
FSMA Part 117: Preventive Controls for Human Food – What Line Staff Need to Know
Charlotte, N.C.
Email ascanlin@easconsultinggroup.com or call 571-447-5500.

8-10
Current Good Manufacturing Practice, Hazard Analysis, and Risk-based Preventive Controls for Human Food
Charlotte, N.C.
Email ascanlin@easconsultinggroup.com or call 571-447-5500.

9-11
Current Good Manufacturing Practice, Hazard Analysis, and Risk-based Preventive Controls for Human Food
Chicago
Email ascanlin@easconsultinggroup.com or call 571-447-5500.

APRIL

17-19
The Changing Paradigm in Halal Certification
Rosemont, Ill.
Visit http://ifanca.org/pages/Conference.aspx.

25
McCloud Services' Annual Pest Invasion
Oakbrook, Ill.
Visit www.regonline.com/builder/site/?eventid=1905173.

MAY

8
FSMA Part 117: Preventive Controls for Human Food – Dietary Supplements
Chicago
Email ascanlin@easconsultinggroup.com or call 571-447-5500.

8-11
Food Safety Summit
Rosemont, Ill.
Visit http://www.foodsafetysummit.com/.

22-23
Whole Genome Sequencing for the Food Industry
Chicago
Email htomlin2@iit.edu or call 708-563-1576.

23-25
Food Microbiology Short Course
University Park, Penn.
Visit http://agsci.psu.edu/foodmicro or call 877-778-2937.

JUNE

13-15
United Fresh
Chicago
Visit http://www.unitedfreshshow.org/.

20-22
The 51st Annual Microwave Power Symposium
Miami
Visit http://impi.org/symposium-short-courses/.

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