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Download a copy of the white paper at  
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\*References listed in study.

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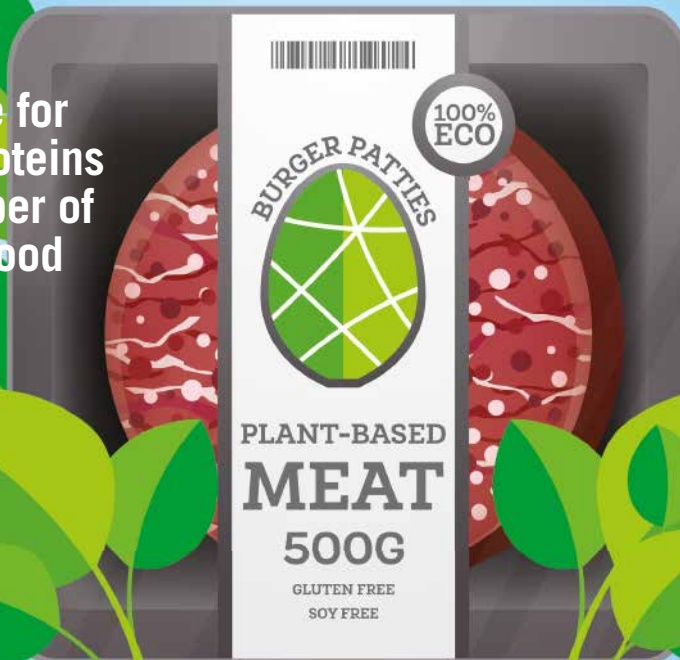
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# From The Editors

## Religion, Politics, and Now ... Food?



There are all kinds of sayings floating around that are designed to help keep things peaceful and civil. One of these is, “Never partner in a game of bridge with your spouse or significant other—this is a sure path to disharmony.” Another is, “Never discuss religion or politics at family events.” This is, unfortunately, becoming more and more the case given the political divisions in this country.

But I am beginning to wonder if this saying should be expanded to, “Never discuss religion, politics, or food at family events.” Why do I say this? Food is becoming more and more of a hot button topic throughout the world. I recently spoke with a few people about bread, wheat, and gluten who informed me that wheat and wheat flour were no longer healthy and should be avoided because they had been genetically engineered over the years and now contained 50 times more gluten than flour once had. One wonders where people get such information, especially since the math does not quite add up. High-gluten flour has up to 12 to 14 percent protein, so when you multiply that by 50, the end point is totally unrealistic. When I suggested that this was not true and that the math didn't work, I was told that there is lots of literature supporting this.

And, of course, this not the only misconception floating around on the Internet and elsewhere; unfortunately, some of these misconceptions are potentially hazardous to people's health (see: anti-vaxers). One of the issues that our editorial staff has discussed recently is whether we should address food-related misconceptions and myths in *Food Quality & Safety* magazine. There are many of these misconceptions that pertain to food, food ingredients, additives, and processes. Should we embark on such a project?

There are pros and cons to doing this. Addressing controversial issues could increase circulation, which would be nice, but more to the point, if we can get good scientists to address these issues properly using science, we might even convert a few people. Now, we will never convert the inconvertible—people who feel that all food chemicals are bad or that, if you can't pronounce it, it shouldn't be in food. But, by making sure that we properly address the science behind these issues, we may be able to help the food industry and the people who make up the industry.

If you have any thoughts, please let us know.

**Richard Stier**  
 Co-Industry Editor

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# NEWS & NOTES

For breaking news on the impact of COVID-19 and the food industry, visit [foodqualityandsafety.com](http://foodqualityandsafety.com).

## Report: Nearly 70 Percent of Fresh Produce Contains Pesticide Residue

BY KEITH LORIA

Nearly 70 percent of fresh fruits and vegetables sold in the United States contain pesticide residues, according to a new report from the Environmental Working Group (EWG).

The guide lists its “Dirty Dozen” of fresh produce items annual, calling attention to the produce most exposed. This year, strawberries, spinach, and kale retained their top-three spots, followed by nectarines, apples, grapes, peaches, cherries, pears, tomatoes, celery, and potatoes. Overall, the 12 items listed saw 90 percent of samples testing positive for two or more pesticide residues. These are the same dozen items that have made the list for the last few years.



Additionally, multiple samples of kale revealed 18 different pesticides. On average, kale and spinach samples showed 1.1 to 1.8 times as much pesticide residue by weight than any other crop tested. The report also concluded that non-organic raisins contained more pesticide residue than any fresh produce on the Dirty Dozen list.

The guide reviewed 47 fruits and vegetables using more than 43,000 instances of sample data provided by USDA and FDA. Data were measured based on the number of detectable pesticides per crop, the percent of samples exhibiting pesticides, and the total quantity of pesticides.



*Salmonella* cells proliferate in an agar plate.

## Researchers Cut Time to *Salmonella* Identification

Researchers from Cornell, the Mars Global Food Safety Center in Beijing, and the University of Georgia have developed a method for completing whole-genome sequencing to determine *Salmonella* serotypes in just two hours and the whole identification process within eight hours. The research was published Feb. 24 in the journal *Food Microbiology*.

Determining salmonella’s serotype makes it easier for food safety professionals to find the source of bacterial contamination, which can occur in a wide range of foods.

Conventional serotyping has been at the core of public health monitoring of salmonella infections for a half-century, says Silin Tang, a senior research scientist in microbial risk management at the Mars Global Food Safety Center. But long turnaround times, high costs and complex sample preparations have led global food safety regulators, food authorities, and public health agencies to change to whole-genome sequencing methods for pathogen subtyping.

All 38 salmonella strains, representing 34 serotypes, assessed in this study were accurately predicted to the serotype level using whole-genome sequencing.

## FDA Loosens Nutritional Label Requirements for Restaurants During COVID-19 Pandemic

BY KEITH LORIA

FDA is relaxing its nutrition labeling requirements so that restaurants and manufacturers with food labeled for restaurant utilization can sell packaged products directly to their customers and other businesses.

“We have seen consumers shifting their food purchasing patterns during the COVID-19 pandemic. A lot more food is being purchased in grocery and retail stores, and less from restaurants,” says Nathan Arnold, an FDA spokesperson. “During this public health emergency, food that would have been used by restaurants to prepare restaurant food is now going unused when it potentially could be made available to consumers.”



To facilitate this further distribution of food during the pandemic, FDA is providing flexibility with nutrition labeling for certain packaged foods so this food can be sold directly to consumers. As long as all allergen and ingredient information is listed on the label, the product can be sold as retail.

The unprecedented policy is temporary and is only in effect during the COVID-19 public health emergency.

# Washington Report



## U.K. Food Safety Post-Brexit

Britain charts an independent path to regulating food safety

BY TED AGRES

**N**ow that Brexit is official, U.K. officials are racing to revise food safety regulations to shift authority from the European Union (EU) to domestic law and jurisdiction. All such revisions need to be in place before the U.K.'s self-imposed Jan. 1, 2021 deadline, when the current transition period ends and new relationships among Britain, the EU, and other nations are set to begin.

"Leaving the EU hasn't changed our top priority, which is to ensure that UK food remains safe and what it says it is," said the U.K. Food Standards Agency (FSA) in a post-Brexit statement. "The FSA is working hard to ensure that the high standard of food safety and consumer protection we enjoy in this country is maintained when the UK leaves the EU. Throughout the transition period and beyond we are committed to having in place a robust and ef-

fective regulatory regime which will mean business can continue as normal."

The U.K. began post-Brexit trade negotiations separately with the EU and the U.S. in March, although concerns over COVID-19 put these on hold. Discussions, either in person or by teleconference, are expected to take months. Many officials are skeptical that agreements between the U.K. and the EU can be reached by the end of the year, even without COVID-19. If so, and unless the transition period is extended, the U.K. and EU will begin trading on World Trade Organization default terms starting in January 2021.

In a report to members of Parliament in February, the U.K.'s International Trade Secretary Liz Truss said the government is seeking major reductions in tariffs on exports made to the U.S. and other trading partners. "We aim to secure free trade agreements with countries covering 80

percent of U.K. trade within the next three years," she stated. "We will drive a hard bargain and, as with all negotiations, we will be prepared to walk away if that is in the national interest."

According to a report by the U.K.'s International Trade Department, a free-trade agreement with the U.S. would add about £3.4 billion (\$4.4 billion), or 0.16 percent to the U.K.'s growth by 2035. U.S. trade negotiators are seeking expanded access to U.K. markets for remanufactured goods and textiles, as well as "comprehensive market access" for U.S. agricultural products and foods, including those developed with biotechnology, according to a report by the U.S. Trade Representative. Currently, the EU (and therefore U.K.) bars such products.

For the remainder of 2020, EU food safety laws and regulations will remain in place for the U.K., with no changes required for food producers, importers, or exporters. Despite government assurances, there is widespread concern in the U.K. that post-Brexit food safety protections will be weakened if Britain doesn't adopt existing EU standards and, instead, weakens them with less stringent regulations, especially if these measures are taken to facilitate new trade agreements with the U.S. and other countries.

In particular, there is concern that Prime Minister Boris Johnson will bow to pressure from the Trump Administration and allow the U.K. to import chlorine-disinfected chicken, hormone-treated beef, and genetically modified food from the U.S.—products that are prohibited under EU rules.

Johnson insisted there would be no "diminution in food hygiene or animal welfare standards" and said all new free-trade deals "will be governed by science and not by mumbo-jumbo." He told critics to "grow up" and "get a grip," noting that the U.S. buys one-fifth of all U.K. exports. In an interview with the BBC, trade secretary Truss bluntly declared, "We will not diminish our food safety standards."

British officials are seeking a Canada-style free trade agreement with the EU that eliminates most, but not all, tariffs and includes cooperation on safety and quality standards. But border inspections on imported goods are still required. While EU officials have indicated general support for such an arrangement, they also noted that the deal with Canada happened only after Ottawa brought many of its regulations into line with the EU's, and are urging the U.K. to do the same.

### “The Devil in the Details”

The European Union (Withdrawal) Act of 2018 permits certain EU laws to be directly transferred into U.K. law effective Jan. 1, 2021. The act also allows the U.K. to make “corrections” to “deficiencies” in these “retained laws” by way of secondary legislation, called “statutory instruments.” The idea is to allow minor technical changes, such as changing references to the name of the agency responsible for carrying out certain activities. “Retained EU law will not work properly unless something is done to transfer the functions to U.K. public bodies,” FSA explains.

However, concerns over food safety standards have been raised because these “corrections” can be made by government agency ministers without approval by Parliament and can go far beyond their intended scope. Calling it “the devil in the details,” a recent report by the U.K. Trade Policy Observatory—a partnership between the University of Sussex and the Royal Institute of International Affairs—identifies several areas where the U.K.’s post-Brexit food safety rules “fall short of the level of protection currently provided by the EU.”

The report discusses several particularly worrisome areas, among them GMO authorization and labeling, food additive authorization and monitoring, and microbiological food safety. For example, U.K. agency ministers can use the Brexit statutory instruments to develop and amend guidance for sampling, testing, and standards for GMO product labeling thresholds. While consultation with FSA is required, this process replaces functions of the EU reference laboratories, said the report.

While Brexit statutory instruments transfer many EU provisions regarding food additives to U.K. law, they also revoke EU requirements to monitor and report

food additive consumption and make substantive changes to regulations for certain additives. “This change suggests that the government intends to cease monitoring the consumption of food additives, which would be a significant change of policy,” the report states.

**Despite government assurances, there is widespread concern in the U.K. that post-Brexit food safety protections will be weakened if Britain doesn't adopt existing EU standards and, instead, weakens them with less stringent regulations.**

### “Chlorinated Chicken”

One controversial area is microbiological food safety. The report states that U.K. officials can abandon the EU prohibition on food derived from washing animal carcasses with anything but water (or a lactic acid solution for beef). This can lead the way to importing “chlorinated chicken”—a euphemism for the practice of cleaning raw poultry with chlorinated water in an effort to kill bacteria, such as *Campylobacter*, *Salmonella*, and *Listeria*.

The U.S. and many other countries use chlorinated water, but the EU banned it in 1997 over food safety concerns. Since then, many studies have concluded that the practice is not harmful to consumers (rinsing salad in chlorinated water is common, even throughout Europe), but it isn't necessarily as effective as many assume. Other Brexit-related concerns involve residue levels of pesticides on U.S. agricultural products, the use of antibiotics and hormones in U.S. cattle, and the use of the chemical ractopamine to make U.S. pigs leaner and meatier.

Following a post-Brexit Cabinet shuffle in February 2020, the U.K.’s new Environment Secretary, George Eustice, said the government had no plans to change food safety laws, but would not rule out the possibility of accepting U.S. food standards as part of a trade deal. He noted that

most U.S. poultry producers now use a lactic acid solution to wash raw chicken, instead of chlorine.

Nevertheless, it is chlorinated chicken that has become a rallying cry for those opposed to Brexit (the “remainers”), and for political opponents in the Labor Party, as well as among those who advocate the adoption of EU standards into British law. A recent survey found that more than four-fifths (81 percent) of the British public are worried about meat quality standards being relaxed in pursuit of trade deals with the U.S. and other countries.

The survey, commissioned by Unison, the largest trade union in the U.K., found that more than half (52 percent) believe government meat quality standards should be tightened after Brexit, one-third (34 percent) say the U.K. should maintain its current laws, and 3 percent say rules should be relaxed. The poll of more than 2,000 people was taken amid concerns that the government could agree to import chicken washed in chlorine or lactic acid in exchange for a U.S. deal.

Still, the likelihood of a major negative impact on food safety following Brexit has increased from “possible” to “probable,” according to a report from Public Health Wales, the national public health agency. “There is stronger, direct evidence of a potential negative impact on food standards in the form of published United States (U.S.) trade objectives,” the report states.

In the scientific arena, there is concern over the loss of UK participation in the EU-wide Rapid Alert System for Food and Feed (RASFF). This system allows member states to quickly send and receive notice of unsafe and rejected consignments of food and feed products, making it harder for dishonest importers to unload them. Unless the UK remains in the program, EU countries “may become less enthusiastic about buying U.K. food products,” the U.K. Trade Policy Observatory report states.

One scientific area at least has been settled: The European Food Safety Authority (EFSA) has decided to continue employing UK experts despite Brexit, noting that science does not recognize borders “and we want to have the best people” in our ranks. ■

**Agres** is an award-winning writer who covers food safety regulatory and legislative issues from the nation's capital in the Washington Report column. Reach him at [tedagres@yahoo.com](mailto:tedagres@yahoo.com).

# Market Initiatives



## Focus on Frozen Foods

Food quality and safety concerns below 32 degrees Fahrenheit

BY LINDA L. LEAKE, MS

**C**apitalizing on winter frosts, consumers in cold climates have been freezing food naturally for countless centuries. The mechanical freezing of food dates to the 1860s, pioneered by Thomas Mort (1816–1878), who established the first commercial freezing works in Darling Harbor, Australia. In 1930, Brooklyn, N.Y., native Clarence Birdseye (1886–1956) patented his method to flash-freeze foods and deliver them to the public, an accomplishment considered to be one of the most important revolutions in the food industry.

Fast forward to the present.

As of June 2019, U.S. retail frozen food sales totaled \$55 billion for 52 consecutive weeks, according to Nielsen Retail Measurement Services (NRMS). Not surprisingly, ice cream was the most popular frozen food during that same time frame, per NRMS, with \$6.7 billion in retail sales, followed by pizza (\$4.8 billion), seafood (\$4.8 billion), novelty (\$4.6 billion), and complete meals (\$4.5 billion). Following the top five are vegetables (\$3.1 billion), cooked meat (\$3.0 billion), fresh meat (\$2.9 billion), appetizers (\$2.1 billion), and potatoes (\$1.8 billion). Categories rounding out the list are sandwiches (\$1.7 billion),

ice (\$1.6 billion), breakfast sandwiches (\$1.3 billion), main courses (\$1.3 billion), fruit (\$1.1 billion), and handheld entrees (\$1.0 billion).

In 2019, in collaboration with the Food Marketing Institute, the American Frozen Food Institute (AFFI), based in Arlington, Va., released a research report, “The Power of Frozen in Retail” that examined the consumption, purchase drivers, and use of frozen foods. These research findings, along with actual sales and consumption data, provide an overview of frozen food that equips frozen food manufacturers and their retail partners with opportunities for continued growth, according to Donna Garren, PhD, AFFI’s executive vice president of science and policy.

Founded in 1942, AFFI is a national trade association dedicated to advancing the interests of all segments of the frozen food and beverage industry. Highlights

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from the report address the retail frozen landscape in 2018, specifically:

- Frozen foods generated \$57 billion annually in retail.
- A total of 99.4 percent of households purchase at least some frozen foods.
- The top three categories for growth in sales were pizza (+\$232 million), novelties (+\$211 million), and dinners/entrees (+\$206 million).
- The top three categories with the largest percent dollar growth include appetizers/snacks (5.8 percent), soups/sides (9.8 percent), and breakfast foods (5.7 percent).

### Addressing Food Safety Challenges

Dr. Garren observes that, currently, *Listeria monocytogenes (Lm)* and enteric viruses are pathogens that challenge global regulatory agencies and food manufacturers alike. “We’re addressing issues in this area by continuing to produce resources related to control and prevention of *Lm*, as well as exploring ways to support the frozen fruit industry in control and prevention of enteric viruses,” she relates.

To that end, in 2017, AFFI embarked on a strategic plan that prioritized the advancement of food safety within the frozen food industry supply chain, Dr. Garren says. “This was shortly after an *Lm* recall for frozen vegetables,” she notes. “We knew then that AFFI could be instrumental to our members and the collective frozen food industry in developing the science and best practices to ensure that frozen foods and beverages are safe.”

For this effort, Dr. Garren says, resources were developed with the support of more than 75 food safety experts repre-

We emphasize to consumers and educators that frozen foods are made from real ingredients picked at the peak of ripeness and flash frozen, sometimes right on the field, to lock in all the beneficial nutrients and keep them in their perfect, just-picked state.”

—JULIE HENDERSON, National Frozen & Refrigerated Foods Association

senting the frozen food industry. All of this information is available for free on AFFI’s online resource, Food Safety Zone. “This website was launched in 2019 to provide frozen food and beverage manufacturers with best food safety practices aimed at *Lm* control and prevention in the areas of sanitation controls, hygienic design, environmental monitoring, process validation, hygienic zoning, and freezer management,” Dr. Garren relates.

### Supporting Research

Since 2017, AFFI has funded several research programs to build the body of scientific information around *Lm* and the public health impact of listeriosis. “Scientists at the University of Georgia (UGA), Cornell University, and the University of Minnesota are conducting these research projects,” Dr. Garren says.

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For one example, a project at UGA evaluates current environmental monitoring practices being implemented across the frozen food industry to prevent and control *Lm*. “We’ve learned there is a need for facilities to review their sampling strategy, including the frequency and timing of sampling,” Dr. Garren relates. “A take-home message of the project is that facilities should focus on sampling for *Lm* at times and in places where they are most likely to find the pathogen, in order to get a more realistic assessment.”

All of the peer-reviewed publications resulting from the AFFI-funded research will be added to the Food Safety Zone, Dr. Garren notes. She shares that, since its launch, AFFI’s Food Safety Zone has resulted in approximately 30,480 page views, with more than 5,000 best practices resources downloaded.

### Food Safety Partnerships

A recent AFFI collaboration with Mérieux NutriSciences has led to development of *Lm* Trend Tracker. “This program is designed to gather industry microbiological sampling data, which can be used to evaluate the implementation of our best food safety practices, develop new resources, and determine if AFFI’s recommendations should be modified or improved,” Dr. Garren explains.

A second partnership was developed with Intertek Alchemy to develop a *Listeria*-specific 12-month food safety training

(Continued on p. 14)



When you want to sink your teeth into the real meat of a food quality and safety topic, turn to the whitepaper and video resources available at [www.foodqualityandsafety.com](http://www.foodqualityandsafety.com).

