PLUS Using the Term "Natural" on Labels ■ Measuring pH in Dairy Products ■ Keeping *E. coli* Out of Flour

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AUGUST/SEPTEMBER 2016

Food Quality & Safety

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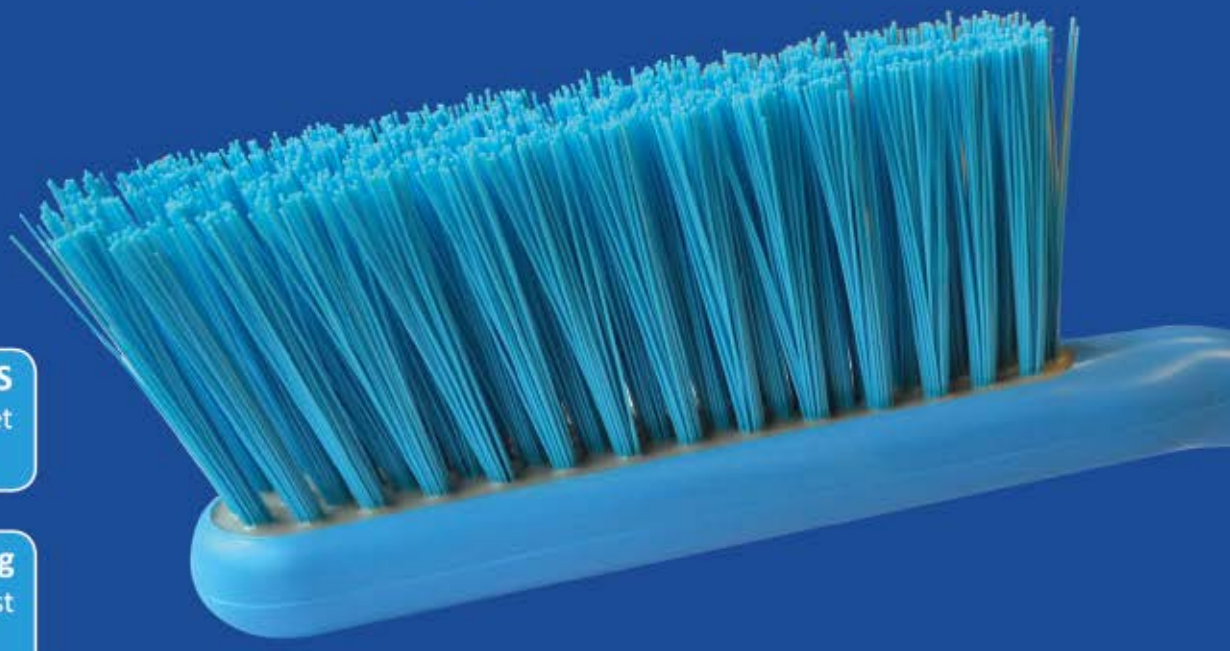

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Special Announcement

Food Quality & Safety magazine was recently honored with two editorial awards:

- 2016 APEX Award in news writing category for "Biosecurity Lessons from Avian Flu Outbreak" newsletter article by Joanna Schroeder
- Silver award in 2016 Azbee Awards of Excellence in government coverage category for Washington Report columns by Ted Agres

WINNER! WINNER!

Congratulations FONA International!

The flavor company has been named the winner of the 2016 Food Quality & Safety Award. FONA was recognized for upholding the highest food standards supported by quantifiable results in all areas measured. *For the complete story, check out October/November issue.*

Here's what a couple of this year's judges had to say:

"FONA's submission shows a company with high product standards and expectations."

"FONA is investing in new technologies and training that they show are making improvement."

From The Editor

Training was a hot topic at this year's IAFP in St. Louis. Posters sessions, roundtables, symposiums, and exhibitions all emphasized the necessity of food safety training.

Sure, the food industry realizes the importance of training; but how effective is the training that you or your employees receive? Not implementing proper food safety training programs can have serious consequences. Food companies' executives, managers, and employees can be charged with a crime even if they didn't know that a food safety violation was happening under their roof.

Alchemy Systems, in partnership with the Campden BRI, SQF Institute, British Retail Consortium, SGS, and TSI released the 2016 results of a global survey of 25,000 food companies about their food safety training practices and challenges. The Global Food Safety Training Survey found that companies are devoting significant time to training: about 75 percent of employees get four or more hours of training per year; and 50 percent of supervisors and managers get nine or more hours of training per year.

However, many companies struggle to translate that commitment to actual employee behavior on the plant floor. In the survey, 62 percent of respondents agreed with the statement, "Despite our efforts in food safety classroom training, we still have employees not following our food safety program on the plant floor."

The survey found a "lack of refresher training" for frontline workers. It uncovered that 75 percent of respondents believe that if food safety programs were consistently applied, employee productivity would increase.

"Closing the gap between a company's commitment to food safety and the frontline's actual behaviors requires new thinking and approaches," says Je Eastman, CEO of Alchemy Systems. "Companies need to devise interactive and relevant training pro- grams that will engage employees with real-world safety scenarios and team activities so they make the right food safety decisions on the plant floor."

From harvesting to processing to service, training programs for food industry workers at every level need to emphasize the gravity of the responsibility being put on employees' shoulders. Their shortcomings could expose people nationwide with serious illness and may even cause death. Only when employees grasp the seriousness of their job can food safety training be successful.

Marian Zboraj
Editor

Food Quality & Safety
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NEWS & NOTES

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UNIDO and GFSI Sign Memorandum of Understanding

The United Nations Industrial Development Organization (UNIDO) and GFSI sign a Memorandum of Understanding to signal their commitment to a large-scale partnership for food safety. The partnership sets out to harness the experience and knowledge of both global organizations in order to implement "a roadmap for scaling up" by developing large-scale food safety capability building projects in key regions, starting with China, Southeast Asia, and Africa before being continued in other regions. This development program will be based on the GFSI Global Markets Program, which will determine how small or less developed food companies can meet the challenge of food safety and gain market access. UNIDO will offer its specialized experience in industrial development capability building.

FSIS to Post Location-Specific Food Safety Data Online

USDA's FSIS will soon begin sharing new levels of food safety data specific to slaughter and processing facilities in the U.S. on Data.gov. The agency has detailed this framework in its Establishment-Specific Data Release Plan, which the agency anticipates will allow consumers to make more informed choices and lead to industry-wide improvements in food safety by providing better insights into strengths and weaknesses of different practices. The new datasets will begin to publish on Data.gov on a quarterly basis starting 90 days after publication in the Federal Register. Initially, FSIS will share information on the processes used at each facility, as well as a code for each facility that will make it easier to sort and combine future datasets. FSIS will first release results for *Listeria monocytogenes* and *Salmonella* in ready-to-eat products and processed egg products. It will then begin to share other datasets, including results for STEC in raw, non-intact beef products.

New ISO Standard Validates Microorganism Testing Methods

ISO 16140:2003 for the validation of alternative (proprietary) microbiological methods has been revised and includes two parts. ISO 16140-1:2016, Microbiology of the food chain, Method validation—Part 1: Vocabulary, describes the terminology used in microbial testing, while ISO 16140-2:2016, Microbiology of the food chain, Method validation—Part 2: Protocol for the validation of alternative (proprietary) methods against a reference method, is dedicated to the validation of proprietary microbiological methods. They are designed to help food and feed testing laboratories, test kit manufacturers, competent authorities, and food and feed business operators to implement microbiological methods. ISO 16140-2 includes two phases, the method comparison study and the interlaboratory study, with separate protocols for the validation of qualitative and quantitative microbiological methods.

CFI Expands to Canada

The Center for Food Integrity (CFI) expands north with the launch of the Canadian Centre for Food Integrity (CCFI). With a growing membership representing diverse aspects of the U.S. food system, CFI is a not-for-profit organization founded in 2007 to help today's food system gain trust. The new Canadian affiliate, a division of Food & Farm Care Canada, shares this mission and will demonstrate its values in areas of animal care, environmental stewardship, and safe food production. Like CFI, the CCFI will conduct annual consumer trust research to better understand changing public attitudes about food and agriculture, and to provide guidance to the Canadian food system.

Prison for Executives in *Salmonella* Outbreak

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As reported by Reuters, a federal appeals court on July 6 rejected a bid by two former Iowa egg industry executives to throw out their 3-month prison sentences after their company Quality Egg LLC caused a nationwide *Salmonella* outbreak in 2010. By a 2-1 vote, the 8th U.S. Circuit Court of Appeals in St. Paul, Minn. said prison time was appropriate for Austin "Jack" DeCoster and his son Peter for negligently failing to prevent the outbreak, which sickened thousands. "Congress recognized the importance of placing the burden on corporate officers to protect consumers who are wholly helpless from purchasing adulterated food products which could make them ill," Circuit Judge Diana Murphy wrote. "The public has a right to expect a heightened degree of foresight and care."

Business Briefs

BRC Global Standards signs up to the U.K. India Business Council Launchpad scheme to drive expansion of the Indian market.

NSF International opens an office in Ecuador, offering certification, auditing, training, and consulting services.

Mérieux NutriSciences acquires Lactolab (Pty) Ltd., expanding dairy testing offering in South Africa.

SGS acquires 20% stake in Transparency-One, a platform for supply chain visibility and risk management.

Eurofins BioDiagnostics merges with **Eurofins STA** to strengthen position in the seed, plant, and agBio diagnostics markets.

Washington Report

Will Food Labels Go Au Naturel?

FDA is tasked with determining if the term "natural" should be redefined or completely banned | BY **TED AGRES**

After receiving nearly 7,700 comments from the food industry, consumer associations, and members of the public, FDA is trying to figure out how to revise its "long-standing policy" regarding use of the term "natural" on food labels.

Specifically, FDA is seeking to determine whether, through rulemaking, to allow foods produced with genetically modified organisms (GMOs), foods made from crops that have been treated with chemicals, or foods processed with thermal technologies or irradiation to be labeled "natural." Alternatively, it is considering whether "natural" should be banned from food labels altogether, as several major consumer groups are requesting. The implications of these changes could be significant for the "healthy" foods industry, which is projected to achieve a $1 trillion global market by 2017.

"When we established our policy concerning the use of the term 'natural' [in 1993], it was not intended to address food production methods, such as the use of genetic engineering or other forms of genetic modification, the use of pesticides, or the use of specific animal husbandry practices," FDA explained in its Nov. 12, 2015 Federal Register request for public comments. Rather, the agency's policy—which remains in effect—means only that "nothing artificial or synthetic (including all color additives regardless of source) has been included in, or has been added to, a food that would not normally be expected to be in the food" (58 FR 2302 at 2407).

In the decades since FDA promulgated the policy, the term "natural" has come to mean widely different things to different people. Thousands of consumer complaints have been lodged and scores of class-action lawsuits have been filed over the presence of GMOs, artificial, or synthetic ingredients in "natural" food products. According to recent surveys, two out of three consumers believe "natural" means that nothing artificial or synthetic has been added, that no toxic pesticides were used during growing, that no chemicals were used during processing, and that the product contains no GMOs. In short, most consumers think that "natural" is a close cousin to "organic," with the advantage of costing less.

In reality, under current FDA policy, "natural" foods may be grown with pesticides, may be chemically processed, and may contain GMOs. They may or may not cost less than organic.

For many years, this definition worked well enough, but as food technology has developed, the agency has not kept pace. For example, the FDA has declined requests from three separate Federal District Courts over the past five years to advise on when ingredients produced using genetic engineering may or may not be labeled as "natural." FDA received citizens petitions from the Grocery Manufacturers Association (GMA) in 2014, Sara Lee Corp. in 2007, and The Sugar Association in 2006 asking it to define the term "natural," and received a petition from the Consumers Union in 2014 requesting that it ban "natural" from labels altogether because the term is "false and misleading" under the Federal Food, Drug, and Cosmetic Act.

"We've seen time and again that majority of consumers believe the 'natural' label means more than it does, and by buying 'natural' foods, they may think they're getting the same benefits as organic, but for less money," says Urvashi Rangen, PhD, director of Consumer Union's Food Safety & Sustainability Center, which commissioned three annual nationwide surveys on label issues. "The term 'natural' is organic's imposter," he added. "It's time for the 'natural' label to go away."

Plethora of Viewpoints

In its formal comments to FDA, Consumers Union, publisher of Consumer Reports, reiterates its opposition to the term "natural" but added that if FDA continues to allow it, the agency should consider food production techniques and not just processing methods and ingredients; rely

on the USDA "organic" standards as a baseline for certification, verification, and enforcement; prohibit the addition of artificial ingredients; and require third-party verification. Organizations supporting this position include the Consumer Federation of America, Food & Water Watch, Friends of the Earth U.S., and the National Organic Coalition.

GMA, on the other hand, encourages FDA to recognize the "current realities" of food manufacturing, safety, and future food technologies and provide the food industry with "flexibility." In its comments, GMA draws a distinction between organic and natural, with the latter being allowed to include biotech or GMO seeds. Synthetic or artificial ingredients, such as vitamins and minerals, would be allowed only as specifically authorized by FDA. Animal husbandry attributes, such as "free range," "fair trade," or "grass fed" should have no bearing on a food or ingredient's "natural" status, GMA says.

GMA supports a three-tiered approach to "natural" labeling. Tier 1: "All Natural" or "100% Natural" for all ingredients, processing aids, and incidental additives; Tier 2: "Natural," the same as Tier 1 except processing aids and incidental additives would not be considered and colors from natural sources would be allowed; and Tier 3: "Made with Natural ..." for individual ingredients meeting Tier 2 criteria in meaningful amounts, to be determined by FDA. "We recognize the complexity of balancing consumer perception with the technical aspects of food safety and processing technologies that must be considered," says Karin F.R. Moore, senior vice president and general counsel, in GMA's comments.

The Organic Trade Association (OTA) says that the confusion between "natural" and "organic" has had a "real impact" on the organic label, with consumers viewing the terms as being equal or similar, when they are not. In its comments, OTA prefers FDA to issue guidance that restricts "natural" from food labels except when its use is already provided for in regulation, such as "natural flavors." The agency should focus on identifying and defining "single attribute" claims on labels, such as "no artificial colors or flavors," "no synthetic ingredients," "minimally processed," or "produced without the use of GMOs." If "natural" is permitted, OTA says FDA should require an explanation, such as "Natural—no artificial flavors or colors." And, as to be expected, "natural" should not be allowed on or associated with GMOs.

The American Herbal Products Association (APHA) supports both FDA's defining of "natural" as well as use of single attribute label statements, such as "Made with natural..." or "100% natural." In its comments, APHA wants FDA to "prohibit use of the term on labeling of raw agricultural commodities from crops produced with genetic engineering (GE) or mutagenesis and on multi-ingredient products" that include GE ingredients. APHA also suggests that both ingredients and manufacturing processes be considered, with the latter being among a "traditional food preparation process...that retains the natural quality of the starting ingredients."

The Natural Products Association (NPA) offers a different perspective on biotech products. In its comments, NPA supports FDA's drawing a clear distinction between organic and natural foods, but notes that "'natural' foods, which are products of the earth, can contain ingredients derived from biotechnology."

"If 'natural' became synonymous with non-GMO, there would be no difference between the terms 'natural' and 'organic,' and it would be pointless for FDA to undertake defining 'natural' through federal rulemaking," says NPA CEO Daniel Fabricant, PhD, in written comments. "Those consumers who simply wish to avoid artificial and synthetic ingredients should be able to do so by choosing 'natural' products," he adds. "They should not be forced into choosing between conventional foods and 'organic' foods," especially when the price of organic foods can be a purchasing barrier.

Agency Coordination an Issue

FDA doesn't have sole jurisdiction over what is and isn't "natural." The Federal Trade Commission (FTC) has jurisdiction over food advertising claims, and evaluates each on a case-by-case basis, requiring advertisers to substantiate their claims even in the absence of clear definitions, according to a brief from the Sidley Austin law firm. USDA policy allows "natural" label claims for meat and poultry so long as the food contains no artificial or synthetic ingredients, is minimally processed, and the label explains the meaning of "natural." FDA acknowledges it will need to coordinate with USDA in considering the issue, but doesn't mention the FTC.

Given the confusion that exists between federal government agencies as well as among food producers and consumers, it is not surprising that Congress has attempted to address the "natural" issue. So far, the efforts have been unsuccessful. The Food Labeling Modernization Act of 2015 (HR 4061/S 2301) would have required the term "natural" to exclude any artificial or synthetic food or ingredients, including artificial flavor or added color, with definitions to be partly based on consumers' understanding of the term. The measure, identical to one introduced in 2013 (HR 3147/S 1653), failed to emerge from committee. In July 2015, the House of Representatives passed the Safe and Accurate Food Labeling Act (HR 1599). It was referred to the Senate Agriculture Committee, where it languished. The measure would have required FDA to promulgate a regulation defining the term, which would preempt state and local requirements. The bill would also have required mandatory GMO labeling and require USDA's Agricultural Marketing Service to enact a voluntary GMO certification program.

Considerable controversy continues to swirl around the issue of GMO labeling. In mid-July, both the U.S. Senate and House passed S-764, a bill that authorizes USDA to establish a single national standard for GMO labeling within two years. The measure specifically blocks states from enacting their own GMO labeling requirements, such as Vermont's mandatory GMO labeling bill, the nation's first, which went into effect on July 1. Many food manufacturers and industry groups had expressed concerns over the likelihood of a "patchwork" of such state laws.

The federal legislation requires GMO label disclosure by way of text, symbol, or electronic or digital link. Opponents say this is inadequate because food companies could simply put a QR code on the label with the words, "scan here for more food information." The bill was sent to the White House, where it was expected to be signed into law. ■

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Industry Insights

Lessons Learned: Compliance Tips from the Life Sciences Industry

Parallels between the life sciences and food industries and how food companies can adopt similar compliance practices in preparation for FSMA

BY **SCOTT GRZESIAK, PMP, CSSBB** AND **CHARLES MANNO PMP, PCQI, LSSGB**

With the Food Safety Modernization Act (FSMA) looming, the food and beverage industry faces some of the most sweeping safety regulations since Congress passed the Federal Food, Drug, and Cosmetic Act of 1938, which authorized factory inspections and established standards of identity, quality, and fill-of-container for foods.

For many food and beverage production companies, compliance with FSMA's stringent new requirements can seem daunting—even as operating in a world where the threat of contamination, allergen exposure, or package mislabeling seems to be an inevitable part of doing business. Based on the "Food Quality & Safety Survey 2016" conducted by Sparta Systems, only 54 percent of respondents say their organizations are compliant with the finalized FSMA regulations.

Regulations Across the Board

The food and beverage industry is increasingly experiencing tighter controls similar to regulations that have been in place in the life science industry for years, including pharmaceuticals and medical devices. These life science companies have established many similar programs that ensure compliance to federal safety regulations—in particular, the need to partner preventive controls with supply chain traceability in identifying and managing the risks of a product recall.

Recall response planning is a critical element for any business, but food is especially vulnerable. A browse through the FDA's recall database shows a preponderance of recent food-related problems—from a massive recall due to traces of *Listeria* in private-label organic frozen vegetables, to undeclared peanut allergens in private label grocery cakes and cookies. Many of the root causes of these issues could have been caught early in the supply chain process through improved preventive controls, including timely supplier audits.

In the past, most food and beverage companies and their suppliers relied on a certificate of analysis, documenting the understood agreement that the supplier had proper controls in place and was delivering a safe product. Now, under FSMA, food and beverage companies are accountable for the quality of their supply chain and must adhere to strict supplier process verification guidelines, including the requirement to share product data, conduct supplier audits, and conduct quality assurance testing. While this process may seem intimidating to food and beverage companies, supply chain traceability and QA are long-standing practices in life sciences. To ensure the highest standard of quality and preserve patient safety, pharmaceutical companies have processes in place to ensure adherence to current Good Manufacturing Practices. This vendor oversight extends to the increasing number of contracted manufacturers who do everything from supplying active pharmaceutical ingredients to commercializing and distributing products.

Conducting both internal and partner audits is also standard practice for pharmaceutical companies to gauge the robustness of their quality system. These audits effectively evaluate the company's and suppliers' alignment with the principles in the quality system, ensure consistent, high-quality production, and embrace a state of continuous improvement—the foundational aspects of a culture of product safety. All of these aspects are elements of FSMA.

More Defined Label Layout?

Another similarity between current life science practices and new FSMA regulations is the requirement to maintain supply chain traceability—something that pharmaceutical and medical device manufacturers have been practicing for years.

When the FDA passed the standardized labeling guidelines known as Unique Device Identification (UDI) and National Drug Code (NDC) for medical devices, the intention was to increase public insight into the item's production history, while

providing a more efficient way to identify and manage product recalls.

The key to identifying a product and its manufacturing lineage is the standardized barcode, such as the international GS1 Standard. The Global Trade Item Number in the GS1 standard means that the identification information on every product's label has the same look and feel, printed in clearly identified human readable text.

This information is also encoded in a printed barcode on the product label, similar to the UPC barcode on all consumer packaged food and beverage goods, which allows the manufacturer, distributor, or wholesaler to easily scan and track the product from supply to manufacturing and all the way to the consumer. This "track and trace" concept is crucial in managing the product through the supply chain. The barcodes can also include product serialization, depending on the need to track individual products or whole lots or batches.

The efforts to track and trace products in the life sciences arena suggest a similar evolutionary path for food and beverage labeling. Under the NDC and UDI, the FDA and pharmaceutical industry had a clearly defined layout upfront for what information should be included in the new label markings, and what industry or international standards should be followed. A similar goal and definition has not yet been established for the food and beverage industry. The Global Food Safety Initiative (GFSI) is aware of the topic and has begun some discussions, and the GS1 consortium is now in the early stages of examining this issue relative to applying the GS1 standard to the food and beverage industry. But clear goals and guidelines must be established before the food and beverage industry can begin to address this next step.

Get Started on the Basics

While some food and beverage companies are confident in their efforts to comply with FSMA, others may benefit from following a few basic steps to get started on their compliance journey.

1. Centralize the audit function. Food and beverage companies can combine different types of audits from their suppliers and co-manufacturers into a centralized audit format. Combining the audit agenda into core elements can help reduce the redundancy of asking for the same topic in each audit. For example, a manufacturing, QA, and environmental safety audit could share core elements to be merged into a single agenda, enabling a team of two auditors to visit the co-manufacturer or supplier during their prescribed visit time and eliminate the need for at least one additional audit.

2. Optimize audit readiness. This year, the Safe Quality Food (SQF) organization, which provides a safety certification framework around a company's food safety practices, instituted unannounced audits in their certification process that consequently will more closely mirror the FDA's use of unannounced inspections. Normally within SQF, organizations will

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undergo a scheduled audit every three certification cycles (possibly four to five years between each audit). This gives the company time to plan and prepare for the audit. Unscheduled audits, however, can be intimidating as companies have much less time to prepare. Typically, a company must scramble to complete activities and hope that it is acceptable to the auditor. A new approach focuses on a constant state of audit readiness to ensure that the company is always prepared for an audit and can be assessed at any given time through on-demand access to real-time metrics, with the areas of focus assessed for risk and impact. A common practice in the life science industry is to perform mock audits to enable this state of readiness.

3. Get certified. By becoming certified under GFSI, a food or beverage company signals to the world that they are operating under the highest industry standards. Although mandatory audits are still required, becoming certified may reduce the probability for a company to be hit with random audits. The certification process itself helps improve overall process management by instilling processes that proactively identify and manage risks. It also gives the FDA and local authorities confidence that the food or beverage provider is serious about a food safety culture.

4. Develop a roadmap for recalls and corrective action. Having systems to verify and document that your suppliers are meeting your expectations with respect to food safety, and having a well-documented, exercised recall plan in case things go wrong are necessary steps to be able to respond to possible FDA inspection findings. It is also essential to be proactive and have a well thought-out corrective action process and plan of attack. Corrective action plans involve the development of a process and procedure to describe who, what, when, where, and how the company will address any identified problems. Training and rehearsing these response plans before an actual event helps ensure proper readiness, reduces overall response-time, and lessens the overall level of panic that often accompanies these events. ■

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Case Studies: Examples of Food Traceability & Tracking

As part of expanding the GS1 standards for food and beverage companies in the U.S. and abroad, the Product Traceability Initiative (PTI) is designed to help maximize the effectiveness of existing trace-back procedures while standardizing the improved speed and efficiency of future traceability systems.

Three recent examples of improving this process involve food and beverage businesses integrating PTI best practices into their existing systems and experiencing improved results.

1. Global produce supplier Oppenheimer Group, Safeway, and iTradeNetwork collaborated on a pilot for implementing produce traceability via the Advance Ship Notice system. This is conducted over the Internet in an electronic data information or extensible markup language format, providing information about when an order will be shipped and other information, including mode of transportation and carrier. Benefits include reduced costs for both suppliers and receivers due to not using Hybrid Pallet Labels; improved inventory and warehouse management for receivers due to advanced visibility of shipment; and elimination of "missing data" errors and the avoidance of labor of having to scan barcodes on each individual case.

2. In response to repeated disease outbreaks at the burrito chain's stores, Chipotle Mexican Grill is working with leading food experts—including a former FDA official—to find ways to prevent future health problems. A spokesperson from the chain said the restaurant has cut some smaller suppliers and is focusing on food traceability as a way to minimize contamination. Chipotle has partnered with traceability solution provider Food LogiQ to implement a traceability program based on GS1 standards for sharing standardized product information at each step along the supply chain. The collaboration resulted in improved QA and logistics efficiencies; real-time visibility of food at each point in the supply chain; improved stock recovery process; the ability to capture and share quality attributes throughout the supply chain and enhance reporting at the restaurant level; and more direct access to supplier-provided information about sustainability efforts.

3. Leading Polish food retailer JMP (Jeronimo Martins Poland), through its Biedronka stores, implemented Global Trade Item Number on its variable measure fresh products such as meats, poultry, fresh salads, bread, dairy, and fish with GS1 barcodes. The switch enabled the chain to manage the expiration date of products in an automated way at the point of sale, ensuring that the products meet freshness quality standards, and are traceable in the event of a recall.—*S.G. and C.M.*

Across The Nation

California Dreamin'

The Golden State's abundant agricultural commodities stay gold

BY **LINDA L. LEAKE, MS**

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

California has long been a place where people go to pursue their dreams.

It all began with the historic Gold Rush, which dates to 1848. Since then, California has become the most populous state, with some 38.8 million people.

California's agricultural abundance currently includes more than 400 commodities grown, including better than a third of the country's vegetables and two-thirds of the fruits and nuts, according to the California Department of Food and Agriculture (CDFA).

This whopping number of food items (and people) creates a great need for outstanding food quality and safety systems, and, in this regard, the Golden State shines.

Dairy Dynamo

The year 1993 was another landmark for California. That's when the Golden State knocked off Wisconsin, the nation's "America's Dairyland," from its number one spot among U.S. "white gold" producers. California has been the leading dairy state since, ranked first in the number of dairy cows, with some 1,775,000 head, and also in the production of total milk, with 40.8 billion pounds produced in 2015, providing about 20 percent of the U.S. milk supply.

California also ranks first nationally in the production of butter, ice cream, nonfat dry milk, and whey protein concentrate, according to CDFA, and is second in cheese production.

The state's dairy farms range in size from large facilities milking thousands of cows to small farmstead operations milking a few dozen goats, sheep, or even water buffalo, says Stephen Beam, PhD, chief of the CDFA Milk and Dairy Food Safety Branch.

"This diversity of approaches to producing, manufacturing, and distributing dairy products requires CDFA to maintain a large breadth of expertise within our food safety inspection staff," he relates. "The ability to uniformly apply laws governing the safe production and processing of milk products, while supporting the innovation and growth of a large and diverse dairy industry that serves both local and global customers, remains an important strength of CDFA."

The CDFA fully appreciates the challenges facing all sectors of the dairy industry as a result of the severe and ongoing drought in California, Dr. Beam adds. "Innovative and novel approaches to water conservation at dairy farms and milk processing plants that continue to ensure the safe and sanitary production of milk products remain of keen interest to the Department," he says, "and openness to discussions and collaboration with the industry in this important area is an additional strength of CDFA's dairy food safety program."

Amazing Almonds

Almonds are California's largest tree nut crop in acreage and total dollar value, not to mention the state's top agricultural export and the largest U.S. specialty crop export, according to the Almond Board of California (ABC).

California's almond production for 2015 is an estimated 1.894 billion meat pounds (edible part only, shells not included), according to the ABC's May 2016 position report.

"California is the world's largest producer of almonds, with some 6,800 farms supplying more than 80 percent of the global demand," says Tim Birmingham, ABC's director of quality assurance and industry services.

More than a dozen years ago, raw almonds were implicated in two salmonellosis outbreaks. The first outbreak occurred in 2000 through 2001, and caused illnesses in Canada and the U.S. due to a rare strain, *Salmonella* Enteriditis PT 30.

The second outbreak occurred from 2003 to 2004, with illnesses again occurring in Canada and the U.S., this time

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due to *Salmonella* Enteriditis PT 9C. Product was recalled from more than 10 different countries.

"These outbreaks were really a watershed moment for the low moisture food industry," Birmingham emphasizes. "At the time, conventional wisdom held that low moisture foods, almonds for just one, posed little food safety risk due to the fact that pathogens including *Salmonella* did not grow on such products. However, it turns out that pathogens can survive in low moisture food products, and in some cases, even with low levels, cause illness."

The California almond industry embraced these food safety challenges with a proactive approach. As a result, the second outbreak led to the promulgation of the rule for the mandatory treatment of raw almonds to achieve a minimum 4-log reduction of *Salmonella*. Almond pasteurization is now required by law in the U.S., Canada, and Mexico.

"From almond growers and handlers, to processing, packaging, and sales, ABC's Food Quality and Safety Program is continually evolving to ensure almonds are produced in a safe, responsible manner, so consumers around the world can have the highest level of confidence in our product," Birmingham emphasizes. "

Leafy Greens Leadership

California contributes some 86 percent of the leaf lettuce, 77 percent of the romaine lettuce, 71 percent of the iceberg lettuce, 66 percent of the spinach, and 20 percent of the cabbage showcased in U.S. salads and other dishes each year, according to USDA.

In 2006, a landmark food safety crisis tossed the California leafy greens salad bowl in dramatic, tornado-like fashion. That year, a widely publicized outbreak of *E. coli* O157:H7 was traced to organic bagged fresh spinach (which was sold as conventional produce) grown in San Benito Co., Calif.

One hundred ninety-nine persons infected with the outbreak strain of *E. coli* O157:H7 were reported to CDC from 26 states. Among the ill persons, 102 were hospitalized and 31 developed hemolytic-uremic syndrome. Three deaths were attributed to the outbreak.

"This 2006 *E. coli* outbreak associated with spinach from California had both human and economic costs, and it definitely woke our state's leafy greens industry up," says Scott Horsfall, MA, chief executive officer of the California Leafy Green Products Handler Marketing Agreement (LGMA), which consists of about 100 companies that market 98 percent to 99 percent of the leafy greens produced in California.

"LGMA was established as a stringent food safety program designed to reduce the risk of contamination from pathogens on leafy green vegetables," Horsfall explains. "At the heart of LGMA is a set of food safety practices that are implemented on leafy greens farms throughout the state and verified through frequent government audits."

The LGMA food safety practices cover five key areas, including general requirements, environmental assessments, water use, soil amendments, and work practices and field operations.

"With LGMA, the California leafy greens industry has been successful in decreasing food safety risks and incidence," Horsfall emphasizes. "We have had no recurrence of major outbreaks in our industry."

"The fact that the California leafy greens industry has a stringent food safety program in place as part of state government under state government oversight gives us great credibility and makes us totally ready for FSMA [Food Safety Modernization Act] compliance," Horsfall adds. "With what FSMA is seeking to establish nationwide, we are 10 years ahead."

Fostering Success with *Salmonella* Control in Poultry

When life sent Foster Farms lemons* in October 2013, California's largest poultry producer didn't exactly make lemonade, but the company did face the challenge head on with exemplary leadership. The outcome: uncanny food safety results never achieved before in the U.S. broiler industry.

The lemons came cloaked as a widely publicized outbreak of *Salmonella* Heidelberg traced to consumption of Foster Farms brand chicken.

On a sour note, according to the CDC, a total of 634 persons were infected with seven strains of the pathogen derived from said chicken products, reported from 29 states and Puerto Rico from March 1, 2013 to July 11, 2014. Some 38 percent of the individuals that became ill were hospitalized.

Ira Brill, director of marketing and communications for Foster Farms, explains some key circumstances relevant to the outbreak.

The LGMA food safety practices cover five key areas, including general requirements, environmental assessments, water use, soil amendments, and work practices and field operations.

"*Salmonella* control in poultry, as the USDA Food Safety Inspection Service long required it, was a first process measurement at the processing plant, meaning after slaughter but before birds are cut up," Brill begins. "Under those guidelines, we typically had close to zero percent *Salmonella* and, as such, were listed as one of the top performing U.S. poultry companies."

The vertically integrated Foster Farms specializes in fresh, all natural chicken products and currently operates 120 ranch complexes and three processing plants in California's Central Valley. Most of its birds are processed and sold in California, including half a million birds processed weekly at a plant in Livingston, the company headquarters.