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(Continued from p. 13)

course that is tailor-made for frontline workers in frozen food manufacturing facilities and the broader food industry. “This program, called *Listeria Stops Here*, includes a variety of interactive content that keeps workers engaged for better retention, results, and risk reduction,” Dr. Garren elaborates, adding that AFFI ships a toolkit of training materials to participating companies.

The National Frozen & Refrigerated Foods Association (NFRA), a nonprofit trade association representing all segments of the frozen and refrigerated foods industry, is the sponsor of March National Frozen Food Month, June Dairy Month, Summer Favorites Ice Cream & Novelties promotion, and the Cool Food for Kids educational outreach program. Headquartered in Harrisburg, Pa., the NFRA, founded in 1945, includes more than 400 member companies.

“Through our Easy Home Meals consumer-facing website and social media platforms, NFRA talks to thousands of consumers every day about frozen and refrigerated foods,” says Julie Henderson, the organization’s vice president of communications. “We share food safety tips on our Easy Home Meals website and blog, including storage temperature and time charts, and also tips on proper refrigerator and freezer cleaning to help ensure the quality and safety of the foods stored there.”

NFRA recently began collaborating with the Partnership for Food Safety Education (PFSE). “We’re looking forward to sharing resources and helping to get more food safety messages out to our large consumer audiences,” Henderson says. “Our goal is to begin implementing PFSE’s Safe Recipe Style Guide, which has all recipe directions begin with the basic food safety measure of washing your hands with soap and water and includes instructions for keeping foods separated.”

To instruct students, NFRA has partnered with Young Minds Inspired, a provider of free educational outreach programs, to create downloadable activities for middle and high school consumer science and health teachers that address both food waste and food safety. “Curriculum materials relative to these topics have been emailed to more than 65,000 teachers

throughout the U.S. since 2019,” Henderson relates.

### Promoting Frozen Food Quality

Relative to food quality, NFRA is consistently telling the farm-to-table story of frozen foods, Henderson emphasizes: that it’s real food, just frozen. “We emphasize to consumers and educators that frozen foods are made from real ingredients picked at the peak of ripeness and flash frozen, sometimes right on the field, to lock in all the beneficial nutrients and keep them in their perfect, just-picked state,” Henderson elaborates.

With its “Real Food. Frozen” consumer public relations campaign, NFRA focuses on changing the current conversation and perceptions about what people can find in the frozen aisles. “The campaign promotes the real ingredients, culturally-inspired recipes, fresh flavors, and smart packaging that make our category of foods unique,” Henderson says.

In 2019, the campaign achieved more than 700 million impressions through influencer marketing, media outreach, strategic partnerships, and social media efforts on the NFRA’s Easy Home Meals consumer channels and EasyHomeMeals.com, Henderson mentions.

### Freezing Technique in Development

A novel technique called isochoric freezing holds promise for use in food manufacturing and preservation, according to its developer, Boris Rubinsky, PhD, a professor of biomedical and mechanical engineering at the University of California, Berkeley.

Dr. Rubinsky first published the thermodynamic principles of isochoric cryopreservation in 2005 in the journal *Cryobiology*. His initial research focuses on using isochoric freezing for human cells and tissues, and organs destined for transplantation. Collaborating with USDA since 2017, Dr. Rubinsky and other scientists have shown that freezing various foods under certain isochoric conditions results in products with quality superior to those preserved by conventional freezing.

Typically, food is frozen under isobaric conditions, which means a constant atmospheric pressure when temperature and volume vary in tandem, Dr. Rubinsky

relates. “Within such a system, an unrestricted volume of water or the total water content within a given solid mass of food will freeze almost completely when held at a temperature below its freezing point,” he explains.

With isochoric freezing, a food product is immersed in an isotonic solution inside a closed chamber so that the volume remains constant during freezing, Dr. Rubinsky elaborates. “The chamber is then gradually cooled down to a preset freezing temperature,” he says. “Once the temperature reaches the freezing point of the solution, ice starts forming and growing in size, generating hydrostatic pressure inside the closed chamber until the system reaches a new thermodynamic equilibrium at the preset freezing temperature. At this point, a two-phase system exists, with an unfrozen liquid portion and a frozen solid portion.”

The most notable benefit of isochoric freezing, Dr. Rubinsky says, is that food can be safely preserved without ice crystal formation if it remains in the liquid portion of the system. To date, the technique has been successfully demonstrated with studies on cherries, tomatoes, potatoes, and tilapia, Dr. Rubinsky reports. “Additional foods that could benefit from the process include berries and leafy greens, which deteriorate after traditional freezing and thawing,” he points out. “Moreover, isochoric freezing of bacteria in solutions at minus 15 degrees Fahrenheit for 24 hours has resulted in a seven-log reduction of *Lm* and *Salmonella typhimurium*.”

“Energy savings is another benefit of isochoric freezing,” Dr. Rubinsky adds. “Our research shows that an isochoric system requires up to 70 percent less energy compared to conventional freezing.”

Another game-changing breakthrough is on the horizon. “Our current research includes freezing for 3D printing of food—cryoprinting,” Dr. Rubinsky says. “That will have a major impact on the food industry worldwide. One day, in the foreseeable future, instead of first making a food product and then freezing it, we will be able to freeze a food product as it’s being made, courtesy of cryoprinting.” ■

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# Salt Safety Insights



## OFF THE SHELF COMPARISON

Retail jar samples. Only the third example has been properly cleaned.

effective way to “clean” dust. Without proper chemical analysis testing, it can’t be identified as solely finely-ground salt (without any other finely-ground matter included).

## Flavor

The flavor should be salt-forward with a slight minerality. A clay-like flavor and gritty texture indicate a lower-quality salt that likely includes impurities.



Rocks

Clay

Foreign Matter

Insolubles

Inclusions

## All is not Rosy with Himalayan Salt.

Not all Himalayan pink salt is created or processed equally. Commodity importers and other suppliers have introduced significantly lower quality Himalayan salt that is poorly processed, often overseas, before being imported and sold in the US.

With lower cost and lower quality comes a higher risk of lower food safety. Crudely processed Himalayan pink salt may contain impurities, insoluble and inedible materials such as: metal fragments, pieces of rock or stone, clay particles, dust and other undesirable organic and inorganic material.

Here are a few facts about Himalayan and some tips on how to identify the highest quality and safest salt possible:

### Color

Correctly processed high-quality Himalayan salt will range in color from light white to shades of pink and light red. When backlit,

every crystal should be slightly translucent. Any solidly opaque particles are not salt.

### Inclusions & Insoluble Materials

Grains that are opaque red, white, gray and brown are inedible or insoluble materials. These inclusions can negatively impact the flavor of the salt and hinder the performance of grinders and mills by damaging the grinding mechanisms.

### Dust

Powder and dust is common in lower quality Himalayan salt. Unfortunately, there’s no

## A CAREFUL EXAMINATION



Not Clean

Optically Clean®

## UNDESIRABLES

Commonly found impurities in uncleared Himalayan pink salt

## The Answer is SaltWorks

At SaltWorks®, we are dedicated to bringing the highest quality, best tasting and cleanest salts to our customers worldwide. We’re passionate about perfecting salt naturally through proprietary methods, like our exclusive Optically Clean® technology, while preserving the flavor profiles, textures and characteristics that make each salt unique. You’ll see the quality and taste the difference of SaltWorks’ Ancient Ocean® Himalayan Pink Salt.

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# Legal Update



## Don't Get Stuck with a Labeling Lawsuit

Understand the law and reduce your risk

BY JOEL S. CHAPPELLE, ESQ., AND SHAWN K. STEVENS, ESQ.

**T**here are few things more alarming for a business owner than receiving a letter threatening a class action lawsuit. Yet, an ever-increasing number of food companies are facing such threats as plaintiffs' attorneys across the country seek to leverage consumer protection laws in pursuit of lucrative claims against food companies. In particular, food companies face significant risk from lawsuits involving allegations of misleading or illegal labeling practices. This column will discuss the legal background and history of these lawsuits and explain how companies can best protect themselves and mitigate against the risks associated with these lawsuits.

### Federal Labeling Authority

The Food and Drug Administration (FDA) and U.S. Department of Agriculture (USDA) are the governmental agencies with primary oversight authority over food labeling. Additionally, the Federal

Trade Commission has a broad mandate to protect consumers from fraud and deception in the marketplace. The Federal Food, Drug, and Cosmetic Act (FDCA) and the Fair Packaging and Labeling Act are the primary federal laws governing food products under FDA's jurisdiction. The Nutrition Labeling and Education Act (NLEA), which amended the FDCA, governs nutrition labeling and requires food labels bearing health claims, nutrient content claims, and structure/function claims to meet applicable requirements.

Labeling regulations can be difficult to interpret, ambiguous, confusing, and seemingly contradictory. In fairness, there is an almost endless variety of food products comprising of an almost endless combination of ingredients, which are sold in packages of all shapes and sizes. Moreover, competition in the marketplace remains fierce, our understanding of nutrition is constantly evolving, and terms used to describe a product can mean different

things to different people. Consequently, complexity is inevitable, and establishing a uniform set of readily understandable rules is nearly impossible. Yet, notwithstanding the byzantine complexity of the rules, their purpose is straightforward: adequately inform consumers in a manner that is accurate and not misleading.

Neither the FDCA nor the FTC Act (false advertising) provides a private right of action for consumers to pursue claims against food companies. In other words, the laws do not provide a mechanism for consumers to bring lawsuits against companies who violate the labeling provisions of the FDCA or the FTC Act. At the same time, FDA lacks the resources and regulatory authority to effectively monitor false and misleading labeling practices. Historically, even when FDA did initiate enforcement actions in response to prohibited or misleading labeling practices, the actions did little to deter future violations.

### The Rise of Labeling Lawsuits

In the early 2000s, America underwent a rapid cultural shift as the importance of healthy eating entered the mainstream consciousness. This cultural shift led to a proliferation of products making misleading and inaccurate labeling claims, which not only resulted in consumer confusion, but also placed companies who complied with the law at a substantial disadvantage. In turn, consumer protection groups began to raise alarms and file the first labeling lawsuits.

In a 2006 report to Congress, the Center for Science in the Public Interest (CSPI) asserted that it had asked FDA to act against almost 200 misleadingly labeled products discovered during visits to supermarkets in the Washington, D.C., area. In 2008, the Government Accountability Board criticized FDA for failing to address mislabeling issues, noting that the agency was doing too little to address mislabeling. In 2009, FDA issued guidance advising companies to stop using misleading front-of-package labeling, asserting "that nutrition-related FOP and shelf labeling, while currently voluntary, is subject to the provisions of the Federal Food, Drug, and Cosmetic Act that prohibit false or misleading claims and restrict nutrient content claims to those defined in FDA regulations." Yet despite the increased



scrutiny, and although most food companies complied with the law, mislabeling issues continued.

### State Laws Allowing Mislabeling Lawsuits

Although there is no private right of action under federal law, some states have enacted legislation that adopts federal law and allows for private lawsuits. California's Sherman Food, Drug, and Cosmetic Law, for example, expressly adopts the federal labeling requirements of the FDCA. California's wholesale incorporation of the FDCA's labeling laws transforms alleged violations of the FDCA into violations of California's Sherman Act. In turn, alleged violations of the Sherman Act may be used as predicate acts to recover damages under the Unfair Competition Law (UCL), False Advertising Law (FAL), or the Consumers Legal Remedies Act (CLRA). New York has enacted a similar legal framework. These state laws allow individuals and groups who claim to have been injured as a result of mislabeling to bring lawsuits seeking to enjoin mislabeling practices, recover damages caused thereby, or both.

One of the first successful labeling lawsuits, filed in 2008, involved a large yogurt manufacturer. In that case, the plaintiff alleged that the defendant company manufactured and marketed yogurt products with unproven health claims and sold them at a premium and, in doing so, violated California's CLRA and UCL. In 2010, the case settled for \$45 million. This case surely drew the attention of litigators nationwide and served as a proof of concept for the lucrative mislabeling class action. As is often the case, settlements like this lead to a feeding frenzy of plaintiffs' attorneys asserting related claims in hopes of capitalizing on the publicity and notoriety of the bellwether case.

In the decade since, there have been dozens—perhaps hundreds—of class action lawsuits filed against companies throughout the food industry. Whatever the number is, it is only the tip of the iceberg. That is because most claims are settled before a lawsuit is filed. Many companies now consider these claims, regardless of merit, as a cost of doing business. Generally, there are two types of labeling lawsuits. The most common arise from

Hiring experts and consultants to review your labeling on at least an annual basis can help you avoid labeling issues. ... Taking steps to ensure your labels are accurate and compliant with all regulations is the best way to avoid future issues.

unregulated—but allegedly misleading—labeling claims. These include lawsuits arising from claims such as “natural,” or “healthy.” So-called “natural” lawsuits, as the name implies, involve products that claim to be “natural.” In most cases, these lawsuits target products that are advertised as natural, but contain artificial preservatives, GMOs, or other synthetic ingredients. Notably, FDA has still not formalized a definition for “natural” foods. Products utilizing claims such as “nutritious,” “healthy,” and “wholesome” have faced similar lawsuits.

The second type of lawsuit involves labeling claims that explicitly violate FDA rules or regulations. These often involve allegations that a label fails to disclose the presence of ingredients in the ingredient statement, makes unauthorized health claims, or that makes expressly prohibited health claims. It might seem that these lawsuits would be easier to avoid than those addressing unregulated claims, given that they involve an alleged violation of the regulations, as opposed to the mere allegation that a claim is “misleading,” but that is not necessarily the case. The trouble is that the labeling regulations are so complex that they can often be interpreted in multiple ways. Thus, even where a company has taken great care to comply with all labeling regulations, the cost of successfully defending a class-action lawsuit can substantially exceed the cost of simply settling it.

Plaintiffs' attorneys and consumer advocacy organizations continue to actively search out any label that could run afoul of labeling regulations. Until the law is amended in such a way that plaintiffs' lawyers are disincentivized from bringing meritless claims, food companies will continue to face the risk of labeling lawsuits.

### How to Avoid Labeling Lawsuits

First, hiring experts and consultants to review your labeling on at least an annual

basis can help you avoid labeling issues. Often, avoiding labeling claims means avoiding the scrutiny of plaintiffs' attorneys. The simple truth is that the costs of responding to a claim tend to far exceed the cost of preventing one. Taking steps to ensure your labels are accurate and compliant with all regulations is the best way to avoid future issues.

Second, well-written supplier agreements that include the requisite guarantees, warranties, and indemnification clauses are critical. Requiring the entities who develop your labels to contractually indemnify you in the event of a claim is a smart, simple, and practical way to reduce your risk.

Third, insure against potential claims. Insurance is the first and best line of defense, but great care is required in selecting policies. More than ever, insurance policies exclude coverage for labeling claims. Have your attorney review any insurance policies and confirm that the policy provides the coverage you expect.

Lastly, continually monitor emerging trends in labeling lawsuits. Often, these types of suits come in groups. If you identify an emerging trend that might implicate one of your products, consider taking steps to revise your label or otherwise reduce the likelihood that your product will be targeted.

The vast majority of companies do all they can to provide accurate labeling information to consumers. Nevertheless, labeling claims can still present a significant risk to many companies. Fortunately, we can significantly reduce that risk by carefully reviewing labels, removing any questionable claims, and continually working to achieve and maintain regulatory compliance. ■

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# Global Interests

## AUDIT



## We're Being Audited ... Again?

View an audit as a tool for continuous improvement that strengthens your food safety culture

BY AURORA A. SAULO, PHD

**I** can't talk now. We're preparing for a third-party audit next week."

"I have a third-party audit in two days and we'd like to get a very high score again!"

"Can you come to our facility tomorrow and help us prepare for an audit scheduled in two weeks?"

Have you heard these statements before? Audits seem to bring on anxiety and fear and, in some cases, the auditees challenge themselves to obtain the high-

est audit scores in the community. They can cause stress for food businesses that allow (and pay for) audits in order to sell their products. Viewing an audit as a tool for food quality and safety rather than as an endpoint may correct some of these misperceptions and relieve some anxiety.

Audits verify that the appropriate activities a food processor is using are written and properly followed to control the hazards of the food, facility, and supplier. Audits consist of the verification of records reviews, key personnel interviews, and on-

site observations evaluated against a set standard or a checklist. The potential areas of verification include the process, sanitation, supply chain, allergens, and system. Audits are conducted by a food regulator, such as FDA, USDA, or their equivalents in other countries; by a buyer/vendor, such as a food manufacturer, the military or government, or a retail food chain; or by a third party.

The auditor verifies that the processor has written food safety plans that describe what is to be done to keep food safe. For example, if the processor states that product temperatures are obtained with a calibrated temperature indicating device (TID), the processor must have procedures demonstrating that someone in the facility is trained to use a calibrated TID to obtain the necessary data and that a trained staff member knows how to calibrate the TID. If the procedures are not properly done or followed, that processor's performance will be reflected in the audit results.

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Auditors are also different from one another; they can interpret the same auditing guidelines differently. Additionally, auditing guidelines and standards are different for different schemes. Thus, when a food processor does not address all the audit elements that a specific auditor has on its prescribed checklist, such omissions may result in audit score deductions. But is a low or even failed audit score a reflection of a poorly run operation? Conversely, is a high audit score a reflection of a superbly run operation? The answer to both questions is no.

### Define Your Goal

A critical requirement of an audit is to define your audit goal. Is the goal to obtain a very high score that gives you bragging rights? Is it to obtain an impressive-looking certificate to hang in your reception area? Or, is it to control food hazards and risks and then learn from the results in order to improve the operations? Defining your audit goal is a critical issue that must be addressed.

When your audit goal has been defined, your company leadership then sets the tone for the rest of the staff to achieve this goal. An audit is not like an exam that you study for, take, and then shelve until another exam is scheduled; an audit defines your establishment's food safety culture, and this must be evident in your daily operations and the products you manufacture. The establishment culture states your belief that food safety is your first and foremost objective. *If a food is not safe, it is not a food and will not be sold.*

### Auditing Services and Standards

To maintain grocery shelf space, diversify product offerings, and potentially increase revenue, processors continue to improve existing products and develop new ones. But, as improved and new food products are introduced to the marketplace, their safety must be verified. Food regulators often require safety verification at least one step back (to vendors) and, at times, one step forward (to users). Processors meet this verification requirement either by themselves or through the assistance of auditing services and consultants.

Many auditors share an audit plan before the audit is conducted to help the auditee prepare for the focus areas and

audit timelines defined by the auditor. If the auditor is a state or federal or foreign regulator, their audit standards (i.e., audit plans) are known. If the auditor is the buyer or vendor, they will have their own proprietary audit standards that are made known to the auditee. If it is a third-party auditor, standards may be made known to the auditee, but these standards also can vary—not widely, but they do vary.

**An audit is not like an exam that you study for, take, and then shelve until another exam is scheduled; an audit defines your establishment's food safety culture, and this must be evident in your daily operations and the products you manufacture**

There are true standards such as those set by International Organization for Standardization (ISO) that address food safety, quality, and environmental concerns. There are industry standards, such as the Global Food Safety Initiative (GFSI), formed by a consortium of major market chains to codify food safety, quality, and ethical practices. Other schemes benchmarked against GFSI have emerged, such as the British Retail Consortium (BRC), International Food Standard (IFS), Safe Quality Foods (SQF), Dutch HACCP, and FSSC 22000. Many food processors are most familiar with the standards, requirements, or expectations created by a number of private or company auditing services, such as AIB International, ASI LLC, Steritech, Merieux NutriSciences, Primus Auditing Ops, McDonalds, and NSF International.

Thus, the processor is faced with many auditing services operating under many and different audit standards. Fortunately, most of the elements in any audit system are the same, or at least very similar to one another, starting with what are known in the U.S. and other countries, as the Good Manufacturing Practice or GMP (21 CFR 117 Subpart B previously found in 21 CFR 110). GMPs comprise the basic food safety laws

and cover eight key sanitation areas (i.e., safety of the water; condition and cleanliness of food contact surfaces; prevention of cross-contamination; handwashing/sanitizing and toilet facilities; protection from adulteration; labeling, storage, and use of toxic chemicals; employee health conditions; and exclusion of pests). Everyone involved in the handling of food must comply with the GMPs.