Starting in 2011, Brill says, USDA started looking at *Salmonella* prevalence during the second process, namely after birds are cut up into parts, before they are packaged.

"USDA evaluated about 400 U.S. poultry plants during second process, and found *Salmonella* present about 25 percent of the time," Brill relates. "And our plants were also at this level for the second process."

** California is actually the largest supplier of lemons in the U.S., producing more than 92 percent of the nation's crop, according to California Citrus Mutual. California produces 40 million to 44 million 40-pound cartons of lemons annually. Some 25 percent to 27 percent of California's lemons goes to processing, including lemonade.*

In 2013 the CDC essentially broadened the definition of outbreak, Brill says. "Usually one strain of *Salmonella* is involved in an outbreak," he points out. "Now seven strains were combined, totaling a relatively high level of *Salmonella* cases." Consequently, on Oct. 7, 2013 the USDA issued a public health alert concerning Foster Farms products.

Brill says Foster Farms responded by looking intently at the second process level of *Salmonella*. "We invested $75 million to make changes to improve *Salmonella* control," he relates.

"We also formed an independent advisory board with industry experts," Brill adds. "We looked at *Salmonella* holistically, from breeding, to growing, to the abattoir, to processing. With the help of our advisory board members, we identified two of our 120 ranches in California with particularly high levels of *Salmonella*."

Investigations revealed that *Salmonella* contamination was concentrated inside Foster Farms chicken houses. It was further determined that once *Salmonella* got established inside the houses, there was a greater likelihood that each new flock could be infected.

"As a result, we focused on cleaning the houses themselves, first by soaping the whole houses down, then disinfecting them," Brill explains. "After that, we let farms sit vacant for about six weeks without any birds in them."

The company also initiated spending more time washing equipment in processing plants. "Our plants close daily for a complete four- to six-hour sanitization process verified by USDA," Brill says.

By April 2014, just six months after the public health alert, Foster Farms' *Salmonella* levels plummeted from 25 percent at second processing down to a mere five percent.

"That is unparalleled," Brill emphasizes. "No other company has responded to a food safety issue that fast and so dramatically."

Today Foster Farms performs more than 135,000 microbiological tests per year, "That's a 50 percent increase in our testing program since October 2013," Brill relates.

Brill is quick to point out that, in February 2016, USDA proposed the second process standard for *Salmonella* now be 15.7 percent, nearly a 10 percent decrease from the 2011 government benchmark standard of 25 percent. "Foster Farms' second process *Salmonella* is currently just five percent, and we are committed to remaining at that level" he boasts.

"We continue to work toward further improvement," Brill says. "You never get to an end. *Salmonella* control requires continuous focus and continuous improvement, since there's no substitute for food safety. Consumers insist on that." ■

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For bonus content, go to August/September 2016 issues on www.foodqualityandsafety.com and click on "California's Abundant Agricultural Commodities Stay Gold."

E-COMMERCE PAIRS CONVENIENCE WITH SAFETY

ONLINE GROCERY SALES ARE GROWING FIVE TO SIX TIMES MORE THAN CONVENTIONAL CHANNELS

BY **LORI VALIGRA**

The once-a-week trip to the local grocery store is quickly becoming a relic of the past. Consumers are now shopping at several different places to satisfy their changing tastes, including online grocers, which offer variety and convenience.

Worldwide, more than one-third of online shoppers expect to buy groceries over the Internet this year, some 34 percent compared to 21 percent in 2015, a recent AlphaWise survey from Morgan Stanley Research finds. And the U.S. could see the biggest adoption rate increase for e-commerce fresh groceries, growing to 26 percent this year, up from 8 percent in 2015. Morgan Stanley estimates the total U.S. online grocery market could grow significantly in 2016 by $26 billion to total more than $42 billion. The total size of the U.S. grocery market is estimated at $675 billion.

GROCERIES ACCOUNT FOR 19 PERCENT OF CONSUMER SPENDING, BY FAR THE LARGEST OF THE E-COMMERCE CATEGORIES SURVEYED BY MORGAN STANLEY.

"Overall, this spike in anticipated online grocery spending speaks to a shift in the way that consumers think about shopping for food," Brian Nowak, lead Internet analyst for Morgan Stanley, wrote when the study was released. And with about a 2 percent U.S. market share, Nowak said he sees room for online grocery sales to grow, especially for urban markets, nonperishable products, and "click and collect" items chosen online and picked up at local stores. Groceries account for 19 percent of consumer spending, by far the largest of the e-commerce categories surveyed by Morgan Stanley.

A.T. Kearney, a global strategy and management consulting firm, also found that online grocery shopping is reaching an inflection point after years of promise but limited growth. The company's latest study shows more than one-third of primary grocery shoppers have bought groceries online in the past 12 months, up substantially from last year. And those buying are in the attractive market segments of urban dwellers, Millennials, and those earning more than $75,000 annually.

The consultancy also found that online grocery is one of the largest sources of growth for retailers and consumer product manufacturers. Sales are growing five to six times more than conventional channels and are expected to rise 15 to 18 percent over the next decade in terms of percentage of total grocery sales.

Tyson, for example, is reportedly considering collaborating with Amazon to introduce meal kits. And *The New York Times* is offering readers the ability to order the ingredients of recipes appearing in the newspaper. The latter is part of a growing trend of pre-measured, packaged food that consumers are ordering to have a personalized gourmet cooking experience.

While online grocers include both Internet-only shops like AmazonFresh and brick-and-mortar grocery store-affiliated websites like Peapod, the former capture 84 percent of all online grocery trips and 59 percent of all online grocery spending, according to a recent report by Brick Meets Click of Barrington, Ill. Those so-called "basket bandit" Internet-only sites include Amazon, Blue Apron, ThriveMarket.com, Drugstore.com, Chewy.com, and the online "stores" of mass and club retailers.

And even though AmazonFresh is available in limited markets, it has a 48 percent share of all online grocery trips. Since 2013, the percentage of shoppers that have bought groceries from Amazon in the past 30 days has increased 25 percent, the Brick Meets Click report finds.

"We also found an Amazon multiplier effect," report author Bill Bishop said when the report was released. "As online grocery trips per month increase, so does Amazon's share of trips. They are continually working on making buying easier, and supermarkets need to respond."

AmazonFresh launched in Seattle in 2007. But in a recent column for The Motley Fool, writer Jeremy Bowman notes, "Some headlines refer to the program as a Trojan horse or say it will one day kill the grocery industry, but nine years after its launch, Amazon's grip on the grocery business is tenuous at best. Amazon has just 0.8 percent of the total U.S. grocery sales." And AmazonFresh said recently it will require $299 annual membership, higher than competitors, but meant to include costly distribution fees, according to Amazon.

According to the "U.S. Grocery Shopper Trends 2015" report from Food Marketing Institute, a trade association for food retailers in Arlington, Va., online grocery shoppers were most receptive to buying pet products at 35 percent. And while consumers are buying more fresh produce online, that category of food came in last in the survey at 5 percent. Receptivity to fresh prepared meals or salads was 8 percent.

A 2016 study from Willard Bishop Consulting LLC, a Chicago analytics and consulting company, called "The Future of Food Retailing" found that e-commerce food and consumable sales are expected to grow at a strong pace of 23.1 percent annually from 2016 to 2020, compared to 0.4 percent for supermarkets. But traditional supermarkets still have the dominant share of food retailing, with $467.8 billion in sales in 2015, compared to e-commerce at $29.5 billion.

Amazon has been offering food and consumables at reasonable prices and the shopping experience is easy and quick, according to the report. But brick-and-mortar grocery retailers are entering the e-commerce space more and more, and many manufacturers like Smuckers, P&G, and Enfamil are bypassing retailers and going straight to consumers via their own e-commerce websites.

Brick Meets Click also says there is some good news for supermarkets because in markets where they have established, well-developed online grocery offerings, they can win a significant share of the online business.

Bricks vs. Clicks

Still, traditional supermarkets are expected to continue to dominate the overall food market. Nielsen's April 2015 report, "The

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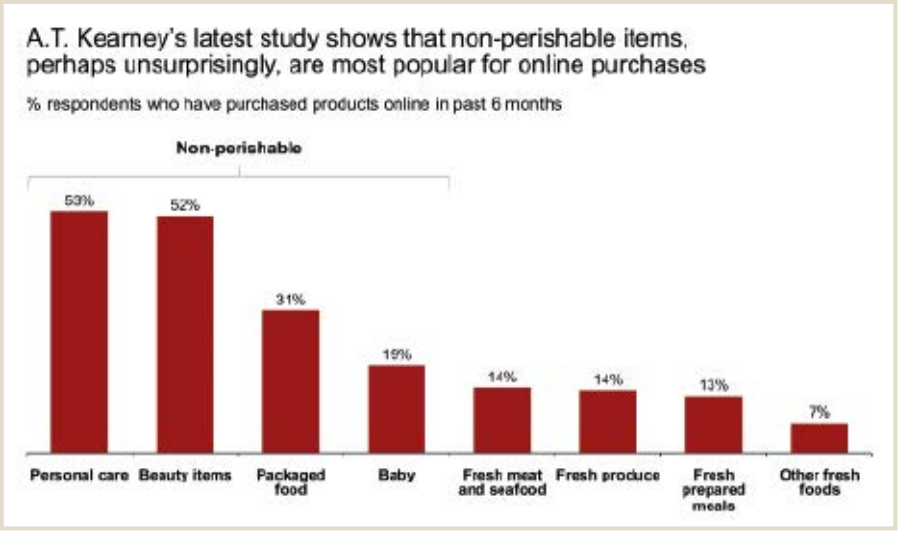
Future of Grocery," which covers the market worldwide, notes that "clicks" won't replace "bricks" anytime soon.

"Online shopping has a number of benefits, but physical stores also have strong key advantages over e-commerce—especially for fast-moving consumer goods," the report notes. "Aside from the obvious in-store benefit of fulfilling immediate shopping needs without paying shipping fees, there are powerful sensory experiences—smelling freshly baked bread and seeing and feeling the vibrant color and texture of perfectly ripe strawberries—that are virtually impossible to replicate online."



Just as important for many consumers, the report says, is that they consider grocery shopping fun. Some 61 percent of global respondents to the Nielsen survey found going to a grocery story is an enjoyable and engaging experience. However, the report says it will be important for physical stores to infuse technology in the in-store experience to address service issues like long lines.

The Kroger Co. grocery chain and its Denver-based King Soopers division is one example of a store that has both an online presence with organics and natural foods and goods and technology in its brick-and-mortar stores. Kroger launched KingSoopers.com/LiveNaturally in 2015. Kroger says it is offering more than 36,000 natural and organic products to King Soopers customers in and around the Denver metro area, a test market before it expands the program. According to Kroger, all produce is free from more than 101 artificial ingredients and preservatives that many customers prefer to be left out of products.

"Increasingly, our customers are looking for more simple, convenient and relevant ways to shop, whether it's in-store, on our website, or on their mobile devices," Russ Dispense, King Soopers president, said in a statement when the e-commerce website was announced. It also has a click and collection option for customers to pick up products ordered online at local stores.

But Kroger is not just focusing on the Internet. It added QueVision technology to its stores in 2012. It is a technology platform that uses sensors and predictive analytics to give managers real-time data on how many customers are in the store and when cash register lines are becoming long.

Keeping Up Quality with Fast-Paced Technology

But how does food quality and safety fit into the speedy, multi-sourced online food market? According to Hilary Thesmar, PhD, RD, the regulatory requirements for food safety are the same as for traditional grocery store distribution.

"The regulatory requirements have to do with the type of facility, such as stores' warehouses or distribution centers, where the food is housed prior to delivery," as opposed to the distribution channel itself, says Dr. Thesmar, vice president for food safety programs at the Food Marketing Institute. "The regulatory requirements are the same in e-commerce [and purchasing at a grocery store] even though the supply chain may not be as visible. I haven't seen any problems. There aren't any visible differences."

Paul Weitzel, vice president at Willard Bishop, agrees, "I do not see any difference in handling processes or procedures for e-commerce versus brick and mortar. Much of online grocery shopping is actually done inside a brick and mortar store. The product is bagged similarly and stored by temperature state until delivered to consumers at curbside or by a van."

He says for home deliveries, trucks are multi-temperature (frozen, chilled, or ambient), or the food product is placed in insulated totes with either dry ice or gel packs. Most of the ratings on the totes keep products cold for at least 8 hours. "Since most deliveries are attended, there are no temperature issues," he wrote in an email to *Food Quality & Safety*.

Dr. Thesmar also agrees that there is little difference in food safety requirements whether it's a traditional or online grocery store.

...WITH THE HOT COMPETITION AMONG GROCERY SELLERS, THERE IS A STRONG INCENTIVE TO MAKE SURE TEMPERATURE CONTROL IS MAINTAINED.

"There shouldn't be gaps in food safety if everything is done right," in stores' warehouses and distribution centers, she says. "Cold items should stay cold through transfers through multiple warehouses and stocking. Temperature controls should be maintained."

She adds that with the hot competition among grocery sellers, there is a strong incentive to make sure temperature control is maintained. "Everyone is fighting for the consumer dollar," she says. "No one will risk taking any chance of a loss of shelf life." Packaging integrity, uniform pallets, and temperature indicators can help let store personnel know if something has been compromised.

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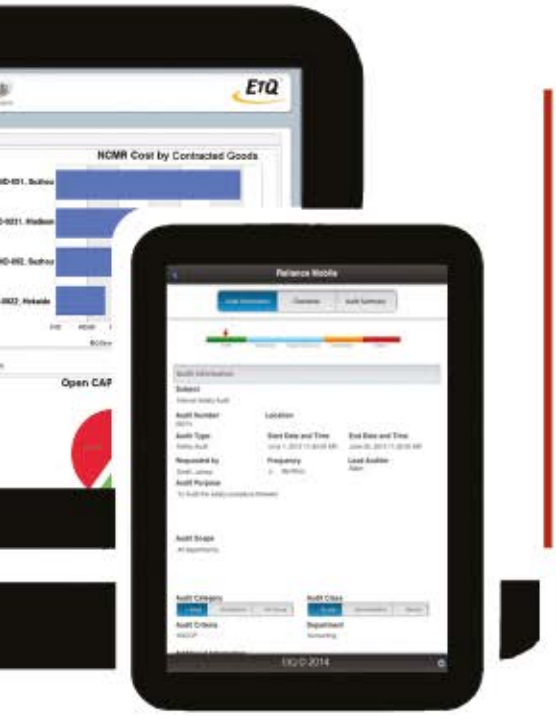

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Dr. Thesmar adds that the regulations and inspection processes are the same for brick-and-mortar and strictly online stores, as everything is relatable to the warehouse and distribution centers.

Under the Food Safety and Modernization Act (FSMA), the store is an extension of food code operations and the distribution center is an extension of the preventive control rules. Delivery trucks are not regulated, so delivery to consumers isn't covered under FSMA regulations, she says.

Dr. Thesmar says one of the trends in food distribution, partly because of the speedy rate of commerce on the Internet, is warehouses popping up on demand so purchases don't have to be moved that far.

"E-commerce is getting nearer to consumers," she says. "And retailers want their customers to come back daily and weekly, so safety is important."

Streamlining Packaging

The speedy world of e-commerce is also driving improvements down the supply chain. That includes the containers used to fulfill orders. IFCO Systems is one such large packager with customers like Walmart that want convenient, clean, and reusable containers.

"Standardization is key," explains Paul Pederson, IFCO director of food safety in Tampa, Fla. "You want to maximize utilization and space and lower costs."

The company is known for its reusable plastic containers (RPCs) in which vegetables, fruit, and other items are shipped. Its standard RPC is 60 x 40 centimeters and varies in height from 8 centimeters for a single-layer avocado tray up to 29 centimeters for bulk items like 40 pounds of broccoli or a head of lettuce.

Each time an RPC is used, it is sent to one of IFCO's 60 wash facilities worldwide and goes through a cleaning process before it goes back to farmers to add produce and start the order fulfillment cycle anew. In March 2016 IFCO released SmartGuardian, an integrated software and hardware system to better monitor and control its sanitation process.

Pederson emphasized that packaging standardization enhances the benefits of automation for e-commerce order fulfillment, improving efficiency while still allowing for safety and quality in grocery retailing.

"The number one piece [in quality and safety] is the time and temperature control, as well as maintaining the integrity of the supply chain," Pederson says. "Within e-commerce I can anticipate much safer delivery systems."

He is including the more localized and personalized deliveries anticipated in the future that are expected to be smaller and can even be focused to one customer. Pederson expects smaller delivery trucks, such as car vans rather than today's 53-foot van trailers, in the future. "And RPCs could come in smaller sizes, such as 30 centimeters x 20 centimeters, that are very personalized, which is where e-commerce shines," he says. "The trend is for distribution networks to spread beyond distribution centers." ■

Valigra is a writer based in Harrison, Maine. Reach her at lvaligra@gmail.com.

Supply Chain Transparency in the Age of Digital and Physical Convergence

Providing data quality, product availability, product images, and product authentication in an online grocery shopping experience aligns with consumer priorities

BY **ANGELA FERNANDEZ**

As consumers spend more time online, their shopping experience expectations are changing. Digital devices play an increasingly central role in shopping and have become consumers' go-to source for product knowledge. This is the age of digital and physical convergence. More people are researching a product prior to purchase and shopping via multiple channels to get the products they need, whenever and wherever they want them. From click-and-collect models to delivered gourmet meals, shoppers are taking advantage of multi-channel offerings and are demanding food companies to go a step further to provide information on food origins, preparation, and ingredients.

While many factors contribute to the blurred lines between real and virtual marketplaces, the smartphone has been the top catalyst. A recent NinthDecimal Mobile Audience Insight Report found that 59 percent of consumers use their mobile device while grocery shopping—an increase of 16 percent from the previous year. Consumers use them to review shopping lists, search for discounts, learn more about products, and to make purchases.

Moreover, a recent report from The Boston Consulting Group and the Grocery Manufacturers Association found that consumer packaged goods companies (CPG) are facing a winner-take-all world in which about half of sales growth is coming from digital channels. According to the study, CPG companies today face a fundamentally different set of competitors than in years past, and even small companies or apps can be massive disruptors.

With a focus on the empowered consumer, it has become clear that the ability to harness and present product information for digital consumption is a key innovation for the food industry. Grocery industry suppliers, distributors, retailers, trade associations, academic institutions, and solution providers that are part of the GS1 US Retail Grocery Initiative are working to further define and use a standards-based approach to delivering on the consumer's call for greater supply chain transparency through the development of best practices and guidelines. They are asking themselves: How can we help consumers get accurate and consistent information about the food they eat, and deliver the product safely and efficiently?

Grocery supply chain partners are leveraging standards in four important ways that will help their capabilities better align with consumer priorities. They are focusing on data quality, product availability, product images, and product authentication to become more in tune with the emerging trend of omni-channel grocery shopping.

Data Quality

Today, huge amounts of data are being created and consumed. Researchers from EMC/IDC predict the total size of the digital universe will double every two years to reach between 40-44 zettabytes by 2020. To put that into perspective, 40-44 zettabytes of data is the equivalent of 6.6 stacks of 128 gigabyte tablets extending from Earth to the moon.

Consumers rely on online information to make purchase decisions—this includes product descriptions from suppliers, distributors, and retailers. Companies are challenged to keep product information consistent across all platforms simply because of the time, resources, and know-how that have not been traditionally dedicated to safeguarding data quality.

Until the online data explosion, data inaccuracies were considered a cost of doing business. Little attention had been paid to product listings that were typically only exchanged between trading partners. Now, forward-thinking companies realize that accurate product data is a powerful tool in today's marketplace.

To address data quality challenges, supply chain partners from both the supply and demand side of the grocery business provided input to develop the GS1 US National Data Quality Program, which helps companies across various industries ensure accurate and timely product information.

Companies that leverage the guidance of the GS1 U.S. program for their own internal data quality initiatives focus on data governance processes to support continual, effective product data management. These companies understand the integrity of product data must be maintained throughout the product's lifecycle and at any point during the supply chain.

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Through good quality data, consumers are provided with the right tools to validate product purchases. When product descriptions, ingredients, nutritionals, or allergens are not transparent, sales and consumer satisfaction can suffer.

Product Availability

After years of slow growth, analysts and experts are predicting grocery e-commerce sales to pick up significantly within the next two years. By anticipating this change, the grocery industry has the opportunity to think holistically about how consumers shop and evaluate how to get the right product into the hands of the consumer fast and efficiently.

Originally implemented in the grocery industry for efficient checkout purposes, GS1 Standards—including the UPC barcode—are now being leveraged to meet various supply chain visibility needs across all retail categories. The foundation GS1 Standards provide consists of three layers: the standardized identification for products and locations, standardized data carriers (like barcodes) that capture essential product information, and standardized data exchange to share through an electronic network. Each layer plays an important role in efficiently moving a product from the source to the consumer. To reap the benefits of standardization, the industry must have uniform adoption. GS1 Standards drive automatic data capture so that companies can share information about a product as it moves through the supply chain. Applying a barcode that contains a Global Trade Item Number (GTIN) allows for more consistent information and the ability to track and trace a product—which is particularly helpful in the event of a recall, or if the quality of a product has come into question.

Once products have been identified with GTINs and barcodes for global uniqueness, electronic commerce can be achieved. With the exchange of standardized product information, it becomes possible to move away from sending faxes and paper copies for orders, invoices, or advance shipping notices. Business transactions become seamless, especially with the ability to link internal systems to an external system all trading partners can utilize. Standards lead not only to improved data for the consumer, but also help retailers improve inventory management to meet multi-channel consumer requests and decrease out-of-stocks.

Product Images

Images now play an increasingly significant role in purchasing decisions, and suppliers see this as a big opportunity to create a more engaging online experience. However, product images can be a shortcoming when consumers are regularly frustrated with inconsistent or unclear product photos.

Sharing images between trading partners can be challenging due to conflicting requirements among partners. To reduce inefficiencies and provide consumers with much needed product image consistency, GS1 US brought industry stakeholders and experts together to develop recommendations for standardizing retail grocery digital product images.

The guideline, titled "Product Images Application Guideline for the Retail Grocery Industry," is a resource for standardizing image capture, naming, and sharing across multiple platforms. It provides general best practices, a style guide, and instructions for publishing images in the Global Data Synchronization Network (GDSN), a central repository of continuously updated product information. Industry stakeholders are now provided with collective definitions, business process standards, real-world examples of use, and step-by-step guidance on image preparation for upload to the GDSN.

For example, the guideline's style guide shares best practices for consistently featuring a product's front, left, right, back, top, and bottom image angles. It also provides improper usage examples, such as super-imposed images, watermarked images and improperly cropped images. Categories covered in the guidelines include meat, poultry, seafood, produce, and more.

Product Authentication

An additional benefit of using GS1 Standards in the new age of digital and physical convergence is the verification that a product truly is what it says it is, particularly when the consumer may be aware of past food fraud cases involving fish, olive oil, milk, and pet food.

The online shopping explosion has swung the door wide open for counterfeiters to sneak false products into the supply chain. This counterfeit issue is particularly systemic within the online marketplaces, which may have different operating models than their brick-and-mortar counterparts. In many cases, the online retailer does not take actual ownership of the inventory—it simply facilitates the transaction, fueling the opportunity for counterfeiters to expand their operations.

Counterfeiters combine legitimate photos with enticing low prices to lure online shoppers into buying false products, all while they maintain anonymity.

When supply chain partners commit to product identification using GTINs, the incidence of counterfeit products significantly goes down. Online marketplaces have begun requiring valid GTINs for sellers to list their products and will not post the product listing if this is not in place.

Looking to the Future

Several years ago, many members of the industry did not think consumers would be interested in online grocery shopping. However, today's consumer is proving that assumption incorrect. Analysts predict massive growth in the next three to five years in online grocery shopping, and retailers that embrace food transparency can grow sales up to 25 percent faster than their peers, according to IRI.

Attitudes and paths to purchase are changing and food companies recognize that they need to put the consumer's concerns first or risk losing sales. New commerce options should not compete with traditional success—it is not "in-store versus online." Those with a holistic and standardized approach will be able to capitalize on consumers' interest in grocery shopping online. ■

Fernandez is vice president of Retail Grocery and Foodservice at GS1 U.S. Reach her at afernandez@gs1us.org.

FSMA Success—The Path Less Traveled

Employees with keen awareness of food safety indicators have the ability to reduce risks and downtime, boost productivity, and ensure regulatory standards are met

BY **LAURA DUNN NELSON**

Two roads diverged in a wood, and I—
I took the one less traveled by,
And that has made all the difference.
—Robert Frost

All the buzz about the Food Safety Modernization Act (FSMA) has led to some familiar approaches to meeting these new standards. In fact, FSMA implementation checklists have been created by dozens of consultants to help provide a clear path to compliance.

It's common knowledge that a qualified individual must be trained, knowledgeable, and accountable for the "new" food safety plan. Hazard Analysis and Critical Control Point (HACCP) documents need to be dusted off and re-assessed to include radiological hazards, environmental pathogens, pesticides, drug residues, and natural toxins, to name a few. Consideration must also include hazards that occur naturally, those that may be introduced into our operations unintentionally, as well as those introduced intentionally.

Once critical hazards are in sight, preventive controls need to be identified and implemented—strategies that assure risks will be mitigated. All this seems to provide a clear path to FSMA success...or does it?

If FSMA was the only regulation to contend with, this check-the-box approach might easily guide everyone. However, the reality is that food industry operations are more complex and demanding than ever. *The Washington Examiner* reported that the pace of agencies issuing new rules and regulations has hit a record high—21,000 new regulations have been introduced during the eight years of President Obama's administration alone. Yet food companies' business challenges go far beyond regulations. Equipment has become more complex, customer expectations more exacting, ingredient sourcing is now multifarious, and frontline workers are more diverse. The list goes on.

Employee Education

Don't turn exclusively to consultants to develop a strategy. Take the path less traveled by harnessing the power of your best asset—your employees.

FSMA's emphasis on preventive controls provides the perfect opportunity to dive deeper into true prevention by educating employees. Employee education helps workers identify risks introduced from critical areas like microbial niches, pooled water, and cross-contamination. Their comprehension translates into keen awareness of emerging hazards at all levels of operations. Engaged, educated employees will begin to look for crimped equipment, rusted seams, drippy hoses, improperly stored sanitation equipment, effective handwashing, and so on. Having trained eyes focused on the critical risk areas within facilitates is a proactive approach to managing food safety concerns.

Sound too good to be true? Consider your own personal goals. What if you shared those goals with everyone around you and asked them to hold you accountable? Odds are you'd have a much better chance at success. Obtaining collective help from your frontline workers in identifying incremental challenges creates accountability from within and sustains food safety culture.

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If this seems like a radical idea, understand that your employees want to help. During my auditing days, it was very common to have frontline workers pull me to the side and say, "Let me show you something." They wanted me to document issues they had identified because they knew it had the potential to be a serious problem. Employees on the frontline have the advantage of experiencing trends and seeing differences from day to day, putting them in the unique position of being able to identify things that "don't look right" before problems have a chance to turn into a serious food safety incident—or FSMA non-compliance.

Employee Awareness

It is important to train employees on *how* hazards are created and *why* hazards must be identified to achieve employee awareness. Expand employees' knowledge of how allergens are inadvertently introduced into product, why damaged equipment is difficult to clean to prevent microbial growth, etc. In turn, your teams will be hyper-focused on reducing the root causes to food safety issues instead of firefighting while trying to meet FSMA standards.

This path will require a level of employee understanding that moves beyond classroom onboarding and food safety training. Achieving superior awareness requires frontline workers to be immersed in prevention. Facilities can accomplish this by using tools such as microburst training, pre-shift huddle conversations, posters, digital signage, coaching, and positive reinforcement from supervisors.

ALCHEMY SYSTEMS

Employee education helps workers identify risks introduced from critical areas.

DENNIS BURNETT PHOTOGRAPHY

Facilities can use coaching as a way to educating frontline workers in prevention.

Consider implementing incentive programs to reward employees for identifying areas of concern. Monthly reinforcement demonstrates the critical role each employee plays and will ensure that each person is held accountable for his or her processes, equipment, and team. Getting the frontline to take ownership of your updated approach will help guarantee the longevity and success of the program.

Key to Success

Management's role is crucial on this journey. Clear expectations need to be set so that employees understand food safety risks. Most importantly, leaders must respond when their employees communicate potential hazards. Facilities should recognize employee contributions to food safety. The importance of the employee's role in prevention is reinforced when their identification of risks, reporting of issues, and their impact on food safety is celebrated.

Having every employee actively participate in prevention may be a path less traveled, but innovative companies are taking that path. Along the way, companies should rally every employee around food safety and preventive controls by recognizing and promoting their critical role in producing safe, wholesome products. These trail-blazing companies realize that frontline workers make all the difference not only for FSMA compliance, but also in overall operations. ■

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Humane Solutions for Controlling Facility Pests

Effectively eliminate critters with a minimum impact on human health and the environment

BY **ELLEN BORZA**

Critters can be an interesting, and sometimes welcome sight when you're enjoying nature. But when they're creeping, crawling, or flying into your food facility? Not so much.

Proactive pest control is a must-have for maintaining facility cleanliness, safety, and reputation. Yet some common solutions, including traps or fumigation, use chemicals or leave behind dead or dying animals in your facility. This article offers humane pest control solutions for your food warehouse, plant, or facility.

Rodents, Insects, and Birds, Oh My!

For most, the term "pest control," conjures up an image of insects and rodents. These creatures are responsible for carrying diseases and pathogens capable of having a serious impact on safe, sanitary food production and warehousing. However, pest birds, like pigeons, blackbirds, sparrows, and crows, can also create major problems for facility management.

Birds must be kept out of food facilities. They carry unwelcome guests, like mites, fleas, and ticks and can transmit dozens of diseases, including *Listeria*, Meningitis, and *Salmonella*. In 2007 a Salmonella outbreak that sickened more than 700 people and killed nine was traced to unsanitary food plant conditions that included accumulated bird droppings.

Our feathered friends also take a toll on valuable equipment investments as well; droppings have a corrosive effect, causing irreversible damage on surface areas. Birds nest in facades, on roofs, and even in ventilation systems, which triggers destruction that eats into budgets. In some infestations, pest bird droppings create a slip-and-fall accident risk that could impact the well-being of employees and guests, as well as increase company liability.

Not only do bird droppings pose a serious risk, but flocks can also be incredibly unsightly. Large flocks that congregate around food warehouses or production plants create noisy, unpleasant environments for employees and nearby residents. Flock elimination can improve a facility's food-focused environment and offer a better experience for customers.

Issues with Poisons, Fogs, and Traps

Decision-makers have plenty of options when formulating a pest management plan that meets audit requirements. Solutions like fumigation and fogging use harsh chemicals, and often require the shutdown of the treatment area, which translates to loss of money and productivity. In addition, such solutions are less effective as a long-term solution for keeping critters out of food facilities.

Rodenticides can also pose an issue for facilities. Government directives limit their use in many areas around food processing facilities. Rodenticides and other poisons can certainly kill pests, but they also kill non-target animals, like owls and cats, that naturally prey on pest animals. In most cases, poison-based pest solutions are considered cruel since they work slowly, causing an animal to suffer for several days.

Traps and glue boards are no more humane. These control methods are indiscriminate, catching anything that comes in contact with them—even animal urine and feces—creating unsanitary conditions. Something else to consider is that traps and boards also require maintenance, which means staff members must handle and dispose of live or deceased animals.

Traditional pest control methods, like those mentioned above, aren't the best options for the animals or the environment. However, modern trends toward more humane pest control technology can remove pests permanently with fewer complications.

Cost-Effective and Eco-Friendly

It's important to maintain an impeccably clean food facility, but traditional pest control methods aren't always the best options. Humane deterrents are a cost-effective and efficient way to keep warehouses and other food facilities free from all varieties of pests.

The concept behind green pest solutions is simple: scare pest animals away and condition them not to return. These methods do not harm or physically traumatize animals.

Humane solutions are safer for people, too. They're non-toxic to employees and guests, as well as any domestic or non-target animals that might come in contact with them. The result is facility staff members can place them virtually anywhere pest birds and animals frequent.

Humane pest methods offer an added benefit for food warehouses and production plants—less time and money spent

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handling live animals or disposing of deceased ones.

Deterrent Options

Sonic pest control. These deterrents help keep food facilities free of animal-sourced health hazards and damages by transmitting audio signals that scare pest birds and keep them away. Some models work by emitting harassing bird distress calls and predator cries, like a hawk or eagle call.

Sonic pest control devices can target a range of birds or be designed to scare a specific species. These devices repel bats that might roost in warehouse nooks and crannies. Some sonic deterrents will also scare off other pest animals, including raccoons, foxes, and rodents.

Sonic pest devices offer a wide coverage area—with some systems like Bird-X's Super BirdXPeller Pro covering up to six acres—making them ideal for large properties. They are often effective for controlling pests in remote outdoor areas. Because they're designed for outdoor use, models may include heavy-duty, weatherproof enclosures to protect the devices from the elements. Generally, sonic repellents are easy to install and fully programmable for no-hassle use.