The other common audit elements are also related to the GMPs and include allergen controls, good laboratory practices, food defense and intentional adulteration, shipping and receiving, purchasing and vendor approval, document control, recall and traceability, weight control, specifications (of ingredients, finished products, packaging, equipment, and controls), written assurances, consumer complaint program, corrective and preventive actions, calibration, and education and training. Quality systems are also included by several third-party auditors. Thus, there are guidelines to meet audit standards, and many of these guidelines are known.

It is short sighted and a waste of resources to view these preparatory activities as being only for a short-term purpose, i.e., solely for the upcoming audit. These activities should be managed as tools for continuous improvement of food safety, quality, sanitation, and security that align all operations, facilities, and personnel for a long-term strengthening of your food safety culture. Relying on the strength of your food safety systems instead of aiming for high audit scores or obtaining an audit certificate is a truer indication of success. It must be noted that a food processor that obtained a lower audit score than another may still be selling its product. Additionally, within the past two decades, there have been several high-profile cases in which food processors given very high audit scores eventually went out of business due to breaches in food safety that resulted in recalls.

Some processors pass audits, and other processors fail audits. What remains critical to the integrity of a food business is to identify the root cause of deficiencies and prevent them from recurring. ■

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# Cannabis Corner



## Dairy Dilemma

Industry awaits federal go-ahead to sell cannabis-infused dairy products

BY LORI VALIGRA

**A**lways one of the first to latch onto a new trend, Ben & Jerry's announced last May that it planned to offer a cannabis-infused ice cream. The caveat? The ice cream maker has to wait until it's legal to do so. "We're still in a holding pattern, as the FDA is the deciding body to confirm if and when food manufacturers can use CBD," says Ben & Jerry's spokesman Sean Greenwood.

"CBD" refers to cannabidiol, a non-intoxicating chemical obtained from hemp

that some believe has medicinal benefits such as pain relief and stress reduction. U.S. sales of CBD-based drinks are expected to grow dramatically, to more than \$1.4 billion in 2023, up from \$86 million in 2019, according to researcher Zenith Global's Beverage Digest.

"Key growth drivers for CBD drinks include loosening regulatory implementation, investment by major brewers, and innovation by numerous startups," Zenith Global Chairman Richard Hall said when the report was released last year.

Speaking at the International Dairy Foods Association's annual conference in Arizona in January 2020, group president and CEO Michael Dykes, DVM, said there is an "absolute insatiable [consumer] appetite" for more CBD products. That will spur dairy industry companies to consider offering products, he added.

"Industry is moving and saying, 'Look, we're going to be careful with the claims we make, and yes, we're going to take some risk,'" industry website Food Dive quoted him as saying. "They are going to find a way [to make CBD products]. There is such a tremendous consumer demand for it, there is such a market for it, that they are going to find some way to tap into that market rather than wait for the [FDA to catch up]."

Other nations, including the United Kingdom, allow hemp stems and seeds for

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industrial use. Milk-alternative company Good Hemp, for example, is selling a CBD beverage called Barista Seed Milk for use in coffee.

### No Approval from FDA

Hemp and marijuana are in the same cannabis plant family, *Cannabis sativa*. The difference lies in the amount of the psychoactive ingredient tetrahydrocannabinol (THC) that they can contain. USDA rules specify that hemp have 0.3 percent or less of THC on a dry-weight basis, while marijuana can contain more.

While hemp is legal, FDA has not approved the sale of CBD-infused foods and beverages, citing safety concerns. Those include potential liver injury, drug interactions, male reproductive toxicity, and side effects such as drowsiness, according to an FDA advisory. Despite the FDA's disapproval, CBD-infused oils, coffees, cookies, and other products already are being sold in the United States, thanks in part to the Agriculture Improvement Act of 2018, also known as the Farm Bill. That act removed hemp from the definition of marijuana in the Controlled Substances Act.

While some large companies have hesitated to sell CBD-infused foods or beverages under their established brands thus far, small entrepreneurial companies are taking the leap into the market. Dr. Dykes said larger dairy companies might dip their feet into the CBD market by introducing new brands, by licensing products from another company, or via a joint venture.

In the nascent industry, companies are reluctant to speak publicly about the business potential of CBD-infused foods or beverages. When selling their products, however, some companies have been brazen about health claims in the face of FDA concerns about the safety of CBD. Last November, FDA issued warnings to 15 companies for illegal sales of products—not all of them selling infused food or beverages—containing CBD.

Said FDA Principal Deputy Commissioner Amy Abernethy, MD, PhD, “We remain concerned that some people wrongly think that the myriad of CBD products on the market, many of which are illegal, have been evaluated by the FDA and determined to be safe, or that trying CBD ‘can’t hurt.’”

### First to Market

Still, some experts think the enforcement has been lax, allowing the companies to operate. Martin Hahn, a lawyer and partner with Hogan Lovells in Washington, D.C., said the risk may be worth it to companies so that they can get to market

**All segments of the food industry are monitoring CBD closely, looking for opportunity. Still, regulatory hurdles and the FDA's position are making many food companies reluctant to jump in.”**

—MARTIN HAHN

first. “All segments of the food industry are monitoring CBD closely, looking for opportunity,” Hahn says. “Still, regulatory hurdles and the FDA's position are making many food companies reluctant to jump in.”

Companies need to choose their markets carefully, Jim Watson, senior beverage analyst at market research firm Rabobank, said at the International Dairy Foods Association's conference. “Fluid milk doesn't make the most sense if you're thinking of a product that has a marijuana association,” the Dairy Reporter quoted Watson as saying. Milk is associated with kids, while CBD is tied to marijuana, he said. He said that CBD is more likely to be infused into ice cream or protein-fortified workout beverages. Ice cream could be used by adults who eat it before bed to relax, he said.

### The Need for More Data

Hahn says Congress is pressing for an update from FDA to issue a regulation that outlines a safe level of CBD, but adds that more studies are needed before FDA, which he described as “data-driven,” could make such a determination.

On its website, FDA encouraged other experts to submit data on the long-term effects of CBD use and other factors. Stephen M. Hahn, MD, commissioner of food and drugs at FDA, says little is known about the potential effects of sustained and/or

cumulative use of CBD and risks to vulnerable populations such as children, pregnant and lactating women, the elderly, and certain animal populations.

“This does not mean that we know CBD is unsafe to these populations or under these circumstances but, given the gaps in our current knowledge and the known risks that have been identified, we also are not at a point where we can conclude that unapproved CBD products are safe for use,” Dr. Hahn says. “We encourage Americans to consult with their health care providers before using CBD products.”

FDA has approved one CBD prescription drug to treat two rare, severe pediatric epilepsy disorders. It hasn't evaluated or approved any other CBD products, Dr. Hahn says.

He adds that FDA is looking for reliable and high-quality data on the sedative effects of CBD, the impacts of long-term sustained or cumulative exposure to CBD, transdermal penetration and pharmacokinetics of CBD, the effect of different routes of CBD administration (oral, topical, inhaled) on its safety profile, the safety of CBD for use in pets and food-producing animals, and the processes by which “full spectrum” and “broad spectrum” hemp extracts are derived, what the content of such extracts is, and how those products may compare to CBD isolate products.

In addition to legalizing hemp, the Farm Bill has opened up significant opportunities for research, including new drugs, says Dr. Hahn. As the body of research grows, FDA will have more information for decision making, he adds.

To stimulate research and additional data, FDA is reopening a public comment document established in May 2019 and extending the comment period indefinitely. The docket also will have a way for researchers from academia and industry to share confidential information.

“As data become available that are high quality, reliable, and relevant to our evaluation of CBD products that fall under the FDA's purview, we will be able to refine—and, perhaps in some cases, revise—our thinking and approaches,” Dr. Hahn adds. ■

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# PLANT-BASED BOOM



The growing consumer taste for plant-based proteins creates a number of unknowns for food safety experts

BY **LORI VALIGRA**

**W**hile the growing consumer taste for plant-based meat generates a wider choice of foods, from meatless hamburgers to meatless “chicken” nuggets, at the same time, it creates a number of unknowns for food safety experts.

One key issue is FDA’s food standards of identity, which are several decades old. FDA held a public meeting in September 2019 to address the standards and how they might be hampering food innovation. “We know that many standards were established decades ago and have not been recently amended to reflect changes in consumer expectations or opportunities for innovation, including the ability to produce healthier foods,” Susan Mayne, PhD, and director of FDA’s Center for Food Safety and Applied Nutrition, told the meeting.

She says FDA wants to modernize the standards of identity program so it will protect consumers against economic adulteration; maintain the basic nature, essential characteristics, and nutritional integrity of food; and promote industry innovation and provide flexibility to encourage manufacturers to produce more healthful foods. Dr. Mayne says that FDA is close to proposing a new definition for “healthy” foods as well as continuing to work on the claim that a food is “natural.”

Separately, the Center for Food Safety and Applied Nutrition has issued a request for information regarding the use of dairy food names in plant-based product labeling so that consumers are informed and not misled by labels. “We issued this notice to obtain data and better understand whether consumers are aware of and understand differences in the basic nature, characteristics, ingredients, and nutritional content of plant-based products and their dairy counterparts,” she says.

### Hitting the Mainstream

The popularity of veggie burgers made by Beyond Meat, which McDonald’s is testing at its restaurants in Canada, and the Impossible Burger, sold by Burger King and White Castle, demonstrates that plant-based proteins aren’t just for vegans and vegetarians anymore, but are going mainstream.

U.S. retail sales of all types of plant-based foods rose 11.4 percent over the past year, to reach \$5 billion now, says the Plant-Based Foods Association and The Good Food Institute. Of that total, plant-based meat sales were up 18 percent, to \$939 million. Refrigerated plant-based meat drove that growth, rising 63 percent.

**Because plant-based foods are relatively new to the food system, aspects from ingredient processing, potential allergic reactions, and how to store and cook them still need to be reviewed under FDA’s Food Code for public health.**

Plant-based meat now accounts for 2 percent of retail packaged meat sales, the two groups said.

“One of the most amazing developments is that more than 100,000 fast food outlets offer plant-based meat including Burger King. McDonald’s has been testing it in Canada,” says Julie Emmett, senior director of retail partnerships at the Plant-Based Foods Association in San Francisco.

Customers ordered 228 million servings of veggie burgers and veggie sandwiches at quick-serve restaurants from April 2018 to May 2019, according to research company NPD Group. Beef burgers still are more popular by far, with 6.4 million ordered in the same time frame. NPD said the desire for more protein in their diets, concerns for animal welfare and how meat products are brought to market, sustainability, and a perception of healthier nutrition all drive customers to buy more plant-based meats.

### “Ultra-Processed”

Plant-based meat, also known as plant-based protein and alternative meat, typically includes proteins such as soy or peas, fats including coconut oil, carbohydrates such as methylcellulose, minerals, water, and flavoring. All of these ingredients put it into the “ultra-processed” category of NOVA, a widely used food classification system developed by researchers at the University of Sao Paulo, Brazil.

NOVA looks at the level of processing in a food. Ultra-processed foods contain at least five ingredients, typically have added ingredients like fats and salts, and have modified or processed food

*(Continued on p. 24)*



(Continued from p. 23)

ingredients. The Impossible Burger, for example, lists 21 ingredients on its website, while Beyond Meat lists 17.

The United Nations Food and Agriculture Organization said in a 2019 report on food processing that the processing in itself is not a good way to assess the food quality scientifically, because today, nearly all food is processed in some way. But, consumers and companies competing in the meat and meatless markets do use the term “processed” with a negative connotation to mean the food isn’t in a natural state.

There is a conflict about processing, says David Ervin, vice president of emerging proteins at Tyson Foods in Chicago. He was part of a webinar on plant-based foods last September hosted by the Center for Food Integrity in Gladstone, Mo., a nonprofit that works to help the food system gain consumer trust. “The processing is required to get the taste and texture, from pulling isolates out of peas and processing them with heat, moisture, and pressure to develop textures,” he says. “Taste is important, and to get that taste there are certain things we have to do.”

Tyson Foods, the largest meat producer in the United States, initially had invested in the plant-based meat company Beyond Meat, but now has its own line of alternative protein products. Ervin says that using the words “plant-based meat” causes controversy among meat producers, so Tyson opted instead to call its foods “plant-based proteins.”

White Castle, an eastern United States restaurant chain, sells a variety of plant-based burgers in its 140 locations. They include Dr. Praeger’s veggie burgers, black bean burgers and the Impossible Slider. “The Impossible Slider looks like, sizzles like, and tastes like beef,” said Jamie Richardson, vice president of corporate relations at White Castle, during the same webinar. The Impossible Burger has coconut oil and sunflower oil in it to help create that sizzle.

Meatless burgers have often been touted by their makers as more healthy than conventional beef, with less fat and more fiber but, on the downside, they have more salt for taste. “People

are reading the labels on all of their food, including plant-based foods,” says Emmett.

But, compared with conventional hamburgers, plant-based proteins have more ingredients, some of which, such as the additive soy leghemoglobin, aren’t familiar to the average shopper. Soy leghemoglobin, or “heme,” is a color additive. Impossible Foods, the maker of the Impossible Burger, petitioned FDA last year to approve the additive, which the government agency did in July 2019. The company said the additive optimized flavor in its meatless products. Before FDA’s approval for direct-to-consumer sales of uncooked, red-colored beef analogue products, Beyond Beef had been selling products in cooked form that consumers could eat in a restaurant.

“We are in the midst of a revolution in food technology that in the next 10 years will likely lead to more innovations in food and ingredient production than there have been in the past half century,” says Dennis Keefe, PhD, director of FDA’s Office of Food Additive Safety, when heme was approved. “As these new products and ingredient sources come to market, FDA has a responsibility to provide the appropriate regulatory oversight to protect public health by ensuring that these new foods and food ingredients are safe,” he adds.

### Food Safety

Because plant-based foods are relatively new to the food system, aspects from ingredient processing to potential allergic reactions to how to store and cook the foods still need to be reviewed under FDA’s Food Code for public health, according to panelists at last November’s Nation’s Restaurant News Food Safety Symposium.

Many of the plant-based meat products contain pea proteins and other ingredients that raise concerns about glyphosate residue levels from the broad-spectrum herbicides that are used to produce them, the panelists said. Soy, a frequently used ingredient in the plant-based burgers, is a common allergen. As with conventional foods, plant-based foods can contain other ingredients that possibly could cause allergic reactions.





Most of the meatless burgers are transported frozen, says Emmett, and cooking temperatures usually are at least 165 degrees. “They can keep for nine months frozen and seven to 10 days thawed in the fridge,” she says.

As for assuring that the foods use only plant-based ingredients, the Plant Based Foods Association and product testing company NSF International launched a Certified Plant Based seal in November 2018. Foods eligible for certification include meat alternatives such as plant-based meat, poultry, and fish; egg substitutes; milk alternatives; and other dairy alternatives such as plant-based cheese, yogurt, butter, and ice cream.

### Just for Vegans?

Meatless proteins aren’t just for vegans and vegetarians, experts say. In fact, it’s meat eaters who are driving the market. “It is about the choice of having plant-based meat in the diet once a week,” Ujwal Arkalgud, CEO of MotivBase, a cultural anthropology consulting company, said during the Center for Food Integrity webcast.

The more recently marketed burgers on the market, including the Impossible Burger and the Beyond Meat meatless burger, include more ingredients than earlier veggie burgers and are aimed at better taste, texture, and juiciness. “We’re clearly seeing a tipping point on consumer acceptance,” said Ervin of Tyson at the webinar. “The biggest barrier in the past was taste. It’s not vegans and vegetarians driving the market, but meat eaters, so we have to satisfy them.”

Still, consumers remain focused on health and nutrition. Ervin says Tyson is bridging the meat and meatless markets with its “Raised and Rooted” brand of plant-based proteins, which blends equal parts of fresh Angus with beef plant-based protein. “It has 60 percent less saturated fat compared than 80/20 beef and 40 percent less calories,” he says. The 80/20 beef is 80 percent lean beef and 20 percent fat.

The Tyson blended burger has 150 calories and 19 grams of protein. It has 1 gram of dietary fiber. An 80/20 beef hamburger has about 300 calories and 30 grams of protein, according to [calorieking.com](http://calorieking.com). A Beyond Meat burger has 270 calories and 20 grams of fat

while the Impossible Burger has 240 calories and 19 grams of fat, according to both companies’ websites.

A 2019 Nielsen study says many of today’s shoppers are omnivores playing the field when it comes to exploring meat alternatives to get their dietary protein. “In fact, protein-seeking consumers are more likely than ever to consider all the options available to them,” Nielsen says. Some 98 percent of meat-alternative buyers in the United States also buy meat products, and 21 percent of those who typically buy only meat also are now buying plant-based meats.

White Castle, known for its sliders, noticed in 2015 that a lot of people wanted an alternative to beef. “We are an almost 100-year-old company, so we’ve always had to adapt and change to what our customers want,” says Shannon Tolliver, social responsibility and environmental sustainability manager at White Castle. She says the company started by partnering with Dr. Praeger’s, which makes burgers out of vegetables. White Castle later added a black bean burger. In 2018, it partnered with Impossible Foods to sell the Impossible Slider, and rolled that out to all White Castle restaurants last year. “Dr. Praeger’s is a veggie burger that doesn’t taste like a hamburger, but the Impossible Slider is similar to a beef taste,” she says. The beef taste has proven popular among Generation Z and millennial customers.

“Plant-based burgers allow consumers to substitute without sacrifice,” NPD food and beverage analyst Darren Seifer said when the market researcher released its data on that food category last summer. “With that said, U.S. consumers have not given up on beef burgers but are willing to mix things up every now and then.”

Arkalgud sees opportunities for both meat and meatless product sellers to innovate. Meat producers can potentially give more information to consumers about the meat they are buying, for instance. “One retailer I talked to wanted to tell consumers where the meat they were buying came from, what farm and what the animals ate,” he says.

“This is not a fad,” says Arkalgud. ■

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# Coronavirus

## Lessons from the COVID-19 Outbreak for the Food Industry

How to upgrade businesses and practices so you can better address a pandemic

BY RICHARD F. STIER

**Y**es, we know what you are thinking: “Oh no, not another preachy piece on coronavirus or COVID-19 or the Wuhan virus or whatever you wish to call it.” We don’t want to preach to anyone, nor do we want to elaborate on the many things that we all have been told to do to minimize the chances of transmission and to protect ourselves from the novel coronavirus SARS-nCoV-2. This has been a once-in-a-century event. We have seen nothing like it since the influenza epidemic that succeeded World War I and, if we are fortunate, we will not see it again in our lifetimes. But, as they say, never say never.

So, let’s step back and take a look at what we have seen and learned from this event and determine how we can upgrade our businesses and practices to be in a position to better address a future pan-

demic. The following is a list of actions that most food and ingredient processors, food handlers, warehouse operators, and restaurants may want to consider:

**1. Handwashing.** Handwashing is emphasized again and again as one of the preventive measures for minimizing spread of COVID-19, the disease caused by the virus. This should not be a revelation for food processors and handlers, restaurant employees, and others. Handwashing is, and has been for many years, an integral element in a processor’s food safety program. The coronavirus simply adds another element to underscore its importance, so emphasize its importance in worker orientations and refresher sessions, and make sure that the handwash stations are all properly supplied with warm water, soap, sanitizer, and a means to dry hands.

**2. Personal hygiene.** This is another area that food processors and handlers already emphasize. This, too, has been one of the preventive measures emphasized for this coronavirus transmission. Processors should take a look at how their programs currently address personal hygiene and expand them if needed to include the elements that have been emphasized with virus control, e.g., do not touch your face, how to properly sneeze or cough, and so on.

**3. Supplier diversity.** There have been reports that some operations have had to stop or cut back on production due to a lack of key raw materials or ingredients. This would happen most often for those processors that practice “just-in-time” inventory management—those that bring in materials as needed for production and do not maintain large inventories. One of the issues that the COVID-19 outbreak has shown us is the importance of diversifying your suppliers. Processors should establish at least one and preferably two secondary suppliers for their raw materials and ingredients. And, they should patronize these secondary suppliers by ordering from them regularly. If there is an issue with the primary supplier, the working relationship can be expanded rather than starting from ground zero.