Ultrasonic bird control. These devices emit high-frequency soundwaves that are undetectable to the human ear but irritate, and even disorient, birds. This type of humane deterrent is non-species specific, allowing the devices to effectively repel many types of animals.

Despite the discomfort ultrasonic control triggers, these units don't injure or kill the animals. This green pest control solution is typically easy to install and maintain. Because the ultrasonic sounds don't penetrate solid objects, facilities may need to use an extension speaker to scare birds in difficult-to-reach areas.

This method is ideal for keeping pest birds out of enclosed or semi-enclosed spaces, including loading docks, warehouses, and factories. Ultrasonic deterrents can be used outdoors, but they generally work best in smaller areas. Since they produce a sound too high for humans to hear, they're the ideal pest control option for areas where people gather, including employee cafeterias and workstations. They are also non-obtrusive solutions

to scaring pests away from guest-frequented areas.

Electronic bird deterrents. Electronic control produces a humane solution designed to disorient, irritate, or frighten pest birds, including pigeons, swallows, and starlings. Once installed, electronic bird control devices start work quickly to condition birds to think that an area is unsafe.

Some models incorporate strobe lights, which scare birds without creating additional noise. The lights also cast shadows that help frighten pest birds away from warehouses, production plants, or loading docks.

Another electronic bird deterrent employs laser technology. A unit fires lasers in colors that alarm birds. They interpret the laser as a threat and react the same way they would for other threats—they flee for safer areas. Since the lasers fire at random intervals, birds don't become acclimated to them. Over time, pest birds become conditioned to avoid the treatment area entirely.

Laser pest deterrents are silent, so they won't disrupt the auditory environment. Use laser control units day or night, in warehouses and production facilities as well as loading docks. Some laser options are designed for outdoor use and offer remote control access for easier control.

Additional Options

Protecting food facilities from pest invasions requires a dynamic approach in which deterrents work simultaneously to reinforce a multi-sensory message.

Visual scares and predator decoys. These approaches help boost the effectiveness of ultrasonic or sonic repellents when used simultaneously. Scare balloons, which are imprinted with predator-like eyes, are cost-effective deterrents that frighten birds by mimicking their natural predators. They're ideal for outdoor areas, like orchards and parking lots, and require virtually no maintenance.

Realistic-looking decoys shaped like coyotes or owls can also be used in conjunction with other humane deterrents. Decoys may be detailed with natural-looking fur tails or flexible wings to increase their lifelike appearance. Utilize them in large outdoor areas frequented by geese, ducks, or small animals.

Bird spikes. Spikes provide an eco-friendly, maintenance-free humane solution. The spikes create a physical barrier that won't harm birds. Install control spikes on ledges, rooftops, cornices, supports, or awnings to prevent birds from landing, nesting, and roosting.

Another physical barrier is bird netting. Some netting options are strong enough to keep out other pests as well, including skunks and raccoons. Bird netting comes in a variety of sizes, including those for commercial applications. Netting systems are highly effective, virtually maintenance free, and require no power supply. This solution works well for warehouses, ceilings, and facility perimeters.

Solar panel power. Panels don't scare away pest birds and other animals, but they do make humane pest solutions more cost-effective. Invest in solar power panels to convert sunlight into energy that will operate a variety of electronic and sonic pest deterrents. These panels are a reliable option to power pest solutions in outdoor areas.

Summary

Humane solutions are one component of a complete pest control plan. They are the ideal complement to additional proactive pest control strategies, including consistent sanitation and inspection, elimination of nest sites, and drain access management.

By being proactive and investing in humane pest control options, food facilities can avoid a situation where an infestation harms customers, ruins audits, damages property, or contributes to a negative public image. ■

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Quality

LABELING

Food Labeling Basics

A rundown of the five pieces of information required on labels, plus tips on food allergen labeling

BY **WILLIAM MCGLYNN**

The first job of a food label is to catch the consumer's eye. A good label makes us want to try what's inside the package. A label accomplishes this by being attractive and by telling the product's story. What is it? Why should we want to buy and eat it? The story may vary a great deal depending on the product. But there are some elements of the story that each and every food product label is required to tell. These elements are mandated by federal labeling regulations.

Food labeling regulations are designed to ensure a consumer has all the information about the product he or she needs to make an informed buying decision. More specifically, the regulations ensure a consumer can reliably find accurate information on a food product label regarding product identity, quality, nutrition, and relevant health and safety information.

What we see on a food label today is the result of many years of laws and regulations, including the Food, Drug, and Cosmetic Act of 1938, the Fair Packaging and Labeling Act of 1966, the Nutrition Labeling and Education Act of 1990, and the Food Allergen Labeling and Consumer Protection Act of 2006. All of these laws have led to a complicated and sometimes confusing set of standardized labeling requirements. Fortunately, breaking down the requirements into a basic set of guidelines makes it easier to design food product labels that are compliant with all the relevant regulations while still being eye-catching.

General Requirements

There are five pieces of information that are required on all food labels with few exceptions: a statement of identity; a net weight or contents statement; the Nutrition Facts panel; an ingredients statement; and a statement that gives the name and place of business of the product's manufacturer, packer, or distributor. Label designers should note there are general requirements for how this information must be presented in terms of type style and size, as well as label location.

The statement of identity is preferably the common name of the food, although a unique name may be used if no common name exists as long as the name is descriptive enough to allow the average consumer to understand what the product is.

The net weight or contents statement describes the amount of edible product in the container by weight, volume, or numerical count as appropriate. Weights and volumes must be listed in both English and metric units.

The Nutrition Facts panel is familiar to most consumers. Label designers need to know the formatting requirements for the Nutrition Facts panel are rigorous in terms of layout, type style and size, and so on. It's not enough to have the correct information; it must be properly formatted as well. Also of note, on May 20, 2016, the FDA announced a redesign of the panel to incorporate changes in formatting and in some of the nutrient content information required. Food manufacturers with $10 million or more in annual sales will need to use the new label design by July 26, 2018; smaller manufacturers will have an additional year to comply.

The ingredients statement must follow the Nutrition Facts Panel and must list all of the ingredients in the product in descending order of predominance by weight. The regulations lay down specific requirements for how various ingredients need to be identified. This is another area of label design that often trips up food manufacturers.

The name and place of business of the food product's manufacturer, packer, or distributor statement must follow the ingredients statement and may consist of a business name, city, and zip code if the business' street address may be found in a public directory under the business name. Otherwise, the complete address must be found on the label.

A food label is typically divided into two main areas for purposes of describing required label information. One area is termed the Principle Display Panel (PDP). The PDP is the main area of the label that is normally presented to the consumer. If there is additional space on the label, the PDP will normally contain the statement of identity and the net contents statement. The other label area that is identified for regulatory purposes is the Information Panel (IP). This is the area of the label immediately to the right of the PDP. If that area is unsuitable for labeling then the IP may be placed elsewhere, such as on the back of the container.

It is important to note labeling regulations state the Nutrition Facts panel, the

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ingredients statement, and the name and place of business of the food product's manufacturer, packer, or distributor must be presented in sequential order on the label and without any intervening material. Optional but commonly supplied label information such as barcodes, graphics, website addresses, and the like are considered intervening material if they act to separate any of the required information. For example, if a manufacturer lists a website after the company name and before the city and zip code that would be considered intervening material and the label would be non-compliant. Similarly, inserting a picture after the Nutrition Facts panel or after the ingredients statement would also render the label non-compliant.

These five pieces of information are mandatory for all food labels, but label designers should be aware that other information may also be required on the PDP and/or IP if some types of nutrient content claims are made.

Allergen Labeling

Undeclared allergens have become the most common cause of U.S. product recalls due to mislabeling. Most often this is the result of accidental allergen cross-contact during production or a formulation change that unwittingly replaces a formerly non-allergenic ingredient with an allergen-containing ingredient.

A rigorous allergen control program in combination with good allergen labeling practices should help minimize the incidence of allergen-related recalls. In an effort to raise awareness and strengthen allergen control measures industry-wide, the new preventive controls rule of the Food Safety Modernization Act (FSMA) requires most food processors to create and implement a robust allergen control program if they do not already have one.

Regulations mandate allergen labeling if a food product contains one of the so-called big eight allergens: eggs, milk, soy, peanuts, tree nuts, fish, crustacean shellfish, and wheat. It is important to note that regulations also require the type of tree nut, the type of fish, and the type of crustacean shellfish to be specifically declared because these types of allergies can be species specific and a person who is allergic to pecans, for example, may not be allergic to almonds.

Manufacturers sometimes ask what constitutes a "tree nut." The FDA considers the following list to be tree nuts for allergen labeling purposes: almond, beech nut, brazil nut, butternut, cashew, chestnut (Chinese, American European, Seguin), chinquapin, coconut, filbert/hazelnut, ginko nut, hickory nut, lichee nut, macadamia nut/bush nut, pecan, pine nut/pinon nut, pili nut, pistachio, sheanut, and walnut (English, Persian, Black, Japanese, California)/heartnut/butternut. Also, crustacean shellfish such as lobster, crab, shrimp, and so on are considered allergens, but molluscan shellfish, such as oysters, clams, mussels, or scallops, are not.

There are two basic options for declaring an allergen on a food label. First, the declaration may be made in the ingredients statement. If the allergen is clearly identified by its common name, such as milk, then no further label declaration is required. If the ingredient is derived from an allergen, but not clearly identified by name, then a parenthetical statement may follow the ingredient in the list to identify the allergen. For example, whey protein is derived from milk but does not contain the word "milk" in its name. In this instance, allergen-labeling requirements is satisfied by listing "whey protein (milk)" in the ingredients statement.

The other option for allergen labeling is through the use of a "Contains" statement. This type of statement lists allergens in the product immediately after the ingredients statement. In the example listed above, the manufacturer could list whey protein in the ingredients statement and follow that with "Contains milk." Note that the "Contains" statement must immediately follow the ingredients statement as a separate line and must use the same font size and style as the ingredients statement. The "C" in "Contains" also must be capitalized. If a manufacturer chooses to use a "Contains" statement, it must list all allergens present in the product, even if they also are identified in the ingredients statement.

The FDA prefers manufacturers to either identify all allergens in the ingredients statement, using parenthetical identifications as necessary, or to use a "Contains" statement. Some manufacturers use both, and while this is not a violation, it is discouraged.

Finally, many manufacturers choose to use additional allergen warning statements such as, "This product was manufactured in a facility that also manufactures products containing peanuts." The FDA does not recognize these statements, but does not prohibit them. The agency has indicated such statements cannot take the place of a proper allergen control program. In addition, such statements may be considered disallowed intervening material depending on where they are placed on the label.

Additional Labeling Requirements

Food manufacturers should also be aware that there is a long list of labeling regulations related to permitted health and nutrient content claims. The regulations are very specific in terms of what kind of claims can be made and how they can be made. Food manufacturers wishing to make such label claims should carefully review the applicable regulations before finalizing their label design.

Imported foods must comply with all U.S. labeling requirements. In addition, processed foods not originally manufactured or processed in the U.S. must declare that product's country of origin on the label. The only exception to this requirement is if the product is "substantially transformed" by further processing in the U.S.

There are some label elements that are commonly seen on food products that are surprisingly not required by regulation. One example is UPC coding. This may be required by various wholesalers and/or retailers to facilitate inventory control, pricing, and collection of sales data, but they are completely optional as far as the government is concerned. ■

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The Role of Labeling in Recall Prevention

In addition to preventing recalls, labeling accuracy is also invaluable when a product recall is initiated | BY **DOUG NIEMEYER**

Food recalls, an unintended consequence of the continued globalization of the food supply chain, continue to make headlines. According to Swiss Re's "Food Safety in a Globalized World" report, the number of U.S. food recalls per year has almost doubled since 2002, a fact that is not hard to believe at a time when headlines related to *Listeria*, *Salmonella*, and *E. coli* are quickly becoming the norm.

This increase has led to changes in the food industry, namely the Food Safety Modernization Act (FSMA), to prevent food recalls. The changes have forced food companies to implement preventive controls, like a better labeling process. Labeling accuracy is one of the food industry's allies in recall prevention.

What is Driving the Increase in Recalls?

While the globalization of the food supply chain continues to open new markets and opportunities for food suppliers, manufacturers, and retailers, it has also increased the complexity of food traceability, labeling, and recall planning and management.

This change is combined with an increase in the prevalence of food allergies, which according to the CDC, have increased among children by approximately 50 percent between 1997 and 2011.

This means that for many consumers, food recalls related to the mislabeling of required allergens represents a serious health threat.

Shift Towards Prevention

FSMA is a major shift in focus from how food manufacturers, suppliers, and retailers *respond* to food contamination to how they *prevent* food contamination. So how does the FDA's fundamental change in food safety management from reactionary to preventive impact food suppliers, manufacturers, and retailers?

First, FSMA shifts more power over food safety controls from companies to the FDA because, for the first time, the FDA will have mandatory recall authority and the ability to keep suspect food from being shipped.

Second, FSMA calls for increased preventive controls from food manufacturers. It requires companies to either establish or enhance operations, plans, and procedures for preventing food safety issues, including product recalls. "Rather than just react to outbreaks, we are requiring food facilities to take measures to prevent them from the get-go," says Jenny Scott, M.S., a senior advisor in FDA's Office of Food Safety. "Food facilities will need to think upfront about what could be harmful to consumers, and then put controls in place to minimize or prevent those hazards."

Third, it requires food suppliers, manufacturers, and retailers to rely more on emerging products and technologies that help keep food safe. According to a study by Freedonia, "demand for food safety products in the U.S. is forecast to increase 7.3 percent annually to $4.5 billion in 2016. Smart labels and tags, and software and tracking systems will see the fastest gains by product."

Labeling Accuracy Plays a Key Role

According to Stericycle ExpertSOLUTIONS' Q4 2015 Recall Index, 42 percent of USDA recalls were due to "misbranding." Such labeling errors, whether due to a missing or incomplete label, mislabeled ingredients, or failure to properly declare a required allergen, can not only be detrimental to food safety, but it can also prove costly to companies.

According to Barbara Kowalcyk, PhD, CEO of the Center for Foodborne Illness Research and Prevention, "initiating a recall costs a company an average of $10 million, the amount saved in reputation, consumer trust, and the avoidance of additional illnesses is priceless."

Companies like TEKLYNX International offer barcode label software solutions that help increase labeling accuracy because the software itself reduces the room for human error throughout the labeling process.

In addition to recall prevention, labeling accuracy plays a key role once a product recall is initiated because it allows companies to quickly identify, locate, and remove affected products. Barcode labeling software solutions prove invaluable on the back end of a recall because the software enables a full view into labeling history.

In a few simple clicks, manufacturers can identify the products labeled with a specific lot number, which can accurately pinpoint the products impacted by a given recall, reducing the amount of time required to locate the products and expedite the recall.

The bottom line is there's a lot at stake when a food recall is initiated, both for the companies and the consumers affected by them. What does this mean for food companies? It means that, now more than ever, they need to rely on technology partners to ensure their preventive controls operate smoothly and accurately to comply with increasingly stringent food safety standards and those demanded by consumers. ■

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Testing

E. COLI

E. coli O121 in the Flour!

Background and process solutions for pathogenic organisms that have found their way into products once considered safe

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

As kids, we used to help our mom clean the kitchen while the cookies were baking in the oven. We would diligently wipe the beaters and bowls clean of cookie dough and fight over any chocolate chips. Those days are sadly gone. The FDA recently sent warnings that raw cookie dough must not be consumed. Not due to the raw eggs in the dough, but gasp, cough, the flour! Yes, a 30 million pound recall of flour has expanded in scope several times due to the presence of *E. coli* O121.

E. coli non–O157 STEC Background

Most members of *Escherichia coli* (*E. coli*) are harmless and live in a symbiotic relationship in the intestinal tracts of humans and animals. However, a few strains are pathogenic and can cause serious disease. Certain *E. coli*, called Shiga-toxin *E. coli* (STEC), cause disease through the production of a "Shiga" toxin that is excreted in the intestine once the organism is ingested. *E. coli* O157:H7 is the most notorious of this group. One egregious property of the STEC group is the low infectious dose. It has been reported that doses as low as 10-100 colony-forming units can lead to symptoms, which include bloody diarrhea and can lead to kidney failure, especially in the very young, elderly, or immunocompromised individuals. Beyond *E. coli* O157, approximately 70 percent of non-O157 STEC infections in the U.S. are caused by six other species and have been coined the Big 6: O26, O45, O103, O 111, O121, and O145. Of those, approximately 6 percent of the overall infections were caused by O121.

Cattle have been identified as the major source for O157 and non-O157 STEC. Thus bovine intestinal matter cross-contaminating onto raw meat is the predominant vehicle of transmission. Nevertheless, non-meat foods have also been implicated in outbreaks and include milk, produce, and water. Now, flour can be added to the list. It seems doubtful that these food groups are sources in and of themselves, rather they have been cross-contaminated likely from a bovine source. For instance, contaminated irrigation water may be a source for agricultural products. Person-to-person transmission has also been identified as a potential route of exposure.

In regards to testing, most STEC testing methods are validated for use with meat and poultry products, but unfortunately not other food matrices. The current STEC testing methods involve an initial rapid screening that will identify if one of the Big 6 non-O157 STEC is present. Testing may be stopped at this point and corrective/preventative actions taken. If testing continues, the screening data will be confirmed through a series of complex assays. Technically trained scientists are needed to carry out the confirmation methods due to their complexity. The results, depending on the test method, will not distinguish between the species but merely confirm that a non-O157 STEC is present in the sample.

The recent flour recall may prompt test methodology to expand from its current focus of meat-based products to other food matrices. For those non-meat or poultry-based producers, if testing for non-O157 STEC is conducted, testing options should be discussed. It is also important that the test be validated for the test matrix. Validating the test method with the matrices is a critical component for data integrity. Furthermore, due to the confirmation complexity, the producer may want to verify that the lab be certified to perform these test methods. One certification tool is ISO 17025 and most labs will publish the test methods pertaining to their certification.

In-Plant Procedures for Keeping Non-O157 *E. coli* Out of Finished Product

Millers. When lots can be segregated because of daily validated wet cleaning and sanitation procedures, the "clean-up to clean-up timeframe" effectually breaks a production cycle. This will provide three benefits: 1) reduce microbial loads; 2) remove transient organisms, and 3) provide lot segregation. In cases where wet washes

are not used, and not wanted, an alternative method to reduce the microbial load is to apply chlorine dioxide gas as a dry sanitizer. Pure Line has developed a patented chlorine dioxide (CLO_2) development process wherein water, as humidity, is absent from the gas. Commissioned research has demonstrated validated log reductions for *E. coli* along with other food-based pathogens. Current research is ongoing for the application of gas onto or throughout dried products and its ability to reduce the microbial populations. For the plant environment, the CLO_2 product can be used on hard surfaces as a sanitizer. For those surfaces that are coated with product, the gas will not be able to penetrate through to the surface beneath without pressure. In these instances, Pure Line has developed a Blower Box that will dispense the gas with pressure.

Sampling plans. The validation and ongoing verification of suppliers is a component of a comprehensive food safety program and in keeping with the Food Safety Modernization Act. This program should be established to include an initial, robust testing regime of in-bound ingredients and incorporating skip lot testing as part of on-going supplier qualification programs.

One sampling plan, considered a rule of thumb, is the Association of Official Agricultural Chemists square root of N plus one for sampling lots of wheat, flour, dried fruit, or other bulk agricultural products wherein N equals the lot size. Acceptability limits for each supplier or raw ingredient category and subsequent lot qualification protocols are components of the program. For example, a supplier would be qualified after the initial sampling regime wherein testing of each lot is conducted for a pre-defined period of time or number of inbound lots. The testing is conducted per unit and is performed on an individual sample basis with a criterion of zero defective/out-of-specification results. Once the supplier is qualified, subsequent shipments of inbound goods would be verified with the square root of N plus one testing regime, but using a composite of the units rather than individually tested. Since the organism tested in this case is non-O157 STEC, a pathogen, a standard of 100 percent of the samples must meet the criteria set. Inbound lots can be tested on a skip-lot basis.

Sampling. Once in production, producers should analyze their manufacturing environment and equipment by taking both environmental and in-process product samples. In-process product sampling means that a test and hold program is in place and corrective/preventative actions are established *before* testing is initiated. In the best-case scenario, product sampling is conducted by an auto-sampler, particularly at the packaging step with each lot tested. Although end product testing is not considered a representative sample, taken together, the testing of inbound raw-ingredients, plant environmental and process equipment sampling, in-line, and finished product testing provide a picture of the microbiological landscape of the process over time. Tracking and then trending the data will provide a depiction of events such as seasonal variations or the effects of supplier or process changes.

In-process product sampling means that a test and hold program is in place and corrective/preventative actions are established *before* testing is initiated.

Corrective/preventative actions. Out-of-specification responses have the best outcome when they are developed and documented as written programs before testing programs are conducted. In most cases, an out-of-specification result stemming from environmental samples should serve as an early warning or detection mechanism. Often when product is implicated, it is a sign of a condition that has been manifesting for some time. The corrective action/preventative action, or CAPA, program, works to immediately minimize the risk. This will often involve maintaining a hold on the product if a food contact surface or product is involved. If a non-food contact environmental site is involved, the site is immediately spot cleaned, sanitized, and dried. A documented investigative process is then conducted by the HACCP, a.k.a. Hazard Analysis and Critical Control Points, team. The multidisciplinary team views the site and looks for root causes. Once a root cause is identified, further corrections and preventative measures can be targeted and then implemented. Although difficult, the process is often a test in patience as it can often span over a multi-week timeframe especially if there are construction events t as part of the corrective/preventative actions.

Using Flour as a Raw Ingredient

During the milling process, flour usually does not undergo a microbial kill-step, but it is expected that further down the production chain, a kill-step is included in the baking process. If a producer has used recalled/implicated flour, demonstrating the use of a validated thermal lethality step may be of importance to reduce the potential or scope of a recalled ingredient. It is, however, incumbent on the ability to demonstrate that a validated thermal lethality has been conducted. To validate an oven, the key processing parameters that should be considered are as follows:

- Using an identified and consistent line speed that is verified;
- Demonstrate uniform heating throughout oven (no cold spots) using thermocouples;
- Inoculate batches with most heat resistant organism that is identified in the Hazard Analysis—if a surrogate is used, provide rationale why the surrogate chosen is relevant to the product;
- Inoculate batches with a mixture (cocktail) of identified strains; and
- Replicate study with at least two, preferably three trials.

Conclusions

Pathogenic organisms continue to surprise us by finding their way into products that we once considered safe. There are processes that can be done to minimize their occurrence once we understand their origin and how they may be cross-contaminated. We may not be able to help mom clean up the kitchen by wiping the bowls clean of raw cookie dough when the rest of the cookies are baking, but we can do our part in helping everyone enjoy safe, quality products. ■

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Next Generation Grain Tests Immerse Themselves in Improvements

Water-based extraction methods help make mycotoxin analysis more safe and user-friendly

BY **JAMES TOPPER**

Advancements in mycotoxin testing technology have produced the next generation of tests that are more safe for testers to use, and easier to perform when testing the same sample for more than one mycotoxin.

The newest tests replaced the extraction solvent, methanol or ethanol, with a water-based solvent, which eliminates the shipping, handling, and disposal of hazardous materials when testing for mycotoxins. These tests also enable the use of a common sample extract for analyzing multiple mycotoxins, including aflatoxin, deoxynivalenol (DON), ochratoxin, fumonisin, T-2/HT-2 toxin, and zearalenone.

"Eliminating hazardous materials from the testing process has been a goal of the mycotoxin testing industry since we first started offering testing kits to grain producers and processors, now more than 30 years ago," says Pat Frasco, Neogen's sales director for the milling and grain markets. "Until recently, the cost of having a very quick and accurate mycotoxin test system in your grain facility included all that goes into using methanol or ethanol—from the potential exposure of your testing staff, to the maintenance of safety data sheets, and everything else. We can now replace the hazardous materials used in the extraction—without compromising the accuracy of the tests' results."

This next generation of mycotoxin tests that use water-based extractions also incorporate useful features of the previous generations, including the ability to create fully quantitative, permanent, and traceable results from lateral flow test strips.

New strip tests feature extraction and testing procedures as simple as:

1. Obtain and grind a representative sample; place a subsample in a cup.

2. Add an environmentally friendly extraction additive to the sample.

3. Add water to the cup.

4. Shake, let settle, filter, and add diluent.

5. Place portion of diluted sample in a sample cup, and allow the sample to wick up the test strip.

6. Read strip in a test strip reader to produce a permanent and traceable test result.

7. Dispose of all test materials as you would with any non-hazardous materials.

"The evolution of the technology of mycotoxin testing has been quite dramatic, even within the professional lives of many of the grain testing customers we've worked with over the years," says Frasco. "If you started in the 1980s, thin-layer chromatography was the recognized test of choice for mycotoxins, which was followed by advancing forms of high-performance liquid chromatography and enzyme-linked immunosorbent assays, or ELISAs. While chromatographic techniques do have certain advantages, they remain laboratory-based tests that require a considerable amount of skill and instrumentation to operate.

"Advancements in ELISA technology have allowed mycotoxin testing to be performed by anyone who could benefit from knowing the grain's test results, and testing personnel without extensive education or experience," he continues. "Taking hazardous materials out of the testing process is another step toward making the tests as accessible as they can possibly be to whomever may benefit from their results."

Testing for Multiple Mycotoxins

Another advancement is the ability to test for multiple mycotoxins from the same, common sample extract. After technicians prepare a sample for testing, they can test the same sample for up to six mycotoxins—without repeating the sample prep process. Testing for multiple mycotoxins from a common sample extract eliminates the need to store and manage multiple extraction additives, and eliminates the need to repeatedly shake, settle, and filter the same sample over and over.

"The ability to test the same sample for up to six mycotoxins represents a potentially significant cost and time savings for grain testers," says Mary Gadola, Neogen's product manager for natural toxin products. "Until now, testers had no choice but to prepare separate samples for each mycotoxin to be tested for—by far the largest time-consuming element of the entire testing process. The newest testing products will eliminate the need for that duplication—and associated costs."

The most commonly tested mycotoxins are aflatoxin, a toxin primarily produced by *Aspergillus* species molds, and DON, primarily produced by *Fusarium*. Since *Aspergillus* and *Fusarium* create other mycotoxins, testers usually test for other toxins created by the same species of mold.

Toxins Produced by Molds

Aflatoxin is a toxic and carcinogenic substance produced by certain strains of the molds *Aspergillus flavus* and *Aspergillus parasiticus*. The effects in animals of ingesting excessive amounts of the toxin range from chronic health and performance problems to death. FDA and many other global regulatory agencies have set maximum allowable levels of aflatoxin in food and feed.

Ochratoxin is commonly produced by the molds *Aspergillus ochraceus* and *Penicillium viridicatum*. Ochratoxin may be present in conjunction with aflatoxin, one of the most potent naturally occurring carcinogens. In fact, ochratoxin is a suspected carcinogen.

DON is most commonly produced by the pink mold *Fusarium graminearum*. DON, a member of the trichothecene family, is produced by fungi living on cereal commodities. The toxicological effects attributed to DON include: nausea, feed refusal, gastroenteritis, diarrhea, immunosuppression, and blood disorders.

Zearalenone is also primarily produced by *Fusarium graminearum*, which produces DON. Hence, there is evidence that if zearalenone is detected, there's a high probability other fusarial mycotoxins may be present. Zearalenone is classified as an estrogenic mycotoxin because it causes estrogenic responses in animals.

Fumonisins are a family of mycotoxins produced by different species of the mold *Fusarium*. These molds commonly infect corn (in fact, they are considered ubiquitous in corn) and rice. Therefore, the potential for fumonisins to be found in feed and foodstuffs is high. Fumonisins affect various animals differently and have been linked to esophageal cancer in humans. Horses are extremely sensitive to low amounts of fumonisin, which can cause leukoencephalomalcia (liquefaction of the brain).

T-2/HT-2 toxins are trichothecene mycotoxins produced by several species of *Fusarium* molds. As T-2 toxin is readily metabolized to HT-2 toxin, and the toxins have been shown to produce numerous adverse effects on many animals, these two mycotoxins are frequently evaluated together.

ELISA Example

One example of the next generation of tests is a single-step lateral flow immunochromatographic assay based on a competitive immunoassay format. The sample extract is wicked through a reagent zone, which contains antibodies specific for target mycotoxin conjugated to colloidal gold particles. If the target is present, it will be captured by the particle-antibody complex.

The mycotoxin-antibody-particle complex is then wicked onto a membrane, which contains a zone of aflatoxin conjugated to a protein carrier. This zone captures any uncomplexed mycotoxin antibody, allowing the particles to concentrate and form a visible line.

As the level of target mycotoxin in a sample increases, free mycotoxin will combine with the antibody-gold particles. This allows less antibody-gold to be captured in the test zone. Therefore, as the concentration of mycotoxin in the sample increases, the test line density decreases. Algorithms programmed into the test strip readers convert these line densities into a quantitative result displayed in parts per billion or parts per million. ■

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In The Lab

MEASUREMENT METHODS

Measuring pH of Yogurt

Consumers expect yogurt to remain texturally consistent, so ensuring fermentation is stopped at the appropriate pH is vital

BY **DAVID MASULLI**

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Measurement of pH presents a critical quality control step in the production of dairy products, especially yogurt. pH offers an indication of contamination from bacteria or chemicals, while also providing a convenient method to estimate the acid development of a dairy product. As there are a myriad of different sampling methods, electrode care guidelines, and electrode designs, determining best practices for pH measurement can be a challenge. This article will discuss electrode selection, calibration techniques, sensor maintenance, and best practices for measuring the pH of yogurt. While the focus is placed on yogurt, the guidelines reviewed can be readily applied to a much broader range of dairy products and quality assurance procedures.

Role of pH Monitoring in Making Yogurt

Monitoring pH is crucial in producing consistent, quality yogurt. Yogurt is made by the fermentation of milk with live bacterial cultures. Following pasteurization and compositional adjustment, milk is homogenized for a consistent texture, heated to the desired thickness, and cooled before inoculation. Most yogurts are inoculated with a starter culture consisting of *Lactobacillus bulgaricus* and *Streptococcus thermophilus*. Once the live culture is added, the mixture of milk and bacteria is incubated, allowing for conversion of lactose to lactic acid. As lactic acid is produced, there is a corresponding drop in pH. Due to the more acidic mixture, the casein protein in milk coagulates and precipitates out, thickening the milk into a yogurt-like texture.

Yogurt producers cease incubation once a specific pH level is reached. Most producers have a set point between pH 4.0 and 4.6 in which fermentation is arrested by rapid cooling. The amount of lactic acid present at this pH level is ideal for yogurt, giving it the characteristic tartness, aiding in thickening, and acting as a preservative against undesirable strains of bacteria. By verifying that fermentation continues to a predetermined pH endpoint, yogurt producers can ensure their products remain consistent in terms of flavor, aroma, and texture. A deviation from the pH set point can lead to a reduced shelf life of the yogurt or a product that is too bitter or tart.

Syneresis is the separation of liquid, in this case whey, from the milk solids; this can occur if fermentation is stopped too early or too late, resulting in yogurt that is respectively too alkaline or too acidic. Consumers expect yogurt to remain texturally consistent, so ensuring fermentation is stopped at the appropriate pH is vital to consumer perception.

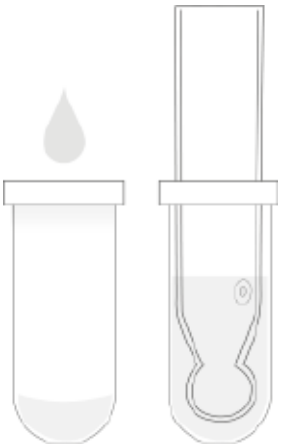
Choose the Right Sensor for the Job

Using the correct electrode for your application is one of the first and most important aspects to consider when measuring pH for quality control or analysis. A variety of electrode features can be combined to ensure reliable and repeatable results for specific samples such as yogurt.

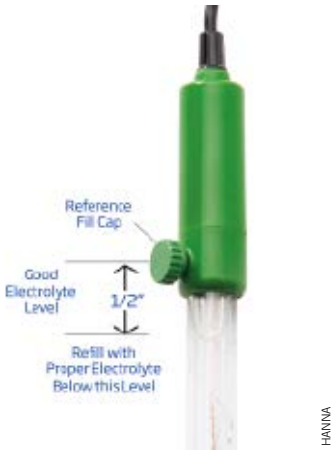
Open junction reference. Conventional pH electrodes have a ceramic frit reference junction that allows the internal reference electrolyte to come into contact with the sample. In dairy products, such as yogurt, proteins and other colloidal solids can partially or completely clog this ceramic frit, resulting in slow electrode response or inability to take a reading. For yogurt, it is recommended to use a pH electrode with an open junction rather than the traditional single ceramic junction.

An electrode that has an open junction design utilizes a gel reference electrolyte that comes in direct contact with the sample; because there is no physical junction, potential clogging is no longer an issue. An open junction design offers the additional benefit of a faster response time because of a higher flow rate of electrolyte into the sample. Other types of clog-resistant, high-flow junctions exist, including

(Continued on p. 38)



Maintaining the ideal fill level for a storage solution cap prevents the sensing tip from drying out.