**4. Re-evaluate risk assessments.** The Preventive Controls for Human Food regulation plus the ISO 22000 food safety standard and the Global Food Safety Initiative audit schemes all mandate that food processors, handlers, and any oper-



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One of the issues that the COVID-19 outbreak has shown us is the importance of diversifying your suppliers. Processors should establish at least one and preferably two secondary suppliers for their raw materials and ingredients.

ation covered by the regulation, standard, or scheme conduct a risk assessment on ingredients, raw materials, packaging, and processes. These assessments are supposed to include two elements: likelihood of occurrence and severity of occurrence. Consideration should be given to re-evaluating current risk assessments to determine whether they would be adequate to cover the coronavirus issues. One of the wineries that I know in my hometown buys glass from China and they were concerned that the bottles might be contaminated with the virus. They stepped back and looked at how wine bottles are manufactured (formed at high temperatures), handled, packaged, and shipped, and determined that there was no significant risk from the virus. Many materials would probably shake out the same way, without major modifications to existing risk assessments.

**5. Sensitive persons.** When you teach food safety, one of the important elements is establishing who will use a company's products. Most foods, beverages, ingredients, and the packaging used for these items are sold to the general public. However, there are items that are manufactured for sensitive populations: the young, the old, pregnant women, and the immunocompromised (YOPI). Processors making such products take extra care when designing their food safety plans and making decisions regarding quality and safety. As has been seen with the coronavirus, the same acronym may be applied. The most sensitive group have been the elderly, especially those with pre-existing conditions that may have compromised their immune systems. These conditions include heart disease, respiratory concerns such as asthma, and diabetes. What has been kind of amazing and quite a relief is that this virus has really not impacted young children.

**6. Expand emergency planning.** One of the elements of a company's food safety plan is emergency planning. Processors and handlers have developed programs to address what to do in emergency situations such as hurricanes, tornadoes, power failures, floods, ammonia leaks, toxic chemical spills, and acts of bioterrorism, but few—if any—companies have a documented program for what to do in a pandemic. Given the current situation, many operations will be expanding their emergency planning programs to include this element. What has occurred over the past few weeks, and each company's experiences, will help form the basis for such programs.

**7. Contingency planning for production.** Contingency planning is usually included in the emergency planning program, but I think it would be good to break it out as a stand-alone program. Contingency programs are designed to fill a gap in production. For example: A company's roof over the production floor collapses under heavy snow, effectively curtailing production. What should be done to meet orders while repairs are made? Many operations establish agreements with contract packers or sister companies to produce for them in such a situation. The last few weeks have underscored the importance of establishing contingency programs or reviewing current programs to determine whether they need to be upgraded.

**8. Testing.** Testing for the virus has been a big issue here in the United States. What the brouhaha has shown is that many people simply don't understand why testing is done. In 1990, Dr. Fred Shank of the United States Food and Drug Administration made the following statement: "Instead of relying on traditional inspections, our role in HACCP will be to review system parameters and operating procedures, to

provide selective auditing of the system's records, including verification by laboratory analysis, and provide for appropriate enforcement." He emphasized that testing is a verification activity, not something done to ensure safety. One of the main reasons that HACCP was adopted was because scientists realized that food industry professionals had to build safety (and quality) into the manufacturing system. Most testing is done to solve problems and not to ensure safety, although many operations include finished product testing as a verification activity. One must realize that this kind of testing is not statistically significant. With this virus, the push has been to test to confirm or deny that someone who has symptoms has COVID-19. There are in excess of 300 million Americans; it would be impossible to test every one of them and, even if that was done, it could create a false sense of security because, even after being tested, a person could end up infected.

**9. Workforce education.** All processors must establish programs to educate their workforce. These programs include orientations for all new employees, refresher sessions for current employees on a range of issues for food safety, sanitation, and worker safety, and job-specific education to ensure that people do their work properly and safely. Given the poor coverage of the outbreak by the media, who seem to think that their job is to frighten rather than inform, food processors, handlers, and warehouse operations should consider conducting emergency sessions for their own workforce that address emergency issues. Companies should bring their whole team together and make sure that everyone is on the same page and understands not only the problem, but also the company's planned response. The company should encourage questions but take care in how it answers. If someone does not know an answer or is unsure how to respond, tell people, "We are not sure, but we will get back to you." Don't guess or theorize.

These are just a few thoughts on how you might make some good out of a bad situation. ■

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# Safety & Sanitation

SANITIZING



## Beyond a Bottle of Bleach

Effective sanitizing and disinfecting for food manufacturers

BY BRET ZAHER

In today's ever-changing food safety environment, food manufacturers strive to meet current regulations while balancing downtime and production efficiencies. Despite the critical importance of cleaning production equipment, the task is often undervalued. In some cases, the hierarchy of cleaning processes that could be implemented is misunderstood. Regardless of the size of the production plant, routine cleaning is required and must be factored into the master cleaning schedule and daily house-keeping activities.

There are different levels of cleanliness that food manufacturers should be familiar with and strategically implement. The minimum standard for cleaning is "visually" clean; however, this is simply removing food and debris from a surface to the extent that the human eye can see

it. As any microbiologist will attest, what cannot be seen can and will still hurt you. So, what's the next step in the process after removing the visual debris? This is where sanitizing and disinfecting come in. Having a solid understanding of some general principles will better equip plants with the ability to attain a higher level of clean.

Like many terms used in the industry, plant personnel can easily confuse sanitizing with disinfecting. So, what is the difference between the two? According to the Food and Drug Administration (FDA), "Sanitize means to adequately treat food-contact surfaces by a process that is effective in destroying vegetative cells of microorganisms of public health significance, and in substantially reducing numbers of other undesirable microorganisms, but without adversely affecting the product or its safety for the consumer." In simpler

terms, many experts say sanitizing kills 99.9% of bacteria and helps reduce its numbers to safe levels, while disinfecting goes even further and kills more microorganisms (including certain viruses and molds).

Many factors influence an effective safety and sanitation program, with the best approach generally being more complex than simply grabbing a bottle of bleach. Because not all sanitizers and disinfectants are created equally, a good starting point is knowing what you're trying to clean and the options available for doing so.

### Define the Target

Give primary consideration to the types of bacteria and other microorganisms you are targeting; this will help you determine whether you need to sanitize or disinfect. This information is usually found in the HACCP or food safety plan with the ingredient and process hazard analysis.

Many facilities use adenosine triphosphate (ATP) swabbing to start a historical record of general cleaning and will then often base cleaning frequencies on this documentation, using total plate count for additional information. Since most sites will not conduct pathogen testing on a product contact surface, the microbiological swabbing programs for zones 2 and 3 are often included in the risk assessment when determining whether to sanitize or disinfect.

Biofilms from the microorganisms must also be considered because they can act like a shield preventing the removal of the bacteria from the surface and thus play a part in the frequency of cleaning and sanitizing. If the microbiological risks are uncertain, resources offering guidance are available through agencies such as USDA, FDA, universities, chemical supply companies, and private food safety consulting and training firms.

### Assess Your Options

Sanitizing and disinfecting can be completed in numerous ways, including through the use of heat, pasteurization,

pressure, or irradiation, to name just a few. Another—and more accessible—way to complete sanitizing and disinfection is through the use of chemicals. Multiple factors will contribute to the process choosing the most suitable chemicals to apply.

In selecting the right chemical, first consider whether the proposed sanitizer or disinfecting agent is authorized for use in a food processing facility. Often, over-the-counter home use chemicals contain perfumes, dyes, and inert compounds that are not authorized for a food processor. In the United States, sanitizers and disinfectants are regulated by Environmental Protection Agency (EPA) and must meet its criteria for labeling, storage, use, and disposal. Always refer to the chemical label and safety data sheet (SDS) directions for this information.

In addition, depending on your type of facility, these chemicals need to meet FDA and/or USDA regulations for food contact. You can get this authorization information from the chemical manufacturer through letters of guarantee and technical data sheets.

Also take into account whether the product is high risk or low risk, and whether the sanitizing or disinfecting process will occur pre- or post-kill step. The surface the chemical will be applied to must also be considered, as many chemicals can stain, degrade, or even react with the application area. Contact the equipment manufacturer and chemical supplier to determine which chemicals can be safely used on your plant's equipment.

Another factor to keep in mind is bacterial resistance to chemicals. Many companies choose to rotate their sanitizers throughout the year to avoid such resistance. One example would be to go from a chlorine-based sanitizer to an acid or quaternary ammonia-based sanitizer.

Also remember that sanitizers and disinfectants both need contact time (called "dwell time") and concentration levels to achieve their goal. Many high-concentration sanitizers and disinfectants need a potable rinse following application to adequately remove them from the contact surface, so consideration should be given to whether a no-rinse sanitizer is warranted.

To help ensure proper use, many sanitizers and disinfectants can now be pur-

chased ready to use, while other chemicals may have to be manually diluted or placed in automatic dispensers and, in some cases, specific water temperatures are required for effective use. Some chemical supply companies can even custom blend chemicals to achieve optimum results. There are many options to choose from, so discussing specific requirements with a chemical supplier can aid in implementing a successful sanitizing and disinfecting program.

Safety determinations aside, other chemical choice restrictions may apply, such as those imposed by customers, religious protocols (e.g., kosher), or special certifications (e.g., organic). Many sanitizers can also be used as disinfectants if mixed at higher concentrations or allowed to stay on a surface for longer periods of time, so, if you want to minimize the number of chemicals on hand, choosing just one chemical to serve a dual purpose may be amenable. Usage directions on the chemical label can aid in such a decision.

### What to Choose

Here are a few points and situations that may further direct your approach:

- **Wash pit/equipment parts wash-room:** Because the smaller parts cleaned in these areas can be used throughout the plant, most sites use hot water with a general-purpose cleaner and a chlorine-based or quaternary ammonia-based sanitizer.

- **Floor drains:** Sanitizing and disinfecting floor drains is a must in a production environment. Many microorganisms can be found in these locations, which is why most plants use a strong sanitizer or disinfect drains. Because drainpipes and drain grates are not all made of the same material, it is important to identify the material and ensure that the sanitizing and disinfecting processes does not damage or erode them.

- **Roof leaks:** A roof leak potentially can carry very harmful microorganisms, so disinfecting the area of the leak is strongly recommended. Items used to contain or divert the leaks should also be on a disinfecting schedule. Since disinfecting does not kill 100 percent of microorganisms, many plants discard their diverters after the roof is repaired to avoid unintentionally providing an area for microorganisms to harbor.

- **A one-production-line bakery making a single type of bread:** Pre- and post-oven sections of the production environment usually do not have a large space to store chemicals. In this circumstance, a general-purpose sanitizer that can also be used as a disinfectant at higher concentrations and/or longer dwell time may be most practical. You may have to disinfect more frequently prior to the oven and less frequently after the oven due to the differing temperatures and, thus distinct environments for microorganism growth.

- **Manufacturer of ready-to-eat refrigerated dips with no kill step:** A strong sanitizer, and sometimes a disinfectant, should most likely be used in this situation because the risk of microbiological growth is much higher in this type of operation. Since the product does not go through a cooking step (kill step), the cleaning and sanitizing processes are often conducted daily or more frequently to reduce the risk of contamination.

- **Biohazards:** Always use a disinfectant when there is a biohazard spill in your plant. Such a spill contains many additional microorganisms not usually associated with the production process, so you'll need to give more attention to the spill than you would with a typical disinfecting scenario. Always be sure you have the appropriate disinfectant listed in your cleaning procedures to address these types of spills.

Ultimately, the determination of whether to sanitize or disinfect is a decision that must be made in coordination with the HACCP/food safety team, as changes to equipment, processes, raw materials, or ingredients will greatly affect the requirements. In addition, actively involving the chemical supplier or chemical manufacturer will help determine and address specific chemical needs. Keeping current with microbiological research is also necessary since new potential hazards and harborage areas are identified each year.

Every plant is unique and has individual sanitizing and disinfecting needs. The more personnel and information you involve in this discussion, the more likely it is that you'll meet your sanitizing and disinfecting needs. ■

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Ohio-based MadTree Brewing installed washdown motors to reduce downtime and contamination.

# Increase Sanitation Compliance at Food Processing Plants While Reducing Costs

High-efficient washdown motors make dramatic impact

BY JOHN CALLOWAY

**F**ood processing equipment poses unique challenges for maintenance personnel. Wet operating conditions and washdown requirements can require specially designed equipment to help ensure mandated sanitation compliance. This results in increasing pressure for manufacturers to design food processing equipment that is easier to clean and maintain, and that reduces downtime.

Millions of dollars are invested each year in capital improvements to facilities and equipment to increase product safety, protect employees, and reduce costs. Equipment in a typical food processing plant may run 16 to 20 hours a day, every day. Often, equipment failure is the most common cause for downtime. The longer it takes plant personnel to respond and repair equipment, the more damaging the interruption. What's more, systems that are not at full speed create a domino effect that can result in missed deadlines, lost revenue, and disappointed customers. Unplanned downtime can cost a food processing facility an astounding \$30,000 per hour, according to a 2017 report from industry research firm Enterprise Strategy Group. Downtime can cost a company more than just money; it can be a logistical nightmare. The expenses and ramifications are simply too high for plants to risk equipment failures.

## Maintaining Sanitation

The Food Safety Modernization Act is transforming the nation's food safety system by shifting the focus from responding to foodborne illness to preventing it. Product recalls cost food and beverage companies millions of dollars each year, but 56 percent of last year's recalls across the U.S., U.K., and Ireland were preventable, according to the Queen's Center for Assured and Traceable Foods in the U.K. Processors must commit to improving equipment hygiene; however, keeping equipment clean presents obstacles, which manufacturers can help overcome.

According to a Deloitte Food Safety Programs report, *Food Safety Management: An Enterprise and Operational Level Risk Perspective*, "reliably delivering safe and quality food is no longer just about food safety science. An effective safe food program needs a broad approach that incorporates science as well as strategic process and risk planning. Risks to food safety exist along each step of this complex farm-to-fork continuum regardless of the journey's length—local farmer to restaurant table or foreign source to domestic manufacturing site."

Food processing plants are very difficult environments for motors due to the daily cleaning and sanitizing of equipment. Harsh chemicals such as sodium hydroxide and other caustics are used to clean equipment and can be extremely corrosive. In addition to caustic chemicals, high pressure spray is used, sometimes up to 1000 psi, with the nozzle held just a few inches away from the motor. While this ensures the removal of all contaminants from the equipment, water enters these motors and does extensive damage.

## Washdown Motors Reduce Downtime and Energy Costs

With rising costs for energy and labor, the need is greater than ever to optimize equipment reliability to maximize uptime and productivity. According to a 2018 McKinsey & Company report, "Customers are demanding machines that improve operational efficiency, cut costs, and increase uptimes...."

Food processing companies can help reduce foodborne illnesses and operating costs through the use of encapsulated stainless steel food safety motors. Unfortunately, because electric mo-



Washdown motors help ensure that Ohio-based MadTree Brewing has a 100-percent dry running conveyor line.

tors are often out of sight and out of mind until production is down due to a burnout, this improvement is often not thought about. However, being proactive can have a dramatic effect on the bottom line.

A stainless steel washdown motor is suitable where motors are commonly exposed to moisture, humidity, and specific chemicals that cause corrosion. With the use of washdown motors, flexibility and durability are enhanced, which can yield to minimal operating expenses while increasing uptime. Hygienic equipment design not only mitigates the potential areas prone to harbor bacteria, but it also facilitates post-sanitation evaluation by ensuring accessibility during visual verification and environmental monitoring.

Specially engineered stainless steel motors also don't have a need for paint that could flake into the food, hold in moisture, and hide corrosion. They are of "totally enclosed, not ventilated" (TENV) design, which means that they do not have a fan and fan cover, both of which are both difficult to clean and could be breeding spaces for bacteria. For example, replacing all painted, standard motors on a plant's conveyor belts – particularly in the processing area – with 2-HP stainless encapsulated motors allows for far greater reliability, particularly in the extreme conditions of a food processing plant.

According to a 2018 article in *IndustryWeek*, while electricity is the largest

energy cost for most food and beverage plants, it also offers the greatest opportunities for savings and can deliver the fastest payback. Electric motors used in production facilities with conveyors are almost always on, driving the energy bill higher. The typical industrial plant can reduce its electricity use by around five to 15 percent by simply improving the efficiency of its motor-driven systems. Committing to running a more energy-efficient food manufacturing plant takes work, but the payoffs are well worth the energy, time, and money that are put into it. Manufacturing facilities in the U.S. spend \$200 billion annually to power facilities yet, by not implementing good energy management processes, the same companies waste nearly 30 percent of that energy. High-efficiency washdown motors reduce energy costs, improve plant efficiency and load factor, and lessen maintenance costs.

### Upgrade Incentives

Many states have created monetary rebate programs qualifying food processing plants for upgrades. Following are just a few examples:

The Wisconsin Food Processing Plant and Food Warehouse Investment Credit is a refundable tax credit for businesses that have invested to modernize or expand food processing plants or food warehouses in Wisconsin and who have been certified by

the Wisconsin Department of Commerce. Tax credits are earned by incurring eligible expenses for modernization or expansion of a food processing plant or food warehouse. This includes constructing, improving, or acquiring buildings or facilities, or acquiring equipment for food processing or food warehousing.

Wisconsin also has the Meat Processing Facility Investment Credit program to support the modernization of the state's meat processing industry. The tax credits build on the success of the state's dairy modernization and investment tax programs. The program provides a tax credit for up to 10 percent of the costs meat processors invest in modernization or expansion. Eligible expenditures include construction, additions, utility upgrades, equipment, and technology.

Because the food processing industry is one of the largest energy users in California, the state established the Food Production Investment Program, which encourages California food producers to reduce greenhouse gas (GHG) emissions. The program's initial budget in 2018 provided up to \$57 million to help accelerate the adoption of advanced energy efficiency and renewable energy technologies.

The Food Production Investment Program helps producers replace high-energy-consuming equipment and systems with market-ready and advanced technologies and equipment. The program also accelerates the adoption of state-of-the-art energy technologies that can substantially reduce energy use and costs and associated GHG emissions.

Iowa's MidAmerican Energy Advantage program realizes that a key barrier to strategic energy management for food processing companies can be the financial costs. MidAmerican Energy provides rebates for high-efficiency motors to help commercial, industrial and agricultural businesses with energy and bill savings.

Through the installation of energy-efficient washdown motors, food processing plants can move from a reactive to a more controlled, predictive maintenance approach and help improve sanitation, extend machine life and reduce operating costs. ■

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# How to Communicate During a Recall

Follow FDA guidance and work closely with non-food safety colleagues | BY AMY PHILPOTT

**W**hen the Food Safety Modernization Act (FSMA) was signed into law on Jan. 4, 2011, some didn't pay much attention to Title 21, §117.139(b) of the Code of Federal Regulations. In fewer than 120 words, the law specifies four recall plan requirements under the Preventive Controls for Human Foods (PCHF).

The subsection states:

“For food with a hazard requiring a preventive control:

(a) You must establish a written recall plan for the food.

(b) The written recall plan must include procedures that describe the steps to be taken, and assign responsibility for taking those steps, to perform the following actions as appropriate to the facility:

(1) Directly notify the direct consignees of the food being recalled, including how to return or dispose of the affected food;

(2) Notify the public about any hazard presented by the food when appropriate to protect public health;

(3) Conduct effectiveness checks to verify that the recall is carried out;

(4) Appropriately dispose of the recalled food.”

Fast forward to Oct. 7, 2019, when the FDA published chapter 14 of its Hazard Analysis and Risk-Based Preventive Con-

trols for Human Food: Draft Guidance for Industry. This chapter includes draft guidance on how to meet the above PCHF requirements. Although these requirements do not cover all food producers, any food company, not just those that must comply with the PCHF, would benefit from including these elements in their recall plan.

You might ask yourself why a public relations professional like myself would take such a keen interest in the recall plan section of the PCHF rule. It's simple: The first three of the four subparts of 21 CFR 117.139(b) are communication activities and good examples of why a company's food safety/quality assurance personnel need to work closely with non-technical or non-food safety members of the recall team.