Maintaining electrolyte fill levels helps obtain more stable readings.

(Continued from p. 37)

polytetrafluoroethylene junctions, triple ceramic frit junctions, and ground glass junctions; these designs confer their own advantages, but are typically better suited for other applications.

Conic electrode tip. Conventional pH electrodes have a spherical sensing bulb that provides an increased surface area for the sample to interact with the sensing glass. This bulb shape is ideal for measurement in aqueous solutions. However, other tip designs exist on the market, and each shape offers an advantage in certain applications. For example, conical tipped pH electrodes are pointed so that they may easily penetrate semisolid or emulsified objects, including yogurts.

If measuring the pH of yogurt with an electrode constructed of a spherical bulb and ceramic reference junction, a homogenized slurry of yogurt and deionized water should be prepared. A slurry is necessary because the flow rate of electrolyte into a semisolid yogurt alone is too slow to enable a direct measurement. An electrode utilizing a conical tip shape in combination with an open reference junction allows for direct measurements of thick yogurt samples, thus saving on preparation time and eliminating a potential source of error. For thinner yogurts or other dairy products such as milk or cream, the spherical tip may be suitable due to its wider area of contact that permits a faster stabilization time. Ultimately, the selection of the tip should be based on the nature of the sample matrix.

Step 1. Measure mV of pH 7.01 buffer and record value
Step 2. Measure mV value of pH 4.01 buffer and record value
Step 3. Calculate the absolute mV difference (pH 4.01 value – pH 7.01 value)
Step 4. Calculate the slope (mV difference/3)/59.16) = Slope)

Examples:
Electrode 1
pH 7.01 = -15 mV
pH 4.01 = +160 mV
Absolute mV difference is +160 mV – (+15 mV) = +175 mV
Slope = (175/3)/59.16=98%

Electrode 2
pH 7.01 = +15 mV
pH 4.01 = +160 mV
Absolute mV difference is +160 mV – (-15 mV) = +145 mV
Slope = (145/3)/59.16 = 82%

Conclusion: Electrode 1 is working properly while electrode 2 has an unacceptable slope. If changing the fill solution, cleaning the electrode, and calibrating does not help, replace the electrode.

Make Sure Your Sensor Works

Calibrate your electrode often. Prior to measurement, pH meters must be calibrated. Calibration adjusts how pH values are assigned to incoming mV (millivolt) readings from the electrode. The pH electrodes generate a mV potential based on hydrogen ion activity. This activity is determined by pH glass, which is specially formulated to measure the hydrogen ion. Hydrogen ions (H^+) contribute to how acidic a sample is, while hydroxide ions (OH^-) contribute to how basic a sample is. The pH scale ranges from 0 to 14, with pH values less than 7 being acidic, pH values greater than 7 being basic, and pH 7 being neutral.

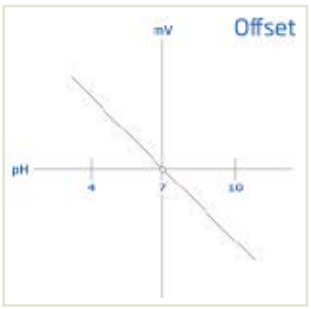
As pH glass breaks down and changes over time due to normal wear and tear, calibration of the meter corrects for changes in the glass. The quality and frequency of calibration procedures will ultimately determine the accuracy of your data. For best results, it is important to calibrate the pH meter at least once per day with standards that bracket the expected pH range of the samples. Because milk and yogurt typically have a pH range from pH 6.7 to 4.0, ideal calibration standards are pH 4.01 and 7.01; a third buffer such as pH 1.68 or 10.01 may be incorporated for higher precision.

Perform periodic slope checks. The theoretical relationship between pH and mV is defined by the Nernst equation. Based on this equation, a theoretical electrode will read 0 mV in pH 7.0 buffer (the value of which is known as the offset), and will have a slope of -59.16 mV per change in pH unit. Calibration corrects for deviations of electrode behavior from this theoretical relationship, but the extent of this correction is finite before the accuracy of the measurement is affected. Many meters will have indications of electrode condition or slope condition, but it is recommended to use the mV mode on a pH meter to periodically check electrode offset and slope.

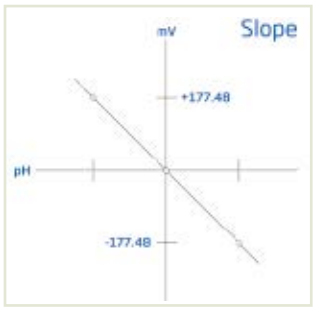
To perform an electrode offset and slope check, first measure and record the mV value in pH 7.0 buffer; this is the electrode offset. Next, measure the mV value in a second buffer, such as pH 4.0. To determine the electrode slope, calculate the difference in mV between the two buffers and then divide this by the difference of pH units between buffers. To convert this result to electrode slope percentage, divide the electrode slope by the theoretical slope of 59.16, and multiply by 100. An acceptable offset range is ±30 mV and slope percentage is 85 to 105 percent; anything outside of these ranges may result in inaccurate measurements.

Improve Your Measurement Technique

Consistency is key when performing any pH measurement. This is especially true when many different users are expected to



The mV reading at pH 7 is the offset. The ideal offset of an electrode is 0.0mV and should never be outside of ±30mV.



Slope is the change in mV per pH unit. The ideal slope of a pH electrode is 59.16, so the difference between pH 4 and 7 should be 177.48mV.

perform the same measurement with the same electrode and meter. Even with a reliable, properly prepared sensor, careless measurement practices can have detrimental effects on a critical pH result. This is especially true for yogurt, where the final measurement window is only four tenths of a pH unit.

Maintain the electrolyte solution. Yet another advantage of owning an electrode filled with gel reference electrolyte is that it does not have to be refilled. The gel electrolyte should last for the lifetime of the sensor. On the other hand, if you own a refillable pH electrode without gel electrolyte, the level of electrolyte fill solution should be inspected before performing any calibration. Over time, the solution flows out of the reference junction, which can happen faster particularly if the electrode is not properly stored. Low electrolyte levels may lead to drifty or erratic readings, so it is good practice to ensure that your electrode fill solution level is no less than one half inch from the fill hole.

Also for refillable electrodes, the fill cap should be removed or loosened prior to calibration and measurement. Removing the cap creates positive head pressure in the reference chamber of the electrode, allowing for a greater flow rate of electrolyte through the junction. This is important for a faster and more stable reading, especially given the thicker consistency of yogurt.

Properly submerge and stir. It is crucial that both the pH sensing glass tip and the reference junction be completely immersed in your sample to function correctly. Make sure there is enough yogurt sample present to perform a suitable measurement.

For pH measurements and calibrations, it is important to stir the sample or buffer. While an automatic or magnetic stirrer is preferred, simply stirring the electrode within the sample can help. It is understandable that this can be tricky for thicker samples such as yogurt, but movement of the sample ensures it is well mixed and helps increase the response time of the analysis.

Keep Up With Your Maintenance

Despite choosing an appropriate electrode and calibrating it correctly, poor maintenance and lack of proper care can reverse any diligence previously exercised.

Regularly clean your electrode. When pH is measured in dairy products such as yogurt, electrode fouling is a common challenge. Electrode fouling occurs when fats and proteins obstruct the reference junction or attach themselves to the sensing glass of the electrode. Electrode bodies and tips may also accumulate mineral deposits such as milkstone, a complex composed of organic matter, calcium, and magnesium.

Electrode fouling can be minimized with regular maintenance, cleaning, and proper storage. Buildup on the sensing glass causes inaccurate and sluggish measurements as it directly affects the impedance of the glass. An offset outside of the acceptable range of ±30 mV usually indicates the pH glass bulb is dirty or coated. Cleaning solutions are effective at both disinfecting and removing oil and protein deposits. These solutions typically contain a combination of mild detergents, solvents, and complexing agents designed specifically for samples of interest such as yogurt.

Always condition your electrode. Conditioning and properly storing your electrode goes a long way to increasing its life and performance. For conditioning and storage, it is recommended to use an electrode storage solution. This solution helps minimize junction clogging and ensures a fast electrode response time, keeping the sensing glass and junction clean and hydrated. When solution isn't available, it is advised to use a pH 4.01 or 7.01 buffer. The electrode should not be stored in deionized water as this can affect the sensing tip and degrade the electrolyte solution inside of the electrode.

Following these guidelines for selection, calibration, and maintenance can help to ensure reliable, repeatable, and responsive electrode for yogurt measurements. ■

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Temperature curtain wall.

Climate Control with HVLS Fans and Curtain Walls

Making better use of chilled/frozen air while protecting product quality | BY ANDY OLSON

Temperature and humidity control is more important in food manufacturing than almost any other industry, since food product quality is directly impacted by both. Long before any food item makes it onto anyone's plate, it has probably gone through a myriad of facilities: from cultivation to processing to storage to delivery. The environments of these facilities are of vital consideration. Plant managers across the food industry supply chain must stay on top of all issues that influence their environments. Industrial coolers, freezers, air conditioning/ventilation systems and many other components of facility infrastructure all play a role in maintaining the proper temperature and humidity levels to protect food quality, prevent spoilage, and keep employees comfortable and safe.

HVLS Fans for Any Season

While almost all building managers are familiar with the acronym HVAC (heating, ventilation, air conditioning), they may not be familiar with a related term, HVLS. High volume, low speed (HVLS) fans can help HVAC systems work more efficiently and economically. In air-conditioned facilities, the breeze from an HVLS fan typically allows for an increase of up to 5 degrees Fahrenheit in the HVAC system's thermostat setting with no change in comfort. Since electricity costs are reduced approximately 4 percent with each degree the setting is raised, in warm-weather climates, annual costs can be cut by 20 percent.

HVLS fans are also helpful in facilities without HVAC systems, helping to guard against heat stroke, heat exhaustion, and other heat-related maladies by providing workers with an evaporative cooling sensation. Just a 2-3 mph breeze can reduce the effective temperature by 7-11 degrees Fahrenheit, making employees safer, more productive, and less prone to quality compromising errors.

The benefits of HVLS fans are equally pronounced during the winter months. The fans, by gently circulating warm air from the ceiling back toward employees at the floor level, destratify the layers of heated air that otherwise would have accumulated and mitigated the rising heat effect. Facilities equipped with HVLS fans can reduce the burden on their heating system and lower the set point on the thermostat, thereby, reducing energy consumption, and saving money.

BMS/HVLS Integration

Many food industry facilities sprawl over tens (or even hundreds) of thousands of square feet, with different areas of the building facing different temperature and humidity challenges. Therefore, multiple fan networks may need to be used, with fans that operate independently of each other. To coordinate these networks, fan control systems have been developed that can control as many as 18 HVLS fans through a single device. The controller allows for independent speed adjustments, scheduled start/stop times, and the ability to start/stop based on preset temperature settings—a feature that can be very important in food operations, such as produce, cheese, or wine storage. It also ensures that fans are only running when they need to run, reducing energy use.

The most advanced HVLS network control systems, when hooked up to an Ethernet port, can be accessed remotely. That means managers can make changes or operate the network from a smartphone, should unforeseen changes in outside conditions (like humidity) occur when the plant is unoccupied. Additionally, HVLS fan networks can be programmed into a building management system (BMS) and connected to other infrastructure equipment such as exhaust fans. A "fire stop" option is also available, with which the BMS will automatically turn off the HVLS fans and activate sprinklers in the event of a fire.

Increasing Cooler and Freezer Efficiency

The same energy efficiency benefits that HVLS fans provide in public areas can be applied in another important area of many food storage operations: industrial coolers and freezers. Through destratification, HVLS fans can help stabilize temperatures in many coolers and freezers from floor to ceiling, allowing for greater accuracy in the thermostat set point reading.

RITE-HITE

HVLS fans help HVAC systems work efficiently.

Humidity walls separate higher and lower humidity spaces.

By creating a more uniform temperature throughout the space, HVLS fans can help minimize the chance of freezer burn on products stored near the floor. Uniformity also yields a reduction in energy usage since the freezer doesn't have to work as hard to maintain the desired temperature. *(NOTE: This does not apply to blast freezers.)*

Additionally, the gentle breeze HVLS fans provide helps prevent condensation—one of the key contributors to food spoilage in refrigerators. HVLS fans also fight mold growth inside the refrigeration unit, which saves companies time and money in mold removal expense.

Humidity Control

Humidity is an even larger issue than condensation. Most often, humidity control applications involve partitioning humidity spaces: separating a higher humidity space (such as a leafy vegetable storage area) from a lower humidity space.

Maintaining a low humidity space in the midst of a high humidity environment requires two basic components: 1) an insulated barrier to surround the space, and 2) a mechanical chiller to de-humidify, cool, and circulate the air within the space. An insulated barrier is desired so that the exterior surface of the barrier does not become so cold that its temperature drops below the exterior (higher humidity) dew point, thereby causing condensation (moisture) to form on the exterior of the barrier.

While traditional walls are often used for developing such a barrier, insulated fabric curtain walls are becoming increasingly popular for a number of reasons. With an exterior made of 18-ounce industrial vinyl, they are quicker and easier to install than traditional walls and can be moved or re-configured should a plant's needs or layout change. Also, vinyl-covered surfaces of most curtain walls are inherently waterproof, protecting the insulation inside from the effects of condensation. Additionally, higher quality curtain walls are treated with an anti-microbial agent to prevent mold or mildew should moisture manage to migrate inside the curtain through a tear or scrape. Finally, the reduced heat transfer across the insulated curtain wall allows the mechanical chilling equipment to operate using less energy.

The principles are the same in the case of maintaining a high humidity space, at least from the standpoint of the barrier. While a mechanical chiller is not used, some source of moisture is, whether it be misting sprinklers or the addition of high humidity air flow into the space. Inhibiting heat transfer is less important in a high humidity space. However, the insulated curtain wall still plays a major role in reducing temperature fluctuations that can trigger changes in relative humidity.

Blast Freezers and Curtain Walls

Fabric curtain walls are also becoming more common in blast freezer applications. While blast freezers have become widely accepted across the food industry, their huge size, combined with other issues like pressure and frost build-up, can be problematic. In some cases, their enormous doors (which can be as a large as 25 feet by 25 feet) have become so heavy and hard to open that employees have resorted to dangerous methods to open them, such as using forklifts. Expectedly, shutting blast freezer doors also presents an obstacle. This is a major problem, since energy is quickly lost if the doors are not closed completely and correctly.

Blast freezer curtain walls are made of insulated, sliding panels nested in a tubular steel frame. Each panel is constructed of 18-ounce, industrial vinyl fabric surrounding a layer of anti-microbial polyester batting. Engineered to be light and easy to use, blast freezer curtain walls form a safe and affordable airflow and thermal barrier and can be operated by a single person. Their tight and effective seal redirects the chamber's airflow, increasing efficiency, reducing blast cycle times, and lowering energy consumption.

The seal also minimizes the build-up of ice on the floor at the base of the doors, reducing the chance of employee injuries from slips and falls. Additionally, blast freezer curtain walls require minimal long-term maintenance and are generally easier to install and less expensive than the traditional doors used for these extreme applications.

Find the Right Temperature

Achieving proper temperature and humidity control is an essential part of food manufacturing and storage. Both HVLS fans and fabric curtain walls play a significant role in managing facility climate, food product quality, and employee safety. Facility managers willing to invest in products like HVLS fans and curtain walls are likely going to see many qualitative benefits, such as increased worker comfort and productivity, almost immediately, and quantitative benefits (ROI through energy savings and food quality) in the near-term future. ■

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Food Service & Retail

EDUCATION

Building a Strong Food Safety Program

Best practices to mitigate the risk of foodborne pathogens from entering businesses

BY **DAVE SHUMAKER**

While many restaurant owners, operators, or managers may believe their restaurant could never fall victim to a foodborne illness outbreak, the reality is an outbreak can happen to anyone, anywhere, and at any time.

According to a 2015 CDC report, there has been a rise in multistate foodborne illness-related outbreaks. In fact, the CDC reports that in 2014 alone, there were 864 foodborne disease outbreaks, resulting in 13,246 illnesses, 712 hospitalizations, 21 deaths, and 21 food recalls. Based on these numbers, it is evident that food service establishments need to re-evaluate current food safety practices to ensure they are doing everything they can to mitigate the risk of foodborne illness, which can be incredibly costly to both their bottom line and reputation.