There are other guidance documents that also encourage this internal collaboration. In September 2018, the FDA published draft guidance on the Public Availability of Lists of Retail Consignees to Effectuate Certain Human and Animal Food Recalls. In February 2019, the FDA published final guidance regarding the Public Warning and Notification of Recalls Under 21 CFR Part 7, Subpart C. Both documents focus on important communication aspects of a recall.

A handful of lawyers and communication professionals have recognized these

various guidance documents in blogs, articles, and columns like this one but, compared with other, more complicated parts of the law, none have received the industry's attention that this PR professional believes they deserve. All of these documents, even the draft guidance, warrant a company's immediate attention because, while the details may change slightly in the final versions, the need for internal collaboration won't.

At the core of all of these guidance documents is the recognition that an effective product recall response requires two-way communications with customers and consumers. They highlight the intersection of several business functions—namely, food safety, sales, customer service, and marketing. As such, food safety personnel and their non-food safety colleagues must work together. This can be one the more challenging and underestimated aspects of a company's recall response.

The following are ways to facilitate this cross-functional work:

## Involve Your Recall Team

As part of the company recall preparedness, hold a recall team meeting and share the aforementioned FDA guidance documents. The purpose of this meeting is to ensure that everyone on the recall team, including alternates, understands the company's recall communication responsibilities and to determine their individual roles in meeting them.

Food safety personnel and those responsible for communicating a recall to customers and consumers (typically sales or customer service and marketing staff, respectively) rarely have reason to share more than the casual exchange under normal circumstances, but during a



food safety event, they must work hand in hand. Identify those who will be responsible for drafting communication documents such as talking points, statements, and messages, and those who will be responsible for actually communicating those messages to customers and consumers.

Once you've identified these communicators, describe the company's general food safety protocols to them. This is a great exercise in explaining technical protocols in easy-to-understand terms, which is exactly what authorized spokespersons may have to do during a recall. Explain the recall process to the team and be sure they understand basic technical terms such as sanitation and sanitization.

Another good exercise is for whoever will oversee the consumer communications to write a half-page, consumer-friendly description of the company's food safety protocols in language that a seventh or eighth grader could understand. This is not a marketing piece; it's an objective description of what the company does on a regular basis to prevent food contamination. The company may or may not use this during a recall, but the background information alone will give your non-food safety staff insight and perspective, which will help them communicate accurately on behalf of the company.

### Prepare to Communicate

With this foundation, your team members can better identify and prepare for the specific tasks of communicating with customers and with consumers. This means identifying what needs to be done, who will communicate, and how they will communicate. It isn't enough to simply assign the task of "contacting customers." Instead dive deeper and identify the microtasks involved in contacting customers and communicating with consumers.

For example, when preparing to communicate with customers, separate them into two groups—those who received the recalled product and those who did not. During a recall, you will communicate with both, but they have different needs. Some of the questions that you should consider when reaching out to those who did receive the product are:

- **How many touchpoints do we have with each customer?** Normally companies have at least two: food safety and the buyer/sales agent relationships.

- **How does the company ensure that the messages are consistent between the various customer conversations?**

For regulatory purposes, recalling companies must inform direct customers of the recall in writing, but for customer relations reasons, companies generally prefer to contact customers by phone first.

- **How can both objectives be accomplished in the least amount of time?**

If you don't have time to call all of the affected customers before a public notice is released, how would you prioritize the calls?

Other questions include, who will track the customer responses and follow up with those who don't provide you with information that you'll need for the effectiveness checks? What information do you need to collect from customers for both insurance and regulatory purposes? How will you respond to customers who did not receive the recalled product, but who will request reassurance of this? What's the most time-efficient way to respond and who will be available to do this?

Communicating with consumers can be even more challenging than customer communications because there are many ways in which the general public can interact with the recalling company. For example, a consumer can engage in a conversation with a recalling company via the company's website "contact us" forms, social media platforms, and phone. The sheer volume of inquiries may warrant using a third-party call center and/or social media response center. But not all situations require additional help and not all companies can afford these centers, so prepare to handle consumer inquiries and then outsource these tasks, if necessary and feasible. If possible, assign someone to monitor and reply (with approved messages) to social media posts; another three or more to answer phones and one or two people to pull messages off the recorder; and finally, at least one person to reply to consumer email inquiries. Develop a feedback loop and identify a process for getting new or updated information to each per-

son interacting with consumers. Additionally, provide clear instructions on how they should process claims of illness, and what to do when they don't have the answer to a question.

Once you've identified the tasks and thought about the corresponding response processes, develop applicable tools or templates. For example, develop a template to track and compile customer responses. For tier-one customers, lay out a process for holding calls between your food safety and sales staff and your customer's buyer/purchasing agent and food safety staff. This will allow the recalling company to answer questions in a coordinate and consistent way, and minimize the number of one-off internal emails and phone calls, which will save a great deal of time. A call log helps track consumers' calls that need to be returned and any action items that require follow up. Marketing staff can anticipate consumer questions and make a list of the ones that will require input from food safety staff. And, of course, the most obvious templates—the recall notification letter to customers and the press release, which addresses consumers' concerns—are on the FDA website.

### Update Your Recall Plan

Finally, add these new internal procedures, tools, and templates to your recall plan. And, most importantly, practice these collaborative tasks during the company's annual recall exercise (a.k.a. mock recall).

Don't wait for FDA guidance to be finalized. It's already a law that companies under the PCHF rule must include in their written recall plan the responsible party and tasks necessary to: 1) contact consignees, 2) determine whether consignees have carried out recall instructions, and 3) inform consumers. An effective recall response requires that food safety personnel work closely with non-food safety colleagues. Take the time to identify and prepare for these interactions now, before they're needed. In doing so, your company's recall response will be more efficient and more effective, benefitting customers, consumers, and, ultimately, the company. ■

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# Quality



## Can Blockchain Fortify the Organic Food Supply Chain?

Blockchain can instantly trace organic goods throughout every level of the supply chain—all the way back to the farm

BY PRATIK SONI

As they browse the aisles of their local grocery stores, today's conscious shoppers aim to make healthier and more eco-friendly purchases. Many now favor the organic variety of their favorite food and beverages, and they are more than willing to pay a premium price. In fact, the U.S. organic food market has seen impressive

growth over the last several years, with sales reaching a record high of \$52.5 billion in 2018, according to the Organic Trade Association.

Organic labels can now be found in nearly every aisle—from fresh produce, eggs, milk, and poultry to juice, coffee beans, breakfast cereals, and snack foods. And a “USDA-certified 100-percent or-

ganic” label guarantees with 100-percent certainty that those fruits were grown without pesticides, those chickens were raised without antibiotics or growth hormones, and those snacks were made without artificial preservatives ... right?

Unfortunately, it's not that simple.

### An Easy Target for Food Fraud

The organic food market is prime target for fraud, particularly since these goods tend to fetch much higher prices than those that are “conventional.” In the United States, USDA enforces stringent standards for growing, processing, and handling organic foods; however, many goods labeled “100-percent organic” are imported—or contain imported ingredients—from countries around the world.

As of 2016, organic agricultural imports came into the United States from 87 different countries—with these shipments handled by countless farmers, production sites, distribution centers, logistics providers, and other middlemen along the way. Herein lies the problem: While every link in this global network of trade partners is required to provide organic certifications and keep related invoices, they each use their own software systems, spreadsheets, or paper records to track their supply chain data. This disconnect creates a convoluted chain of custody in which product origins are hazy. It's then nearly impossible to verify product provenance with absolute certainty.

In 2016, for example, 26 million pounds of soybeans treated with pesticides were transported via cargo ship from Ukraine to Turkey and, finally, to California. Certification documents were forged at some point in transit, and the conventional soybeans arrived at port falsely labeled as organic. Twenty-one million pounds were already distributed by the time the deception was caught. Many were sold to farmers of organic livestock—which must be fed organic feed—ultimately compromising the integrity of the organic food label.

To protect their products and processes, organic farmers, manufacturers, and retailers need a system that provides complete farm-to-fork traceability. This is exactly where distributed ledger technology (commonly known as blockchain) can help.



### Connecting the Global Supply Chain

Businesses can integrate distributed ledger technology into their supply chain management systems to create a permanent, digital ledger of all product movement. Essentially, blockchain is a connected, peer-to-peer ledger that supply chain stakeholders can use to record and track all data on transactions and exchanges in real time.

Blockchain digitizes each interaction by saving it in a series of cryptographic blocks (from which the technology gets its name). No single party can alter any records, and any change is visible to everyone in the network. The resulting ledger is tamperproof and immutable, providing complete product lifecycle history and minimizing opportunities for fraud.

Stakeholders no longer have to waste time and resources piecing together a complicated paper trail of documentation. Rather, they can instantly trace organic goods throughout every level of the supply chain—all the way back to the farm. This eliminates any doubt as to how products and ingredients labeled as “100-Percent USDA-Certified Organic” were grown, processed, or handled. Farmers can rest assured they are truly sowing organic seeds or feeding their livestock organic grains, food manufacturers can irrefutably prove the ingredients and processes they use meet organic standards, and retailers can feel confident they are offering quality organic products to shoppers.

### Trust in the Organic Market

That same supply chain data can also be used to build consumer confidence in the organic food market, where shoppers demand more information about the goods they buy. Organic food brands and retail-

ers can make all product lifecycle history available to the end consumer through simple tools.

An organic fruit juice brand, for instance, could include a QR code on its packaging. Customers could scan the code with their smartphone and instantly see everything that went into making that specific item: what fertilizer was used to grow the apples, what orchard they were picked from, and where and how they were processed. Similarly, an organic milk supplier could offer a lot number search on its website—consumers could type in the number on their carton, and buyers could see what dairy their milk came from and how those cows were raised.

With product history verifiable through blockchain, consumers wouldn’t have to take labels at face value. No matter their reason for buying organic—whether it be personal health, environmental responsibility, or animal welfare concerns—they’d feel truly informed and confident in their purchases.

### Traceability and Transparency for All

Using distributed ledger technology for the food and beverage supply chain is more than just a theoretical solution. But with major corporations such as Walmart, Starbucks, and Nestlé announcing blockchain pilot programs, it’s easy for small and midsize businesses to assume this technology isn’t within their budget.

However, distributed ledger software is now available through a Blockchain-as-a-Service (BaaS) delivery model. This means there is no expensive infrastructure to purchase or upgrade. BaaS platforms only require a device with an internet browser and easily integrate with other existing supply chain management

Businesses can integrate distributed ledger technology into their supply chain management systems to create a permanent, digital ledger of all product movement.

systems. These subscription-based, out-of-the-box solutions are ready to deploy with little implementation time or costs required.

Frozen treat brand Ruby Rockets’ work with blockchain is a great example of BaaS success. The company is committed using only organic or natural fruits and vegetables, with no added sweeteners or artificial food colorings in its nutritious snack foods. To support this commitment, Ruby Rockets needed to offer full transparency into the lifecycles of its products and ingredients. Tracking this information, however, was a time-consuming, complicated process of piecing together spreadsheets, paper records, and certificates of analysis.

Ruby Rockets implemented a BaaS solution, integrating the platform with its existing accounting system, purchase orders, inventory management system, and online shop. In fewer than 90 days, Ruby Rockets had a system to track products upstream and downstream. Now, the company can quickly trace ingredient origins and log processing information, ensuring product integrity and compliance with USDA standards. With BaaS, Ruby Rockets has truly delivered on its promise of creating natural, organic snacks for its customers and their families.

Backed by data on the distributed ledger, there is no doubt about the integrity of a “USDA-Certified 100-Percent Organic” label. As blockchain technology adoption rises among farmers, suppliers, and food manufacturers, the organic food supply chain will only strengthen, and that means healthier food and beverages for consumers today, and a sustainable future for tomorrow. ■

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## Organic Manufacturers: Know Your Supply Chain

Food manufacturers should have a robust supplier approval program to help ensure the organic compliance of ingredients

BY MARY BETH NIERENGARTEN

**R**ecent cases of massive organic fraud in the Midwest highlight a central tenet of organic manufacturing: Know your supply chain. In February 2020, a man in South Dakota was indicted for selling non-organic grain and seed products marketed as organic to buyers. This comes on the heels of the August 2019 sentencing of four farmers in federal court in Cedar Rapids, Iowa for a scheme in which non-organic grain was sold to livestock producers as certified organic grain.

These types of stories must send shivers down the backs of food manufacturers who strive to build trust with consumers by ensuring that foods they process and sell as organic are truly organic.

The best way to ensure that ingredients are organic, says Gwendolyn Wyard, vice president of regulatory and technical affairs for the Organic Trade Association (OTA), is for food manufacturers to know their supply chain. “There is nothing more important than developing relationships with your suppliers and getting to know them,” she says, adding that undertaking this extra work is critical to ensure that products labeled organic are indeed organic.

### Meeting Organic Certification

The basic threshold for ensuring that organic products are organic is to make sure all products are certified as organic. USDA mandates that farmers and han-

dlers follow strict production and labeling requirements to represent their products as organic and receive the USDA Organic Seal. One way to verify the authenticity of organic ingredients is for manufacturers to check organic claims of their suppliers by using USDA’s Organic Integrity Database.

Harriet Behar, an outreach specialist in the Organic and Sustainable Cropping System Program at the University of Wisconsin-Madison, who also sits on the Governing Council and Policy Committee of the Organic Farmers Association, a policy arm of the Rodale Institute, says that the database includes all operations certified by the USDA National Organic Program and allows manufacturers to look up farms and processors that handle specific ingredients or products and where to buy them. Open to the public, the large database includes organizations certified by all of the 80 different certifiers, she adds.

Wyard also refers to the database as a place manufacturers can go to verify that an operation is operating with a valid (in good standing) certificate. She says that all products certified as organic must be accompanied by a valid organic certificate along with additional supporting documents ensuring that the product received connects to the organic certificate. This includes ensuring that the product documentation meets the organic certification all along the supply chain, including storage and transportation of the product. “One of the beautiful things about the organic system is that, with a narrow exception that may be made for brokers and traders, everyone handling a product in the supply chain has to be certified,” she adds. “There is a chain of custody and traceability that can and should occur all the way through the supply chain, so that is very helpful.”

Ensuring organic throughout the supply chain includes not only making sure that the primary production and manufacturing of food meet organic requirements, but also that contamination prevention controls are put in place as the product moves from field to manufacturer to retailer. All of these factors need to meet the food safety regulations detailed in the Food Safety Modernization Act (FSMA). Jacob Guth, director of food safety for California Certified Organic Farmers (CCOF),

emphasizes that organic farmers need to be aware of various requirements when working to meet FSMA requirements.

Major hurdles for organic farmers in meeting these requirements, he says, include the paperwork and record keeping needed. “If it’s not written down, then it didn’t happen,” he says, adding that even though many operations may have practices in line with food safety and organic requirements, it may still be difficult for them to document the many policies, procedures, and practices needed to demonstrate compliance.

One solution, he says, is to set up record-keeping systems that are easy to fill out and tailored to the size and scope of the operation. “Many times, operations set ambitious record-keeping goals for themselves, only to find out it’s nearly impossible to keep up with those records,” he adds. “Operations that can combine logs or records to check many control points on one record have success ensuring their employees complete those records.”

To help organic growers with FSMA compliance, CCOF offers product safety alliance training, good agricultural practices webinars, and food safety certifications for farms and packinghouses. “While third-party certification is not required by FSMA, it’s often required by buyers and wholesalers, and the process of certification helps prepare an operation for FSMA compliance,” says Guth.

Overall, he recommends that manufacturers have a robust supplier approval program to help ensure that they can verify the organic and food safety compliance of the ingredients they buy. Behar also emphasizes the need for a good tracking system. “If you have a good tracking system in place, doing organic is not going to be difficult,” she says.

Both Guth and Behar add that once operations become certified organic, they have an easier time with food and safety requirements overall because of their established documentation and recording systems.

### Extra Work: Due Diligence

Despite a fairly rigorous certification process for meeting organic criteria all along the supply chain, gaps do exist.

One gap is an area of the supply chain that does not need to be certified organic.

“Any operation that sells a product that remains enclosed in a container and is not otherwise processed while in the control of the operation, such as brokers and traders, is not required to be certified organic,” says Wyard. Problems of fraud that can result are illustrated in the above-mentioned Midwest organic fraud cases in which

One of the beautiful things about the organic system is that, with a narrow exception that may be made for brokers and traders, everyone handling a product in the supply chain has to be certified. There is a chain of custody and traceability that can and should occur all the way through the supply chain.”

—GWENDOLYN WYARD,  
*Organic Trade Association*

middlemen profited by selling fake organic seed, as well as similar fraud uncovered in 2017 by the Cornucopia Institute of the largest importer of fake organic grain from the Black Sea region.

According to Behar, this loophole may soon be closed, pending approval and enactment of a piece of federal legislation by the USDA National Organic Program that would mandate certification of types of operations to become certified. Called the “Strengthening Enforcement Rule”, the new rule is currently under review by the Office of Inspector General.

Until then, Behar says that manufacturers who work with noncertified brokers can request from them source organic certification and verify that certification by contacting the organic source. When working with certified brokers, she says that manufacturers can “source more domestic products certified under the National Organic Program rather than working with foreign imported products that are more difficult to track.”

A further gap may be the be the difficulty of ensuring organic ingredients from

farms that are transitioning from conventional to organic farming. Per USDA regulations, farms transitioning to organic cannot sell products certified as organic for three years. During the transition, farmers must reestablish an ecosystem for organic plants that prohibits the use of herbicides and pesticides and are in compliance of all organic methods. This is a labor intensive and costly undertaking, says Wyard.

Although products from these transitioning farms only become certified organic after the three-year transition window, manufacturers may need to perform extra due diligence when partnering with a new organic farmer to ensure all processes are in place. Behar notes that, for most of these newly certified farmers, obtaining information such as an organic certificate from a USDA-approved certifier should be enough given that the requirements for organic certification are the same between newly certified and long-term certified farms. “If there are concerns, the certifier can be contacted to verify the information on the certificate,” she adds.

Wyard emphasizes that manufacturers need to go beyond just relying on the organic certificate to ensure products are organic. “Everyone has to do their due diligence to take on buyer responsibility and take extra steps and measures to know their supply chain,” she says, adding that the recent cases of fraud have shown that manufacturers can’t turn a blind eye and think everyone is trustworthy in the supply chain.

To help manufacturers avoid fraud or reduce their chances of buying from fraudulent players, the OTA has developed a program to help manufacturers identify areas of vulnerability. Based on a model adopted in food safety systems worldwide, the Organic Fraud Prevention Solutions Program is a voluntary program manufacturers can enroll in to help them put measures in place to prevent fraudulent acts and to ensure a robust supply chain. Billed as a quality assurance program (not a certification or verification program), the program provides a framework and formal processes for manufacturers to use for continuous improvement of internal programs aimed at achieving organic integrity throughout their supply chains. ■

Nierengarten is an award-winning freelance writer based in Minnesota.



Hair nets should be worn by all employees.

# Audit Trouble

Issues that companies regularly get dinged for during an audit, and how to resolve them

BY RICHARD F. STIER

**T**he more food plants you visit, the more you see problems that seem to be ubiquitous throughout the food processing industry. Some of these are basic good manufacturing practice (GMP) issues and others are food safety issues. Some of these issues are a function of management commitment (or lack thereof), whereas others may crop up due to a lapse of awareness. There are also a few issues that may not crop up on audit checklists but are issues that food processors often ignore and that really should be incorporated into audits—especially the ever-present checklist audits.

So, let's look at some problems that you can find in many food plants.

**Baseball caps.** People love baseball caps. They are worn everywhere: softball games, fishing trips, cutting the grass—you name it. However, the baseball cap that goes everywhere really has no place

in a food plant. Because they are worn so many places, they are not the cleanest things in the world. In addition, baseball caps simply do not cover and contain all the hair on your head. The objective of a hair restraint is to contain hair so it does not get loose and fall into food. There are food companies that allow line workers to wear ball caps but, if that is the case, part of the policy should be to ensure that they are clean and that they be worn in combination with a hairnet. This policy should be fully documented and, ideally, include a risk assessment that addresses the issue.

**Hair restraints.** Baseball caps are a great lead-in to hair restraints. Hair restraints include both hair nets and snoods or beard nets. They can also be expanded to include special cases; for example, if a food handler's arms look like the pelt of a bear, the company should be sure that the person wears a long sleeve shirt with

elastic at the wrists. Hair nets should be worn by all, and company policy should mandate that they cover hair and ears. All too frequently, line workers wear their hair nets above the ears and all the hair on the head is not fully contained within the net. It is also a good idea to mandate a specific type and color (preferably white) of hair net. Why? Many workers have dark hair and there are times when it is hard to tell if a person is even wearing the hair net, much less wearing it properly. Food plant operators must also establish policies for men who have beards and/or moustaches. There are plants that flat-out ban facial hair, but they are few and far between. Any man who has a moustache or beard must wear a snood. Companies should not try to establish policies that define the size of a moustache and whether a snood is required. If a male has a moustache, he must wear a snood. It is a good idea to post pictures that show how hair restraints should be worn. This should be included in a worker's orientation and as part of yearly refresher sessions.

**Retractable knives.** Knives are an essential tool in most food processing operations for opening boxes, bags, or other ingredient containers. The type of knife used needs to be established by the quality group. They should be one piece and be able to be cleaned and sanitized at the end of the day. This means no retractable razor knives. These knives cannot be properly sanitized, are prone to breakage, and could potentially contaminate product with the pieces of broken metal. Such knives also pose a potential allergen risk: Retractable knives are hollow. Open a bag of cheese powder and the powder may get into the works. That powder can contaminate another bag and, hence, another formulation later in the day.

**Mops and mop buckets.** Mops and mop buckets really have no place in food plants, especially a facility making ready-to-eat (RTE) foods. Why no mops? All too often processors do not set policies for how mops and mop buckets should be handled. The end result is a mop bucket full or partially filled with dirty water and a mop that is wet and dirty. Using these implements to "clean" is going to spread dirt not clean up. Look for alternatives to mops such as squeegees and, if mops must be used, be

sure that the mop and bucket are cleaned and sanitized each and every day.

#### **Cold water at handwash stations.**

Every company that has had an audit has probably observed the auditor go to a handwash sink, turn it on, and start to count. The auditor is checking to see whether the handwash sink has warm water. The expectation is that there will be warm water within five to 10 seconds. Warm water is not required in the regulations, but it is an expectation when it comes to audits. It also enhances the efficacy of handwashing. Warm water and soap clean more effectively than cold water does. In addition, it is more comfortable to wash hands in warm water as opposed to cold. If handwashing is uncomfortable due to cold water, there is a lower chance that hands will be washed properly.

**Inspection aisles.** All food processors have warehouses. They are used to store packaging materials, ingredients, finished goods, and many other things, some of which really have no place in food processing facilities. All warehouses should maintain inspection aisles of at least 18 inches between walls and stored materials. There are several reasons for this, one of which is in the section header: inspection. Failure to maintain these aisles means that rodent monitoring stations may be inaccessible or that spills may be inaccessible for cleaning. Spills can attract pests, which means that failure to maintain the aisles can contribute to an infestation.

**Sign-in sheets.** All food processors should have a program for signing in visitors and contractors. There are many reasons for this, but the paramount goal is to control access and know who is in your facility and with whom he or she is working. An integral element of the sign-in process should be to ensure that everyone coming

Part of managing a food plant is thinking outside the box and looking at anything that might potentially compromise product quality and safety.

into the facility understands what is required of them when in the plant. Therefore, the sign-in process should include a means to communicate to the visitor or contractor what is required from both GMP and work-safety standpoints. Most processors include a handout that clearly defines plant requirements, and most facilities will print these documents in more than one language, which is usually Spanish but may be another language depending upon the make-up of the workforce. The sign-in form should reflect an understanding of plant requirements by including a field that reads “I have read and understand the

GMPs/safety requirements.” There are also companies that mandate all visitors watch a video that describes the requirements. The sign-in sheet will be the first thing an auditor sees, so having a good sign-in procedure is a necessity.

#### **Flat surfaces in production areas.**

This is something that processors don’t think about very often, but it can be an area of concern. There are always desks or work stations that line workers use for testing or recordkeeping, but take a walk through any plant and look for flat surfaces in the plant or warehouse; You know what you will see all too often? Junk piled on the surfaces: jackets, hairnets, bump caps, and a wide range of other things, most of which do not belong there. If an auditor sees personal belongings that should have stayed in the locker room, he or she will probably write you up.

**Supplies at handwash stations.** We have already discussed the need for warm water at handwash stations and how auditors will check on that. Auditors will also ensure that all handwash stations are properly supplied. Is there soap? A means by which to dry hands? A trash bin? Hand sanitizer (if required)? Any other needs? The wise processor should assign someone to monitor all handwash stations to ensure they are properly supplied and document his or her checks, which should include a space for addressing deficiencies. Lack of supplies is one of those things that com-

*(Continued on p. 40)*

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panies do get cited for. This is one of those lack-of-attention issues.

**Jewelry.** A basic requirement for all food processing operations is that there be no jewelry in processing areas. Many processors allow workers to wear plain wedding bands but more and more operations now say that the worker with the wedding band must wear a glove over the ring. Rings are allowed for a number of reasons but one is fairly simple: The wearer cannot get the ring off. The person put the ring on when they married and weighed 150 pounds and now they are 220 pounds and the ring is a part of them. Now, it should be mentioned that there is one piece of jewelry that is allowed: an emergency bracelet or medalion. These should be covered by a long-sleeved shirt with an elastic wrist band or should be worn under the shirt. If these are allowed, this should be documented in the personal practices guidance. The point is that management must keep their work-force on their toes when it comes to jewelry. Inevitably, there are always one or two people wearing jewelry that they should not have on, so it is up to management to keep an eye on their people.

**Clueless CCP monitors.** One of the changes in how audits are conducted is that there is now an emphasis on interviewing line workers and warehousepersons. One of the favorite targets for these interviews is any person responsible for monitoring a critical control point (CCP). Auditors and regulators will ask these workers what they are doing, why they are doing it, and what they will do in the event of a process deviation. It is, therefore, imperative that food processors take the time to ensure that anyone monitoring a CCP or anyone who may monitor a CCP be properly educated to handle these questions. If a person who is responsible for monitoring a CCP cannot properly describe a task and its importance, that could be deemed a failure, as it is a potential food safety concern. Be sure that your people are properly trained, and practice answering questions with them.

**Processes not properly validated.** One of the primary mandates of the Preventive Controls for Human Food regulation found in 21 CFR Part 117 is the importance of properly validating all process preventive controls or our old critical control points. Fail to be able to demonstrate

that a process preventive control is not properly validated and it is likely that this could be deemed a critical failure and the end of the audit. So, make sure that your company takes the time and spends the necessary funds to ensure that everything is properly documented.

This is just a sampling—there are others. But, let's look at a couple of things that processors either ignore or simply don't follow through with during actual production operations.

**Metal detector checks.** One of the common failures of many food processors is how they manage and monitor their metal detectors. In most cases, if one reviews their procedures, everything may seem to be very well organized, but what is on paper and what is done in the plant often differ slightly. Metal detectors should be checked using known standards at the start of every production run, at set intervals during the run and at the end of each run. This should be done for every product; if there is a changeover during the day, it is imperative that there be a check conducted at the end and beginning of each product that is run. Processors occasionally do not test their standards at the beginning, middle, and end of each product run but only do the testing at the start and end of the day and neglect the product changeovers. Processors need to make sure that they do this and auditors need to confirm that the checks are done properly.

**Ladders.** It is the rare food processor that has an established policy regarding ladders, if there are any. In fact, very, very few have ever thought about establishing such a policy, but it is one that should be seriously considered. Think of how often a ladder is used and where these ladders are from. The maintenance crew has ladders for their projects, contractors may bring ladders on site for their projects. But, where have these ladders been and how have they been handled? Have they been properly cleaned and sanitized by the contractor? Probably not. How have your own maintenance people handled their ladders? The point is that all processors should seriously consider establishing a policy regarding ladders (and other materials that contractors may bring on site). One does not want a ladder or any other tool that is brought on site to pose a potential source of contamination, so it is

a imperative that a policy be established to ensure these instruments are properly cleaned and sanitized. In addition, the policy should also clearly define what tools may not be brought into the facility.

**Pallet management.** Pallet management is something that every food processor needs to do, but not every processor has developed, documented, and implemented such a policy. There are many reasons for establishing such a policy including—but not limited to—minimizing the potential for product contamination, ensuring that product that is manufactured and shipped is accepted by customers, minimizing the chance of pest problems, and enhancing operational efficiencies. Elements of the pallet management program should include inspection of all pallets when they are brought into the plant, repair or rejection of damaged pallets, where pallets should be stored and why and how pallets should be cleaned. In addition, the pallet management program should clearly define how pallets are inspected upon arrival at the plant and the grounds for acceptance or rejection. If product or ingredients arrive on damaged, infested or wet pallets, the program should state that they should be rejected. Many operations have such programs, so if your company uses poor quality pallets to ship finished goods, don't be surprised if they are rejected.

These are some of the many issues that auditors look for—or should look for—during audits. They are also elements that are often seen to be deficient during such audits. Food processors should be sure that they develop, document, implement, and maintain procedures for each of these elements and more.

An integral part of implementation is ensuring that every person involved with each of these elements is properly trained in the procedure and that the training is fully documented. Part of managing a food plant is thinking outside the box and looking at anything that might potentially compromise product quality and safety. Once that is done, the next step is to develop protocols to address any issues that pose a realistic risk. ■

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## How to Tackle Quality Problems Related to Mixing

Production mixing can be very different from your typical mixing experience | BY DAVID DICKEY

Everyone, especially those in the food industry, has experience with mixing. All of us have at least some experience in the kitchen, and many of us have extensive experience. Commercial process mixing can be very different from kitchen or laboratory mixing for several reasons. In the kitchen or development laboratory, quantities are small and distances are short. Almost any mixing occurs quickly, especially in comparison with production scale equipment and processes. In the kitchen or laboratory, mixing intensity usually can be increased or decreased to achieve good results. Small-scale results can be easy to observe even as the mixing takes place. Kitchen and laboratory mixers are usually designed to handle a wide variety of food properties.

Everything that seems simple in the kitchen or laboratory becomes more difficult at the production scale. Even when successful mixing is done and observed carefully in small-scale development,

scale-up to reproduce those results at a production scale can be difficult. Some knowledge of mixing and a little creativity can overcome many of the common problems.

The following discussion of mixing includes many of the common problems experienced in production mixing for foods. The discussion also provides ideas on how the problems can be solved, or at least improved. If the process results do not make products that meet your quality standards, something needs to be investigated and changed.

### Obstacles to Improvement

One of the biggest obstacles to improving mixing is the requirement to use existing equipment, as opposed to buying new equipment. This limitation becomes an even bigger challenge when the equipment is more than 25 years old, which is common, or when used equipment is purchased. Old equipment, even if it has been well maintained, may not match the

current product or process requirements. Used equipment is probably chosen because of price or availability rather than needed performance.

The upside to these equipment problems is that many facilities have a variety of mixing equipment with different sizes, mixers, and heating capabilities. The first step in solving these practical limitations is understanding the capabilities of each piece of mixing equipment. Total tank volume is important but knowing the minimum and maximum practical operating volumes is more important. Trying to mix a batch that is too small for a mixer can be as bad as mixing a batch that is too large. Mixing intensity is usually inversely related to batch size. The same mixer used in a small batch should provide more intense and rapid mixing than in a large batch, even if the mixer does not have a variable speed capability. Batch size will also affect the mixer's influence on surface motion.

Good surface motion may be an advantage for ingredient addition. However, a deep surface vortex becomes a problem if it draws air into the product, especially if the product tends to foam. Antifoam may solve some problems, but not all of them. A surface vortex should never extend more than halfway from the surface to the mixing impeller. Vortex depth is strongly influenced by the depth of the liquid over the impeller nearest the surface. If all these ideas seem obvious, unfortunately they are often overlooked or not communicated to the people who need to know.

Solving problems or making improvements in existing equipment requires a little creativity. For example:

- **Changing the order of addition can improve mixing or reduce batch time.** Ingredient additions to a batch with a changing viscosity will be easier if the additions are made when the viscosity is low. Two liquids with different viscosities can take a long time to blend, even if they are mutually soluble, like corn syrup and water. If the more viscous liquid is added to the less viscous liquid, the operation should be easier and faster than adding the low viscosity liquid to the high viscosity one.
- **Adding minor ingredients to a batch can be similar to combining dif-**

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**ferent viscosities.** To be sure that minor ingredients, such as nutrients, stabilizers, flavorings, emulsifiers, and preservatives, are well mixed, they should be added to low viscosity liquids whenever possible. In some cases, pH adjustments are necessary to cause a viscosity change. Reactive ingredients may be adversely affected when an acid is added for any reason.

- **Similar suggestions apply to mixing batches of bulk powders.** Free-flowing powders are the bulk solids equivalent to low-viscosity liquids. Ingredients should be added while the blender is running, and the powder is free flowing. Once ingredients such as water, oils or moist ingredients are added, powders are likely to become more cohesive and difficult to blend. Very minor ingredients, less than half of a percent of the formula, should be pre-blended in a portion of a major free-flowing ingredient.

- **Another solution to some mixing problems is to change to different forms or concentrations of problem ingredients.** Different particle sizes or granulations may make powder addition to liquids easier. These steps may solve initial production problems but may create operational problems if the changes are not controlled during ongoing production. Sometimes an ingredient change happens unintentionally, such as when going from product development to production. Other problems may not appear until after the product has been in production for a period of time. Consistent results almost always depend on consistent ingredients, equipment, and procedures. A process needs to be sufficiently robust to avoid process problems caused by minor ingredient changes.

- **In any mixing application, an optimal mixing time probably exists.** Too little mixing time may not yield uniform results. A mixing time that is longer than essential may be more than just a waste of time; overmixing may cause product degradation. During initial production runs, you should carefully observe and probably sample to get an idea of how long a batch needs to mix to get a quality result.

- **The time required for batch uniformity in similar equipment should be inversely proportional to the rotational speed of the mixer.** Large batches often take longer to mix than small ones just be-

cause the mixer rotates at a slower speed. Similar uniformity is often achieved after a certain number of mixer rotations, not the mixing time. For those cooks familiar with old cookbooks, some recipes called for a certain “number of stirring strokes” for proper mixing, which is similar to the number of mixer rotations. The rotational speed of a mixer should be known and not subject to the whims of the operator.

Mixing is a chaotic process; the chaotic flow patterns are the fluid motion effects that cause mixing to take place, but that chaos should not have a significant effect on process inconsistencies.

### From Product Development to Production

Many process problems develop in the transition from product development to commercial production. Scale-up is not a single procedure that always works. Successful scale-up will depend on different methods for different products. Some knowledge and observation of a specific formulation can make scale-up from the development lab to production more reliable.

The ingredient formulation is rarely the only factor in the production of a failed or successful product. Food has many subtle characteristics that define the success of the product, even if the “product” is an intermediate ingredient on the way to a consumer product. The start for successful scale-up begins in the development lab. The new or modified formulation must first meet basic customer requirements. Then, the combination of the ingredients must establish the expected quality standards. Scale-up to production must also provide important or unique information about the ingredients and process. Those observations made during development or known to the developer need to be communicated to production.

One of the best pieces of scale-up advice is: Make your mistakes on the small

scale and your money on the large scale. This means that not all formulation or preparation problems in the development lab are real failures. Some “failures” may be useful learning experiences that should be noted and understood. Successful scale-up may be just a matter of avoiding the causes of failures. Observing the effects of undermixing or overmixing also may help plan for conditions to be avoided in production.

Not all production problems are mixing problems. Ingredient addition, transfer pumping, final screening, and heat transfer can all contribute to production problems. Knowing a few reasons for scale limitations can be important. Processes associated with area will cause more problems after scale-up, because area does not increase at the same rate as volume. For the scientists, area increases as length squared and volume as length cubed. For the practical minded, this means that if volume increases by a factor of eight, the area only increases by a factor of four. This surface area effect means that the addition rate for ingredients in the large scale should be proportionately slower than in small-scale development. The rate of addition should be in proportion to the increased surface area, not the formula weights, which increase as a function of the volume. Heating for cooking also takes longer in production, not just because of a larger volume, but also because the heat transfer surface area is less in proportion to the volume.

### Viscosity

Viscosity is always an important factor in mixing. Simply described, viscosity is the resistance to flow of a liquid or what appears to be the thickness of a fluid. The real problem in food is that viscosity is almost never represented by a single value, other than possibly for low-viscosity water-like liquids. Low-viscosity liquids usually are easy to mix and less likely to cause problems. Many factors affect the observed viscosity of a fluid. Understanding some of the factors affecting viscosity can be a useful tool in understanding food quality and production. Temperature is an obvious factor, both with respect to viscosity and quality. Higher temperatures almost always result in lower viscosities, which makes higher temperature liquids flow



Special mixers may be needed to handle unusual viscosities.

more easily. Easier flow may be good or bad, depending on the desired performance of a product.

What makes viscosity difficult to understand are the factors that affect it other than temperature. After temperature, the most common effect on viscosity is caused by shear rate. Shear rate depends on the relative motion internal to a liquid. Equipment such as mixers and pumps create shear gradients in a fluid because some mechanical parts of the equipment are moving, while others are not. This difference in velocities is what causes shear rates in a liquid. The effects that shear rates have on viscosity depend on the physical and chemical properties of the liquid. Some fluids are shear thinning, which means that the viscosity is reduced when the fluid is in motion. This effect will also be observed when the viscosity is measured. A lower viscosity may be observed if the measurement is made with an instrument that turns faster or causes the liquid to move quickly.

Shear thinning behavior also may be time dependent. That means that the longer a food is sheared, the lower the apparent viscosity becomes. The reduced viscosity may be only temporary and return to the unsheared condition after the fluid stops moving. In other cases, shear may cause a permanent breakdown of the original viscosity. The performance effects of shear on viscosity may be observed in food behavior as coating ability or mouth feel. Shear effects occur most often in fluids with droplets or particles dispersed in them. Some concentrated multiphase fluids, such as starch solutions, may exhibit

shear thickening behavior, where the apparent viscosity increases as the fluid flows.

Another viscosity effect observed and even desired in some food products is yield stress. Yield stress causes a fluid to behave like a semi solid until a minimum amount of force is applied. Common examples of yield stress fluids are ketchup and mayonnaise. Once the initial resistance to

flow is overcome, e.g., a hit on the bottom of the ketchup bottle, the food flows as a viscous liquid, e.g., as when the ketchup splashes on your shirt. Another viscosity property important in foods is viscoelasticity, as in bread dough, taffy, and gels.

When fluid viscosity is affected by shear rate, mixing becomes more difficult than when shear rate is not a factor. Understanding, measuring, and observing viscosity is necessary for the success of both processes and products.

### Inconsistency

Perhaps the most common problem with mixing that affects food quality and production is inconsistency. Mixing is a chaotic process; the chaotic flow patterns are the fluid motion effects that cause mixing to take place, but that chaos should not have a significant effect on process inconsistencies, unless something is done to cause problems. If ingredient additions land in a location with insufficient surface motion, such as near the tank wall, inconsistent mixing results may occur. One way of overcoming ingredient addition in a poor location is to use a funnel or chute to direct where the ingredient addition lands. A funnel may even be used to control the rate of addition for ingredients. Control of ingredient addition can overcome some inconsistency problems caused by different equipment, different operators, and different procedures.

The best way to get control of inconsistency is through process documentation. Documentation needs to be more than just records for quality control. Quality control typically checks incoming ingredients and

finished products. The missing information may be in what happens between the ingredients and the products. Most operations pay attention to the measurement of ingredient quantities and sometimes the order of addition, but process records should also track which equipment was used, who operated the equipment, and how long each step took.