So how do these dangerous pathogens find their way into a restaurant? Unfortunately, there are many ways risky microorganisms can enter. Some walk through the front door with restaurant guests, which is often a largely overlooked risk. Others come in with the food supply. For example, if a restaurant does not follow safe handling, preparation, and storage protocols, they might be at risk for an outbreak. Employees can also play a role, especially if they come to work sick or do not follow proper hygiene protocols.

Foodborne Illnesses

According to the CDC, there are more than 250 foodborne illnesses caused by viruses, bacteria, parasites, toxins, metals, and prions. Some of the most common foodborne pathogens are *Listeria*, *E. coli*, *Salmonella*, *Campylobacter,* and viruses like Hepatitis A and norovirus, all of which pose a serious threat to public health.

Listeria frequently makes headlines. It is unique in that it can grow at low temperatures, whereas other bacteria need higher temperatures to grow. Another key attribute of *Listeria* is that is can come from the environment and is spread to the food through cross-contamination. It is most dangerous for immunocompromised individuals, especially pregnant women, because it can lead to infant mortality.

E. coli, which causes intestinal illness and has been linked to many outbreaks, can cause an infection even if you ingest only small amounts, according to the Mayo Clinic. The most common way to acquire an *E. coli* infection is by eating contaminated food, including fresh produce. The bacteria is spread by a fecal-to-oral route—it can start at the farm with contamination and then infect by the food not being prepared properly (e.g. not cooked to the correct temperature), poor hand hygiene, or cross-contamination due to not properly cleaning and sanitizing surfaces.

Salmonella is another bacteria often associated with foodborne illness that affects the intestinal tract. It is prevalent in food, and food animals such as cattle, pigs, and chickens, according to the World Health Organization. Eating food contaminated with feces is the most common way people become infected with *Salmonella*.

In addition, it can be spread by people through cross-contamination and improper hand hygiene.

Norovirus is a highly contagious virus that is spread most commonly through human-to-food-to-human contact in a food service environment due to poor hand hygiene. This virus often survives for weeks in the environment. Humans can still be infectious and transfer the virus even if they are not showing any symptoms.

Hepatitis A is a viral infection that can be prevented through vaccination. However, unvaccinated people can become infected by a fecal-to-oral route of exposure—ingestion of contaminated feces, which is why proper handwashing, specifically after using the restroom, is important. Other preventive measures include getting a vaccination and avoiding eating raw or undercooked oysters and shellfish. According to Mayo Clinic, symptoms of Hepatitis A infection include fever, fatigue, loss of appetite, headache, and yellowing of the skin and eyes.

Camplylobacter typically comes from raw or undercooked poultry. FoodSafety.gov emphasizes that it's critical to properly handle poultry in order to prevent cross-contamination and to cook and hold poultry at safe minimum temperatures.

Clostridium perfringens infections often occur when large quantities of food are prepared and kept below 140 degrees Fahrenheit for long periods of time, which causes spores to survive the cooking process and then grow at the holding temperature, which in turn, contaminates the food. Keeping foods hot (above 140 degrees Fahrenheit) and refrigerating foods (below 40 degrees Fahrenheit) within two hours can help prevent *Clostridium perfringens infections*.

A Strong Food Safety Program

Having a strong food safety program and culture within a restaurant is critical to its overall health. First and foremost, for any program to be successful, the employees need to understand why food safety procedures are important. This means a focus on education and openly discussing the importance of food safety practices and addressing any concerns is a must.

Establishing a food safety management program is critical to the well-being of restaurant guests and helps reduce the chance of an outbreak happening at your establishment. Components of a food safety management program, according to industry expert Hal King include the following.

Identifying hazards and determining risk. Once you identify the hazards that could cause foodborne illness, it is important to define what they are, determine the impact they have on your business, and then assess the likelihood of that hazard happening. According to King, Risk = Hazard x Probability.

Implementing systems to reduce hazards. These systems can be programs, policies, and/or standard operating procedures that reduce hazards known to cause foodborne illness.

Manufacturing control systems in retail food preparation. This includes Hazard Analysis and Critical Control Points (HACCP). HACCP is a preventive food safety assurance system that King believes provides the most value to a food retail business because it makes corrective action mandatory before a product is finished, as opposed to a nontraditional corrective system that measures the presence of hazard in the finished product. Both the FDA and USDA have established HACCP as a mandated food regulation for all food manufacturing in the U.S.

Corporate control systems. This includes a product withdrawal/recall system, which requires cross-functional collaboration between many parts of the business.

The following are some key practices to include in your food safety program:

- Be sure workers do not come in while ill;
- Make sure workers wash their hands at key moments;
- Provide an alcohol-based hand sanitizer for guests to use when they enter the restaurant;
- Keep restrooms visibly and hygienically clean;
- Follow proper cooking instructions; and

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- Implement processes to avoid cross-contamination.

How to Implement Good Hygiene Practices

Gloving. According to the FDA, gloves should be worn by food service workers when handling ready-to-eat foods. It is important to note that gloves should only be used for one task; food workers must change gloves when switching tasks. Hand hygiene (e.g. washing hands) should be performed before and after donning gloves.

Cleaning and sanitizing food contact and non-food contact surfaces. Keep the surfaces your food and hands contact clean, especially in food preparation environments, which are ideal for growth and proliferation of bacteria. Be sure to use a surface cleaner and sanitizer designed specifically for the food service industry that quickly and effectively removes germs on surfaces, including norovirus, *E. coli,* and *Salmonella*. Surfaces that touch raw food are the most susceptible to these pathogens.

Consider both the front and back of the house. Illness-causing germs are not only spread in the back of the restaurant (i.e. the kitchen); customers can also bring them in. This is why it is important to offer an alcohol-based hand sanitizer in the front of the house, so your customers can sanitize their hands before they eat and after touching menus and other commonly touched and shared objects.

Hand hygiene. The practice of good hand hygiene—washing with soap and water and using an alcohol-based hand sanitizer—is one of the most important steps any restaurant worker and patron can take to ensure the safety of food and reduce the risk of getting sick. It has often been estimated that the majority of infections are caused by hand transmission, which highlights the importance of hand hygiene and the vital role it plays in preventing our food from becoming contaminated.

There are numerous components to a strong food safety program. Restaurant owners and operators must look at their food safety procedures and ensure they are doing everything they can to reduce risk plus provide the best guest experience possible. ■

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NEW PRODUCTS

Ozone-Based Disinfection

Two Diamonox Ozone Technology systems feature point-of-use ozone generation through electrolysis. Inline industrial disinfection systems and portable ozone sprayers provide delivery of precise amounts of ozone in water-based devices. Inline Diamonox Ozone Systems can be integrated into industrial equipment to streamline and improve disinfection. These systems require only tap water and electricity to generate ozonated water, allowing operators to reduce biological contamination without using chemicals. The portable Diamonox Ozone Sprayer can be quickly integrated into any areas that face disinfection challenges, such as restaurants, breweries, grocery stores, and restrooms. **Advanced Diamond Technologies, 815-293-0900, www.thindiamond.com.**

Headspace Gas Analyzer

F-920 Check It! is designed to meet the needs of the growing modified atmosphere packaging sector. It is a CO_2/O_2 gas analyzer that enables all levels of QC personnel to take quick and precise headspace gas measurements. With a low sampling volume and a fast response time (6-9 seconds), Check It! can provide rapid measurements at all points along the supply chain. Long sensor lifetimes minimize maintenance and servicing, and data transfer is effective with the included SD card or through Bluetooth connection to smartphone or PC. **Felix Instruments—Applied Food Science, 360-833-8835, https://felixinstruments.com.**

Monitoring Temperature and Humidity

The WSG30 system provides 24/7 remote monitoring of commercial food cold storage equipment. It is a web-based system that uses wireless sensors to detect problems such as temperature changes (from -109°F to 115°F), humidity fluctuations, water leaks, and power outages. A single WSG30 unit can support up to 30 wireless sensors. When the system detects a problem, it instantly sends alerts to up to 32 people by email, text message, SNMP, or Modbus, enabling personnel to take corrective action to save critical inventory. Users can make programming changes, access status conditions, and review data logs through any web-enabled device. **Sensaphone, 877-373-2700, www.sensaphone.com.**

'Smart' Dishwashing

IntelliDish is a cloud-powered management, insight, and monitoring system that optimizes the performance, productivity, and resource-utilization of commercial dishwashing operations in hotels, restaurants, and healthcare kitchens. The system works by identifying and communicating various aspects of a dishwashing machine's cycle to a cloud-based server. Then it automatically analyzes the data, sends real-time status reports and alarms to an intuitive user dashboard, and provides the information required to resolve any issues. This allows operators and managers to identify consistent pain points that are reducing profitability and pre-empt them from happening. **Sealed Air's Diversey Care division, 800-668-7171, https://sealedair.com.**

Sanitation Solution

Foamico Low Pressure Foam Cleaning System allows users to rinse, foam, and sanitize with one machine, one hose, and one handle to switch functions. Surface rinsing power of 334-725 PSI reduces bacteria-spreading aerosols while effectively removing dirt and oil without damaging equipment. Water consumption is reduced with a recommended pre-foam setting, which loosens the dirt and oil for easy removal. The stainless steel machine features color-coded chemical identification labels for safe and simple operation. In addition, the unit features a chemical mixing block. **SULBANA Inc., 608-426-6415, www.sulbana.com.**

Food Grade Oven Chain Lubricant

No-Tox Food Grade Oven Chain Lubricant is used on chains, conveyors, and bearings found in high temperature commercial ovens. The extreme pressure and anti-wear properties allow it to deposit and deliver suspended food grade white-graphite after prolonged exposure to high temperatures, reducing energy consumption and friction. Due to its synthetic ester oil base, the lubricant leaves no sludge or carbon residue behind when thermally decomposed. It can effectively lubricate up to 1652°F. The lubricant can also effectively inhibit growth of certain bacteria, yeast, and mold. It is Kosher and Pareve approved, Halal certified, and meets NSF H1 and FDA requirements for products that might have incidental contact with food as defined under Title 21 CFR, 178.3570. **Bel-Ray, 732-938-2421, www.belray.com.**

In Other Product News

3M Food Safety releases its enhanced 3M Clean-Trace Hygiene Monitoring and Management System to verify that surfaces have been effectively cleaned in seconds.

Eppendorf expands its portfolio of rigid-wall single-use vessels for fermentation with its BioBLU 3f, developed specifically for microbial bioprocessing in working volumes of 1.25 to 3.75 L.

Dynamic Systems and **Northlake Partners** announce a joint venture—integrating their applications to provide a fully automated ERP solution for fresh food processors and meat and poultry processors.

GS1 US launches a new online platform called GS1 US Data Hub that integrates three existing GS1 US online tools—GS1 US Data Hub Version 2.0, Data Driver, and the GLN Registry—offering users a better automated platform to help improve business processes and data quality.

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Events

AUGUST

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

23-24
Dairy Plant Food Safety Workshop
Beachwood, Ohio
Visit http://www.usdairy.com/foodsafety
or call 847-627-3241.

23-25
Dairy 101
Logan, Utah
Visit http://www.cfsrs.com/home.html
or call 571-931-6763.

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

SEPTEMBER

7-9
BRC Global Standard for Food Safety Implementation & Internal Auditor Course
Columbus, Ohio
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

12-16
CAT2 User Summit
Little Rock, Ark.
Visit http://catsquared.com/save-the-date-user-summit-2016/.

14-15
3rd Process Safety for Food & Beverage Industries
Houston, Texas
Visit http://www.marcusevans-conferences-northamerican.com.

15-16
Tougher Import Rules for FDA Imports in 2016
Salt Lake City, Utah
Visit http://www.globalcompliancepanel.com/control/globalseminars/~product_id=900459SEMINAR
or call 800-447-9407.

22-23
Microbiology & Food Safety Course
Dallas, Texas
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

26-27
HACCP Certification Course
Dallas, Texas
Visit http://fsns.com/education.html
or call 888-525-9788 ext. 239.

26-28
13th Confocal Raman Imaging Symposium
Ulm, Germany
Visit http://www.raman.net.

OCTOBER

4-6
Introduction to Dairy Processing and Management
Columbus, Ohio
Visit http://foodindustries.osu.edu/Dairy101
or call 614-292-7004.

4-6
Food Safety and Sanitation Short Course for Food Manufacturers
University Park, Penn.
Visit http://agsci.psu.edu/sanitation.

5-7
Rutgers HACCP Plan Development for Food Processors
New Brunswick, N.J.
Visit http://www.cpe.rutgers.edu/courses/current/lf0403ca.html
or call 848-932-7315.

17-18
Sensory Evaluation at Rutgers University
New Brunswick, N.J.
Visit http://www.cpe.rutgers.edu/courses/current/lf0606ca.html
or call 848-932-7315.

19-20
HTST Maintenance Workshop
Columbus, Ohio
Visit http://foodindustries.osu.edu/htst-maintenance
or call 614-292-7004.

Food Quality & Safety
FARM TO FORK SAFETY

A host of audio and video webinars are available on demand at **www.foodqualityandsafety.com/webcast/**

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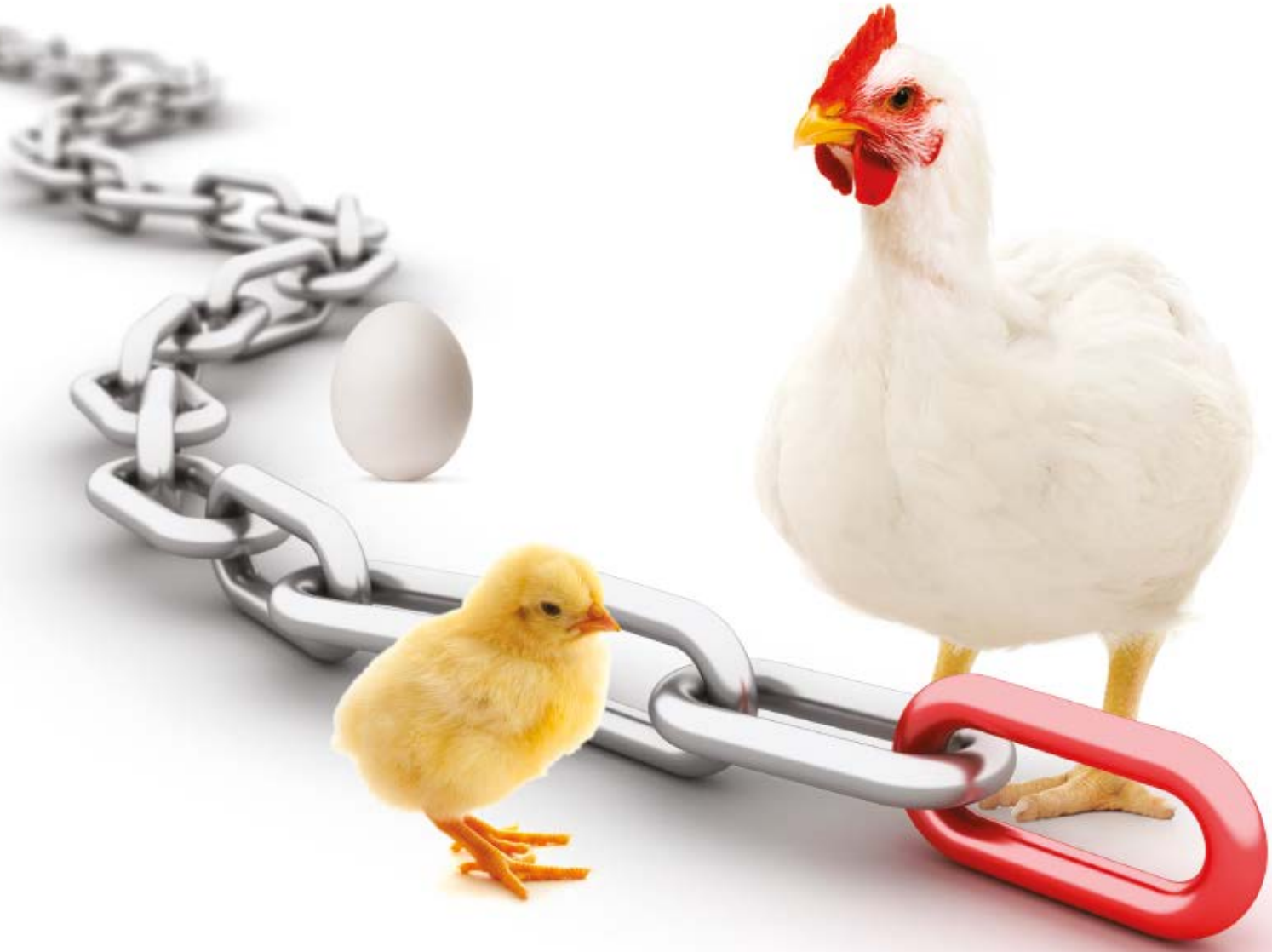

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