Record keeping needs to follow the production process. Procedures for combining ingredients need to be defined and followed in production. Product development information may influence the choice of production equipment and scheduling. Once production begins, the planned steps need to be followed. Any necessary or incidental deviations should be recorded. At the end of the process, some measure of quality should verify whether or not the desired properties were achieved. If quality problems are observed, the records of the actual process may provide insights into possible causes. Elimination of batch-to-batch differences must be achieved for continued product success. The usual packaging and shipment samples with batch records will provide traceability and identification. If that information is linked to the production procedures, many problems can be identified and corrected for future production.

If problems develop, the missing information may not be just in the written records of what was done or not done during mixing. Today's technology provides powerful and available tools to make better observations. Extremely effective ways to observe vague or transient problems are to take photos and make videos. A photo of the liquid level at each stage of batch loading, especially in different mixing equipment, may reveal reasons for the success or failure of mixing.

A 30-second video of a liquid surface or powder batch during mixing can provide information about both properties and processing. Process viscosity or bulk powder behavior can be difficult to sample and measure with instrumentation. Even the desired quality standards may fail to capture the process conditions. For example, quality control may be done at a standard or final temperature, while the actual conditions in the process equipment may be different. Sometimes a photo or short

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# In The Lab

## Mass Spectrometry for Foodomics

A practical application of proteomics and marker peptidomics to detect and screen for food allergens

BY KATHERINE C. HYLAND, PHD

It has been a few decades since the first “-omics” terms for various analyses were coined. Genomics sought to map and characterize the genes and genetic makeup of an organism; proteomics described the analysis and investigation of the protein profile, or proteome, of an organism. And in the years since, the “omics” suffix has served as a convenient way to describe all the potential profiling, mapping, qualitative and quantitative analyses, etc., that could be explored for a given biochemical compound class.

Foodomics, then, which might be the latest in this long line of “-omics” disciplines, is when food products are studied for safety, nutrition, and authenticity through the application of those same “-omics” workflows and technologies. And, among the techniques that might be employed, mass spectrometry is considered crucial to the work and applications of this growing field.

Applications of foodomics could potentially incorporate genomic, proteomic, and/or metabolomic analyses of any of an

infinite variety of food products for compound or ingredient profiling, fraud detection/authenticity, or biomarker research such as those used for allergens screening or crop modification. The vast and complex global food market today presents a wide world of potential as research for food supply, production, international distribution, and nutrition reach unprecedented consumer interest and demand. Foodomics represents a field that is rooted in established analytical practices developed from related disciplines while also being on the cutting edge of analytical needs and demands of academic researchers and industry alike. Keeping up with the challenges that these diverse applications present demands the development of advanced, powerful, and highly versatile analytical strategies.

One high-demand application for foodomics is the identification of and screening for markers of common allergens in a food commodity. Allergenic foods such as nuts, eggs, milk, and soy, can be very dangerous for sensitive individuals to

consume. There is no cure for food allergies, so sufferers must rely on food safety guarantees and correct labelling to avoid consuming allergens. Common triggers are peanuts, tree nuts (such as almonds, walnuts, cashews, hazelnuts, pecans, pistachios, Brazil nuts, pine nuts, and chestnuts), shellfish, egg whites, and in children, milk. As such, a reliable method that can screen for the marker constituents of these has enormous implications for food safety and the global food market.

SCIEX has established methodologies that enable the simultaneous analysis of multiple allergens in food products, using high-resolution quadrupole time-of-flight (QTOF) technology to identify the marker peptides for the allergenic commodities, and then a subsequently developed triple quadrupole mass spectrometry (LC-MS/MS) method for routine screening of foods for the allergens. This routine analysis might be employed to ensure that foods processed in the same facilities have not become cross-contaminated.

This importance has spurred the development of foodomics techniques aimed narrowly at the identification and detection of allergenic materials. Advanced chromatography and spectrometry technologies are now routinely employed to perform proteomic and metabolomic analyses of foodstuffs. Diverse foods, ingredients, and manufacturing methods present analytical challenges for the laboratories tasked with testing finished food products. A rapid method that can confidently confirm and identify a panel of allergens would be invaluable for the testing and screening of food.

Despite the current industry standard of using immunoassays and polymerase chain reaction (PCR) techniques in aller-

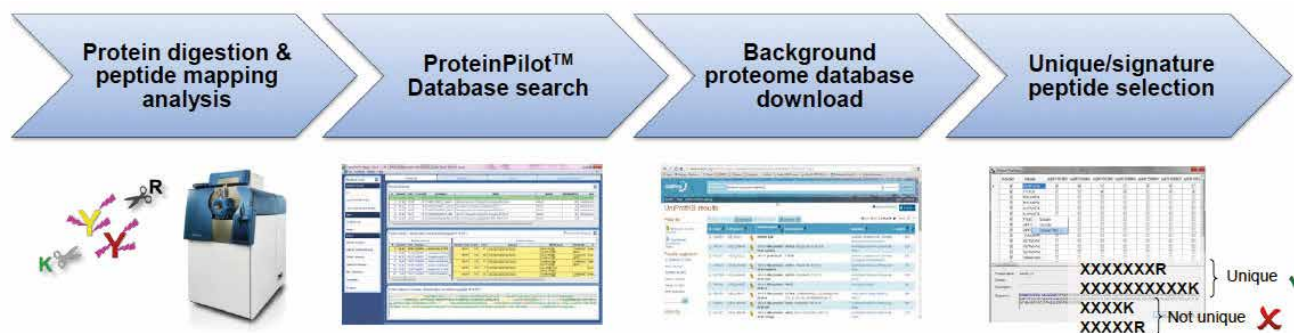
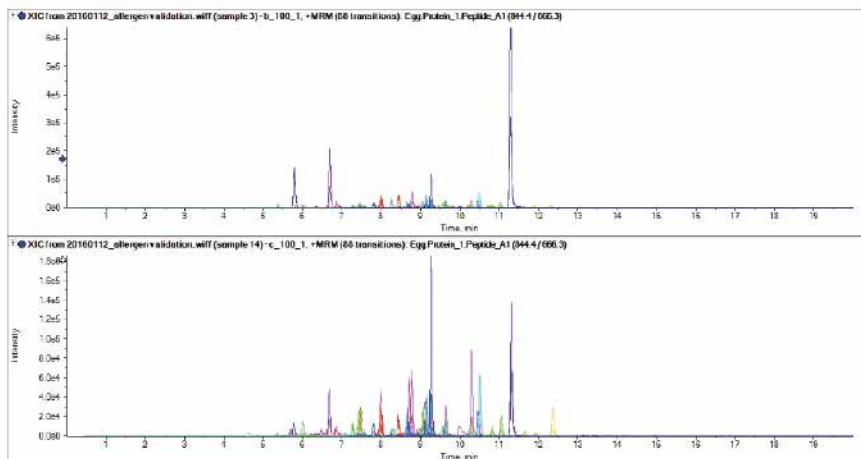


Figure 1: Peptide-selection workflow using the LC-MS/MS and database-searching software.

CREDIT: COURTESY SCIEX

gen screening, the rapid advancements of liquid chromatography mass spectrometry (LC-MS) technology mean that we are seeing a shift towards LC-MS/MS methods. While immunoassays, particularly enzyme-linked immunosorbent assay (ELISA), are rapid, sensitive, and easy to use, they are susceptible to cross-reacting with components of the sample matrix, leading to false positive results. False negative results can also occur, especially when the marker protein(s) being detected undergo denaturing or modification due to heat or other food processing. ELISAs are also unable to detect more than one type of allergen protein at a time in each sample. However, PCR can be multiplexed, meaning that more than one marker for allergens can be detected in a single reaction in single samples. The only drawback is that PCR detects only DNA and as such, cannot be used to directly screen for proteins. Moreover, DNA can be destroyed by thermal or food processing, and as such can result in false negatives in tests using PCR methods.

The accurate, sensitive and rapid detection and quantitation of large and complex molecules, such as proteins, can be performed using LC-MS techniques. Not only can the target protein be detected, but the digested peptide fragments of the marker protein can also be detected through the utilization of their distinct molecular masses. LC-MS/MS also has the greatest potential for future improvements due to its reliability, sensitivity, and speci-



**Figure 2:** Extracted-ion chromatograms (XIC) from LC-MS/MS analysis of bread (top) and cookie (bottom) homogenates fortified with egg, milk, peanut, soy, and nut proteins at 100 ppm. Multiple peaks corresponding to allergenic tryptic peptides are displayed.

dren with food allergies react. These were egg whites, milk, peanuts, soy, almonds, Brazil nuts, cashews, hazelnuts, pecans, pine nuts, pistachios, and walnuts. A targeted multiple-reaction monitoring (MRM) method using the SCIEX QTRAP 4500 system was then optimized to successfully screen for the mapped marker peptides of the 12 types of allergen in samples of bread and cookies. The bread and cookies were prepared with the allergen commodities incorporated before baking, to mimic typical manufacturing conditions more closely than spiked food matrices. Further, 16 commercial bakery products were analyzed to verify the applicability of the screen to the 12 allergen commodities mapped. To en-

titation method demonstrated excellent sensitivity with a quantitative limit of three parts per million (ppm) in whole egg, and 10 ppm in the milk, peanut, and hazelnut samples. There was also good recovery at 60 to 119 percent, and repeatability with an RSD of less than 20%. The analytical range was 10 to 1000 ppm for each allergen commodity.

As such, this detection and quantification methodology meets the performance criteria defined by the AOAC International Standard Method Performance Requirement (SMPR) for the detection and quantitation of selected food allergens. The developed method was therefore assessed

*(Continued on p. 57)*

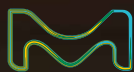
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# Testing

MEAT & POULTRY



## Put Food Safety Analytics into Action

Four best practices for strategic meat and poultry testing

BY CHRISTINE ALVARADO, PHD

**P**roduct inspections, swab sampling, HACCP validations, shelf-life tests, hygiene audits, and more—there is no shortage of testing within meat and poultry production systems. Regulatory and customer audits demand accurate and complete testing on a multitude of parameters, all designed to help the industry meet consumer expectations and comply with regulatory standards for food safety.

With all this testing, managing and analyzing the resulting data can be a full-time job. One of the last things a plant

manager wants to think about is gathering more data; but using testing analytics more strategically can lead to better management of food safety, product quality, and overall operations, paying dividends in regulatory compliance, customer satisfaction, and consumer trust.

Here are four best practices that can help you make better use of food safety data.

### 1. Understand the Why

When it comes to food safety validation, it's important to understand what data

you need and why you need to collect it. By setting data collection goals, you can ensure your testing generates the most relevant data, leading to better food safety intervention decisions.

Start by defining three to five questions you need to answer to improve food safety. Often, these questions align with the food safety concerns that may keep you up at night. Getting a handle on these questions can help you collect the data needed to address those concerns.

For example, you might ask: "How can we reduce total pathogen loads so antimicrobials can do a better job of meeting food safety performance standards?"

Gathering pathogen data at each step from preharvest to postharvest can help identify the points where pathogen loads spike and interventions could be added or improved. You may want to start by measuring the types and levels of pathogens that are present on animals entering your establishment. Animal-borne pathogen data may be helpful information as you assess needs for preharvest interventions to bolster your plant's multi-hurdle food safety solutions.

### 2. Fine-Tune Your Record Keeping

Data overload is a pitfall of any testing system. The meat and poultry industry as a whole collects millions of data points each year to meet HACCP or other audit requirements and to evaluate effectiveness of food safety interventions.

Once collected, it's important to keep data organized so that it can be useful in analyses and decision making. Even more important, data must be quickly accessible in case of a potential recall or food-borne disease outbreak. As food safety recalls have evolved over the past few years, accurate data and record keeping may mean the difference between a short-term, localized issue and a nationwide recall involving millions of pounds of product.

Keeping data organized and analyzing it effectively are two of the biggest challenges the industry faces every day, week, and year. Most operations can improve the way they input and store data to more easily observe or evaluate trends.

Some companies create their own customized internal record-keeping systems or purchase online systems. The best record management system is one that

meets your needs. Most often, simpler is better.

Establishing data spreadsheets across complexes within a company is also important to allow observation of trends across different geographic locations as well as different management styles. Having uniform data collection and record keeping among complexes is critical for future trend and metadata analysis.

Once data has been organized in an online record-keeping system, analysis and interpretation become important. When keeping and analyzing records, metadata can be just as important as outcome measurement. This is where trend analysis and decision making can occur. Metadata analysis can be difficult but very important, especially when determining current trends and future predictive modeling.

Although metadata collection may seem contradictory to the idea of simple record keeping, it's important to gather all relevant information that could potentially influence test results and the outcome of food safety interventions. For example, when determining the effectiveness of various antimicrobials within a company, it is important to collect biomapping data across all processes and operations. Once collected, trends can be determined within each processing operation and across the entire company to determine the effectiveness of interventions to reduce pathogens. Based on trends data, you can make informed decisions to foster improved food safety.

### 3. Keep Your Eye on Trends

With such an abundance of food safety data, managers often become hyper-focused on specific parameters and miss important trends. Look beyond daily data to identify trends based on location, season, and production cycle. Understanding trends revealed by data can separate meaningful information from “noise” in order to determine the most effective interventions.

It is critical to note any changes in system approaches when analyzing trends. For example, a revision in sample collection procedure or a simple change in process equipment can affect food safety data. These updates should be noted to allow for easier trend identification. The answer to

“what changed” is easier to find with good record keeping and notes from processing employees, providing important information for future food safety decisions.

Therefore, when monitoring trends, it's important for the plant manager to maintain a time log of changes in the system. To make accurate decisions based on data, consider any changes in laboratory methods, chemical use, or any other variables that may affect test results. Be sure you are identifying true trends in addition to simple changes in process. Realize that even the smallest of changes—even changes that are not specific to your food safety processes—can impact food safety interventions.

A history of your operation provides another clue to identifying trends within your data. Building a history of your operation takes time; however, knowing how weather and other seasonality factors affect production demands and food safety concerns will allow you to analyze data more effectively based on time of year. It is never too early or too late to start collecting data and building a food safety history.

Predictive analysis and predictive modeling are emerging as helpful tools to predict food safety outcomes based on statistics. These tools use machine learning to provide insights into patterns that may not be immediately apparent through simple statistical process control (SPC) data analyses. Most data analysis has always relied on standard and simple SPC; however, with increasingly complex food safety systems and the proliferation of data, the typical box statistics are no longer able to provide in-depth trend analysis.

Those wanting more predictive modeling and analysis over their entire food safety systems may want to consider contracting with third-party trained statisticians for complex analyses. Prior to enlisting these third-party statisticians, it is important to ask questions regarding the use of the data and the safety of the data control. Third-party statisticians for metadata analysis can be useful for handling complex systems and helping to answer complicated food safety questions and meet objectives.

Whether using SPC or a third-party statistician, be sure to step back and take your own experiences and knowledge of

your operation into consideration as well. Combining your expertise with predictive analytics tools can help you understand and manage data trends that lead to better decision making.

### 4. Don't Forget Quality Considerations

It's important to understand how food safety interventions may affect product quality. In addition to pathogen testing, measurements of color, shelf life, and other food quality parameters can reveal your products' overall acceptability in the marketplace.

For example, a food safety intervention may affect your product's water-holding capacity. Without conducting product quality testing, you may be unaware of negative effects on yield and the consumer's eating experiences.

Food safety is a basic expectation from consumers, but quality also matters, both for initial and repeat purchases. Quality is directly tied with product branding and drives consumer purchasing decisions. If a food safety intervention affects product appearance or taste, sales may suffer accordingly. In addition, even a small decrease in yield from a food safety intervention can result in millions of dollars lost per year.

Data collection, record keeping, and analyses can be overwhelming tasks. To ease the burden and achieve effective food safety systems, it is important to define the goals for data collection, develop systems to collect data relevant to these goals and objectives, and then determine the proper process for analysis to answer the questions. Analyses may be completed in-house if the questions are relatively simple and straightforward. More complicated situations may require a third-party statistician trained in statistical methods to help answer relevant food safety questions and model data for predictive analysis.

When done correctly, data analyses and modeling are effective tools to improve food safety. The data and the answers are in your hands. Using information properly can provide the insights and interventions to help you sleep better at night. ■

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## Modern Meat and Poultry Pathogen Testing

Well-designed environmental monitoring programs and modern pathogen detection technologies can help ensure food safety

BY RAJ RAJAGOPAL

**F**ood safety is top of mind for today's food processors and consumers, and processors of meat and poultry products need to make sure their food contains as few unwanted microorganisms as possible. Animals are rife with microbial organisms, including some very significant human pathogens—most notably *Salmonella*, *Campylobacter*, and pathogenic *E. coli*.

According to CDC, 1.4 million cases of foodborne illness and more than 450 deaths are attributed to *Salmonella* infections in the U.S. annually. *Campylobacteriosis* is the second-most frequently reported cause of foodborne illness, and *Campylobacter jejuni* is the most common strain that causes illness. CDC estimates 1.3 million campylobacteriosis illnesses each year in the U.S. When it comes to *E.*

*coli*, while most strains are harmless to humans, Shiga toxin-producing *E. coli* (STEC) can cause severe illness. CDC estimates that 265,000 infections occur each year in the United States and, due to its ease of infection and high mortality rate, STEC is among the most feared foodborne pathogens, by processors and consumers alike.

As we increase our understanding of how pathogen contamination occurs, regulations evolve as well. For example, USDA Food Safety and Inspection Service (FSIS) implemented a revised *Salmonella* and *Campylobacter* testing program in 2016 while also replacing its *Salmonella*-specific sampling set approach with a routine sampling approach for all USDA FSIS-regulated products that are subject to verification testing. *Salmonella* and *Campylobacter* performance standard verification

samples are now taken as part of a “moving window” sampling approach, and the results are used to determine if an establishment is meeting the performance standard on a continuous basis.

More recently, CDC announced new goals as a part of its Healthy People 2020 initiative to drastically reduce the number of foodborne illnesses caused by some of these pathogens by more than 50,000 cases—a goal that will require cooperation and reduction efforts from both consumers and processors.

Consumer advocacy groups also expect processors to shoulder a greater responsibility from a foodborne illness prevention perspective. In January 2020, a law firm filed a petition with USDA to completely ban more than two dozen strains of *Salmonella* entirely from meat and poultry samples; unlike STEC, *Salmonella* is not currently considered an adulterant. Government agencies around the world are taking similar steps to reduce pathogen contamination; however, increased regulations place a greater demand on food processors to limit pathogen exposure and contamination as much as possible, lest they suffer a costly recall.

Most foodborne illnesses caused by meat and poultry products occur when consumers ingest these pathogens on improperly handled or cooked product. Many of the most dangerous pathogens live in specific parts of the animal or originate in the farms on which they were raised, but, during slaughter operations, contamination from the farm can spread to processing facilities through bacteria on the skin and intestine. Proper sanitary operations and the use of systemic antimicrobial interventions are necessary to minimize the contamination occurring during slaughter and further processing, if the carcasses are fabricated into parts and comminuted (e.g., ground or mechanically separated non-ready to eat) products.

However, processors can go beyond basic intervention steps to ensure that products delivered to consumers are as safe as possible. Two of the best ways to do this are well-designed environmental monitoring programs and utilization of modern pathogen detection technologies.



### Innovations in Testing Methods

Testing for pathogens in meat and poultry products can be especially arduous due to the complex nature of the matrices. Detection is often assessed at the primary production level—in broiler carcass and/or in parts rinses and in raw meat. Competitive microflora in all of these types of samples can impact the growth of *Salmonella* required for detection in most culture-based methods. In addition, confirmation procedures become complex when associated microflora are also recovered in most selective agars. Therefore, traditional agar methods can struggle to rapidly and accurately assess the presence of *Salmonella* and *Campylobacter* in poultry products.

Through the early 2000s, DNA-based methods commonly utilized polymerase chain reaction (PCR) to help amplify samples. PCR methods typically require multiple steps to process enriched food samples and amplify target DNA for detection of pathogens. More recently, new molecular tests have been developed with loop-me-

diated isothermal amplification (LAMP) technology to simplify and quicken the testing process.

Whereas PCR methods typically rely on two primers to copy and amplify a sample's DNA and then read the strands, LAMP methods use between four and six primers which, in addition to displacing the target DNA strand, also loop the ends of the strands together before the amplification process. This looping structure accelerates the reaction and increases the sensitivity of the test, allowing for a much, much larger accumulation of the target DNA.

LAMP technology also allows for minimal transfer steps instead of the multistep process used in PCR methods. Fewer steps allows labs to process more samples in less time, allowing for a reduction in cost, time, energy, and manpower.

The advent of molecular pathogen testing methods has also allowed technicians to become much more specific and accurate in their testing. For example, many processors are testing for specific serotypes of concern.

### Pathogen Environmental Monitoring Programs

Pathogen testing of finished products, while crucial, should be viewed as only one part of a comprehensive pathogen prevention plan. The implementation of these technologies as part of a well thought-out, well-executed pathogen monitoring program is necessary for processors to prevent contamination with pathogens in ingredients and during processing operations.

Pathogen environmental monitoring (PEM) programs are often considered to represent a proactive approach to microbial food safety. These programs can identify challenges and pathogen sources within the manufacturing environment before they lead to contamination of finished food products.

PEM programs are typically used to validate and verify the suitability and effectiveness of food safety systems and to provide early indication of potential food safety hazards. The validation of sanitation procedures and other control strate-

*(Continued on p. 50)*

# [kam-pi-lō-'bak-tər]

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gies typically requires the use of multiple environmental monitoring approaches, including ATP testing, to validate cleaning and total plate count (TPC) methods to validate sanitation.

Often, use of these tests is supplemented with pathogen testing to identify specific harborage sites that allow for pathogen growth or survival. The process used to identify specific harborage sites or niches (e.g., as part of validation or similar type efforts) is often referred to as the “seek and destroy” technique. In addition to validation and verification, testing of environmental samples for pathogens is used to support root-cause analysis efforts and to verify that corrective actions taken are effective in addressing specific pathogen-related problems. These activities may be part of “for-cause” and “not-for-cause” investigations.

These tests are much less effective when done in isolation rather than as a

comprehensive, custom PEM program tailored to a producer’s specific products and specific facility, which is designed to ensure that no likely harborage site stays untested. But, the specifics of how the plan is executed are just as important as the plan itself.

Small details from the amount of pressure applied to a sponge and the specific locations tested (e.g., a floor crack vs. an adjacent uncracked floor section) can have a huge impact on whether pathogens are detected. Hence, it is important to design the sampling plan to avoid intentionally or unintentionally providing incentives for the sample collectors to not collect samples that would likely yield pathogen positives. For example, setting numeric targets or key performance indicators for the percentage of positive PEM samples may simply lead to sample collectors not collecting samples that will likely yield positives. The goal of a PEM program is

to find and eliminate pathogen contamination in the processing environment, and this goal cannot be compromised.

Technology also plays a large role in pathogen detection. Whether a producer is testing samples as a part of a PEM program or testing finished product or ingredient samples, a test is only as useful as the technology instrument allows.

The entire food industry is striving to meet the highest safety standards, and meat and poultry processors are no exception. The best course of action is to adopt a total solution from sample collection and preparation to monitoring and detection. Whether it’s *Salmonella*, *Campylobacter*, *E. coli* or another pathogen, processors can utilize advancements in technology to mitigate risk at every step while improving operational efficiencies and productivity. ■

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# Manufacturing & Distribution



## Making the Move to ELD-Compliant Devices

The second phase of ELD implementation means critical decisions for food manufacturers with transportation fleets

BY JIM GRIFFIN

**T**he two-year grace period allowing automatic on-board recording devices (AOBRDs) in place of electronic logging device (ELD)-compliant devices for electronically tracking hours of service in commercial trucking fleets expired in December 2019. This means that food manufacturers with distribution fleets that did not upgrade to ELD-compliant devices but were operating

under the AOBRD extension should have already made a commitment to an ELD provider and service.

Additionally, food manufacturers and distributors that were operating under the AOBRD extension for the last two years are now faced with the same decisions that fleets had to make when the ELD mandate was initially put into place: Who do I select as my provider? It is now

even more important that companies not make hasty decisions that can set them back with regard to data and technology.

The ELD conversation for food manufacturers and their distributors is larger than just an hours-of-service (HOS) determination, especially for time-sensitive and temperature-sensitive operations due to the passing of the Food Safety Modernization Act (FSMA). ELDs are also part of a broader discussion about telematics and on-board computers and the use of telematics to optimize data that comes from the truck, as well as the use of that data for overall fleet compliance, analytics and operations.

ELDs can be a different technology than an AOBRD. ELDs are not required to capture all the operating data that your AOBRD may have been capturing. ELD data requirements are focused and governed based on the HOS rules; what this means is that the food manufacturers and their distributors need to be careful in their selection to ensure they do not focus only on ELD compliance. Food manufacturing and fleet executives need to also determine what data they need to continue to manage their food distribution fleet efficiently and in compliance with FSMA. For example, they may select a compliant ELD but may lose important operational data, including load data, maintenance data, and fuel data, used to monitor total cost of ownership.

### Data Rich

AOBRDs have been around for several years and can capture an extensive amount of data. Many telematics providers have upgraded their technology to maintain their data collection and monitoring and enhance them with the ELD mandate compliant functionality. These devices will continue to record the same data as the AOBRD. However, newer ELD devices and services may not be collecting the same rich data set.

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The ELD mandate opened a vast market of opportunity that attracted several new providers claiming to be ELD-compliant. Many of these providers are focused on the ELD compliancy and not the valuable fuel, diagnostic and fault code data, or the load-specific data that might be needed for food distributors under FSMA.

When switching to ELDs, food manufacturers and their distribution fleets need a few key questions answered: Are they or did they give up access to critical data they have been historically using and, are they giving up the ability to gain access to data that would help with FSMA compliance in the future? This depends on the viability of the technology platform offered by the provider. If fleet managers are not careful, they may lose out on critical truck data they can use, or have been using, for performance optimization via data analytics.

This additional data could be of further use to food distributors with time- and temperature-sensitive loads. These organizations rely on identifying longer idling times and when combined with temp-sensitive orders can greatly impact fuel expenditure; and critical routing data that can also impact perishable deliveries. What's more, FSMA mandates that sanitary transportation of food requires temperature monitoring and control to prevent refrigerated/frozen food from becoming unsafe during transportation. This information can be monitored with the right ELD telematics solution.

Food distributors need to have more stringent routing plans in place for deliveries, as data extracted from the ELD might make it more difficult for time- and temperature-sensitive operations to remain compliant. A real scenario is a load time and temperature-sensitive load being stranded because the driver is out of hours, not only delaying the load but potentially putting the whole load at risk.

### Choosing a Vendor

Do food distributors view the telematics mandate as a “necessary evil” and spend the least amount to meet compliance, or do they go “all in” and realize the value of the data that the entire ecosystem provides to the operational bottom line?

Amid the overload of applications, hardware and services available in the

**The ELD mandate opened a vast market of opportunity that attracted several new providers claiming to be ELD-compliant. Many of these providers are focused on ELD compliancy and not the valuable fuel, diagnostic and fault code data, or load-specific data that might be needed for food distributors under FSMA.**

ever-changing telematics world, deciding on the range of system functionality and associated costs can be overwhelming. Pricing for hardware can range from free to several thousand dollars per truck, while functionality can range from basic GPS tracking to a fully integrated mobile asset management system. With options that include vendors, applications, features and costs, where do fleets begin?

Fleet managers must look beyond ELD compliance and think strategically about the data they need to manage their food distributor's compliance and performance, their drivers' behaviors, and their vehicle lifecycles that will ultimately pay off in improved fuel economy, enhanced preventative maintenance, lower operating costs, and improved driver retention.

The hardware is just the first decision. Fleets must also choose a provider/partner that is there for the long haul, that can support the organization and fleet well into the future. A short-sighted decision to simply meet the ELD mandate without understanding the “actionable data potential” for greatly reducing operating costs is still ill advised. The incremental costs to acquire systems and services that provide additional data and applications to modernize the fleet are minimal, and the return on investment is substantial.

By attempting to minimize this step and focusing strictly on ELD compliance, fleets will find they have lost substantial operational savings and competitive advantage and will experience increased costs that could have been avoided by not having access to actionable decision-making data that can assist in optimizing the food distributor's fleet performance.

### What Makes a Good Partner/Vendor?

1) How long has the organization been providing fleet telematics? Fleets need a provider that has a legacy of providing

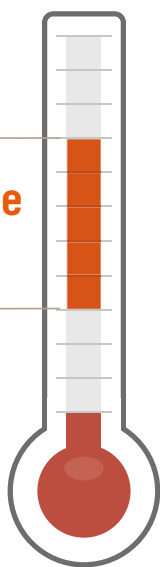
solid Telematic Technology and services. Telematics and transportation technology is a lifetime of lessons learned. It is beyond the technology, and it is also understanding how the technology impacts the operation of the fleet. No two fleets are the same.

2) What does the organization's technology roadmap look like? What is the strategy for the advancement of technology in the future, and how this will impact the collection and interpretation of data? Remember, this is a long-term investment, and it is unwise for fleets to jump between providers frequently. The operational disruptions/costs alone will deplete any realized savings. Fleets also don't want to lose any competitive edge due to their competitors' actionable data strategies.

3) How good is the organization at deployment and support services? It is important to find a partner that understands all complexities involved from planning to execution and is there to work with fleet management teams to overcome any unforeseen challenges.

Choosing the right business intelligence partner can help fleets interpret the abundance of data that's collected by the AOB RD and ELD. Beyond this critical interpretation, the right partner offers its own technology resources that can help fleets make sense of data from many different platforms and sources—a difficult action when fleets try to make sense of data on their own. With the right partner selection, fleets can be compliant and obtain business intelligence and analytics allowing them to maximize the value of the data they extract from each truck to create both operational and bottom-line financial efficiencies that provide significant return on the investment into the technology itself, as well as their partnership with the data purveyor. ■

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**danger zone**

40 to 140 degrees F

# Temperature and Humidity

Using SPC to keep out of the “danger zone”

BY STEVE WISE

and/or food preparation process. After all, without a set monitoring frequency, personnel may lose track of time, leading to uncertainties around how long a product has been exposed to unsafe temperatures. Like the grocery store manager, most companies in this scenario would then destroy said product—absorbing the incurred cost and losses—rather than risk a potentially dangerous item reaching store shelves.

But SPC leaves little to chance; instead, it gives clear, accurate insight into production processes and environments, which helps to optimize quality and significantly reduce risks to food safety.

## How Can SPC Benefit Temperature and Humidity Control?

SPC is an industry-standard methodology for measuring and controlling quality during the manufacturing process. Process data collected in real time are plotted on graphs against pre-determined control limits to highlight any process variations. Using SPC, food manufacturers and restaurants can proactively monitor how processes are running, track for concerning trends, catch issues, and make corrections and process improvements that lead to better, safer, more consistent products.

SPC can leverage practically any measurable data from a line—that includes temperature and humidity readings. Notably, SPC software that can send alerts to notify operators to conduct necessary checks and record what they measure. This ensures that data are collected regularly and on time—and eliminates any uncertainties around what has been done, by whom, and when for better accountability.

In monitoring these data, plant managers and other quality personnel can easily see if there is a sudden jump or a pattern of rising temperature or humidity developing over time. The SPC software can then also alert the appropriate and responsible personnel to take timely, corrective action, turning that data into actionable quality intelligence that keeps products out of the danger zone.

## Is It Time to Take a Fresh Look at Data Collection?

The insights derived from SPC are only as good as the quality of the data collected,

*(Continued on p. 54)*

**T** rue story: I learned something interesting and insightful through a recent act of forgetfulness. Late one night, I was checking out at my local grocery store when I found that I had left my wallet at home. So, I parked my shopping cart to the side and explained to the cashier that I’d forgotten my wallet and would be right back to pay for my groceries.

My trip home and back took about a half hour. When I returned to the store, my cart was gone. The store manager told me they could not sell me the perishable items in my cart and they would have to be destroyed. Why? Store policy forbids the sale of refrigerated or frozen foods that have been out of their chillers for more than 25 minutes, due to the risks of foodborne pathogens and illness.

I felt bad that my forgotten wallet caused this loss of profit to the store. I was willing to play the odds that the items would still be safe to eat, but the store was not. And I realized why: It is simply safer for retailers to write off such a revenue loss than to invite the potentially catastrophic health, legal, and reputational consequences of selling food products that have been left out at room temperature for (possibly) too long.

My story goes to show how critical temperature and time are to stakeholders in the food supply chain. This careful attention starts back upstream in production,

where food manufacturers must closely monitor and control temperature—along with humidity—within plants to ensure product quality, consistency, and safety. During the production process, one of the most effective ways to maintain an optimal, safe environment and prevent products from entering “the danger zone” is through data-driven statistical process control (SPC).

## What Is Considered Dangerous?

USDA describes the danger zone as the temperature range between 40 and 140 degrees Fahrenheit, where harmful bacteria can multiply quickly in food products—possibly doubling in numbers in as few as 20 minutes. In the case of raw foods, such as meat or seafood, if anything is left out in an environment higher than 40 degrees for more than 30 minutes, it is considered unsafe and unsuitable for human consumption.

When it comes to humidity, too much moisture in the air can be dangerous because it can lead to the growth of microorganisms, such as bacteria and fungi—all of which can create mold. In fact, most microorganisms only require a relative humidity (RH) of 60 percent to start growing and reproducing.

To prevent food from lingering in the danger zone or high humidity too long, regular temperature and humidity checks are necessary throughout the manufacturing

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though. And while innovations in sensors have made it possible to automatically capture accurate temperature and humidity readings in real time, most manufacturers and restaurants today unfortunately still rely on manual data collection and good old paper and pencil. One survey of 260 manufacturers conducted by InfinityQS found that 75 percent of respondents currently manually collect their data—with 47 percent reporting they do so with paper and pencil.

But such manual data collection practices are altogether too slow—not to mention highly prone to inconsistencies, errors, and missed/late checks—which prohibits timely, proactive quality control. Often, by the time someone has the chance to look at any handwritten data, it is done, after the fact. With time being such a critical factor in ensuring safe food, it may be too late at this point to catch a problem, and the affected products have gone farther down the line. Remedial action then only causes production delays, rework, and additional costs. Or worse, these items may have already been dispatched, thereby posing a risk to public health and requiring a recall.

Some manufacturers try to get by with plant personnel transcribing handwritten data into digital spreadsheets to make it easier to report and act upon. But that still takes considerable time as well, including trying to decipher questionable handwriting on paper that has been passed along a cold, wet food production line.

With today's technology available literally at our fingertips, food handlers should look at modernizing data collection on the plant floor and in their kitchens, allowing operators to input data electronically using a mobile device, tablet, or personal computer—or even introducing the sensors mentioned earlier for automated collections. These modern data collection methods are more conducive to getting prompt information for real-time SPC and the discovery of any unsafe temperatures or humidity levels or emerging patterns.

I cannot stress enough how important standardization is to data collection and effective SPC practices, especially if a food company's executives want to understand process performance across multiple plants or stores. Data must be collected in a standardized way—including in naming conventions and units of measurements—and stored in a centralized repository. This makes it far easier and faster to aggregate data and run comparative analyses between sites. For executives, it then becomes clear which locations are struggling with temperature and humidity, which ones have the best practices in place, and where to dedicate resources for improvement. The collected data thus not only helps in addressing production-line problems, but also in ensuring quality and safety throughout the entire enterprise.

As the saying goes, "time is money." But it is also true that haste makes waste. SPC is all about timing and precision to enable agile actions and decisions. With data at their fingertips, key personnel on the plant and boardroom floor can obtain real-time insight into production processes and maintain a controlled environment where food products are kept safely out of the danger zone. Ultimately, they can avoid foodborne illness risks and protect their brand names. ■

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# NEW PRODUCTS

## Anti-Pathogenic Packaging

Aptar Food + Beverage, part of AptarGroup, Inc., a producer of a range of premium active packaging systems and processing equipment for fresh-cut fruits, vegetables, and seafood, launches InvisiShield platform technology—an anti-pathogenic packaging solution integrated into sealed packages to protect fresh-cut produce from harmful pathogens such as bacteria, fungi, and viruses. Easy to incorporate into existing or new produce packaging lines, the technology mitigates pathogen growth without negatively impacting the product.



The InvisiShield is activated within sealed packages to safely and effectively release a specially formulated amount of an anti-pathogenic agent into the fresh cut produce's packaging environment that is undetectable to the consumer and dissipates from the package within 24 to 48 hours of activation. This mechanism significantly reduces pathogens that may have been introduced during the supply chain without coming into contact with the product itself. The result is a final intervention step that also reduces cross-contamination within the sealed package.

The technology can be seamlessly integrated into an existing production line with complete on-site technical support. The technology is available in different packaging configurations insuring flexibility and adaptability to a wide range of packaging and delivery systems. **Aptar Food + Beverage, aptar.com.**



## Decontamination System

To prevent food recalls resulting from pathogens on foods that can make consumers sick, the food industry is constantly striving to improve the processes and procedures used to decontaminate foods and food contact surfaces. One known source of contamination is the food conveyor.

Xenon's Z-2000 Conveyor Decontamination System provides food processors with the ability to supplement existing procedures. The system exposes conveyor belts to rapid pulses of high-energy UV light, destroying microorganisms before they can grow and contaminate food products. The system can operate during production to continuously decontaminate food conveyors as an integral piece of the "hurdle concept," whereby a number of non-overlapping treatments are used to destroy harmful bacteria.

The system consists of a food-grade controller and lamp housing that are designed to meet IP67 and NEMA 4X standards. Constructed of stainless steel, the system is safe for use in washdown environments. The lamp housing easily bolts on to existing conveyors without interfering with food moving on the belt. **Xenon Corporation, xenoncorp.com.**

## Gas Analyzer

The Viasensor G100 series of carbon dioxide gas analyzers from Q.E.D. Environmental Systems, Inc., measures CO<sub>2</sub> levels and for indoor air quality measurements. The accuracy and portability of the analyzer makes it useful for a variety of food and beverage applications, including the brewery fermentation process and carbonated soda dispensing systems.

The systems are a good choice for measuring the CO<sub>2</sub> in brewing vats. These instruments feature improved stability with built-in moisture removal, and easy user calibration right on the analyzer. They offer data storage for 1,000 readings, download capabilities, a

long life battery, and quick manufacturing and service lead times. Available options include dual temperature, oxygen, and relative humidity capabilities. **Q.E.D. Environmental Systems, qedenv.com.**



## Cleaning and Sanitizing Product

The Klarion On-Site Generation system produces cleaners and sanitizers on site and on demand. The system mitigates the risk associated with supply chain disruption and enables manufacturers to produce solutions as needed right in the plant. The solutions produced can be used throughout the plant—in filling lines, pressure washers, CIP systems, equipment, tanks, work/break areas, floors, bathrooms, and more. Klarion is also safer for workers as solutions are produced in ready-to-use concentrations, eliminating the need for dangerous chemical dilution. The solutions are non-irritating to eyes and skin and fragrance-free. **Spraying Systems Co., spray.com/klarion.**

# SCIENTIFIC FINDINGS

For access to complete journal articles mentioned below, go to “Food Science Research” in the April/May 2020 issue at [foodqualityandsafety.com](http://foodqualityandsafety.com), or type the headline of the requested article in the website’s search box.

## ARTICLE: Effects of Microwave Processing Conditions on Microbial Safety and Antimicrobial Proteins in Bovine Milk

The simultaneous effects of microwave processing variables affecting the microbial quality and preservation of milk bioactive proteins were evaluated. Response surface methodology was used to investigate the individual and combined effects of ramp time (2.9–5.5 min), holding time (6.6–23.4 s), and final temperature (60–80°C) on the in-



activation of two surrogates (*Staphylococcus aureus* and *Escherichia coli*) added to the milk and on the preservation of the main antimicrobial proteins present in milk (lysozyme, lactoferrin, lactoperoxidase, xanthine oxidase, and immunoglobulin G). Experimental conditions resulting in 5 log reduction of *E. coli* and *S. aureus* (75°C, ramp time of 4.10 min, and holding time of 20 s) were replicated in quintuplicate for validation of the observed effects. At this experimental condition, more than 95% of the naturally present antimicrobial proteins were inactivated. The inactivation of antimicrobial proteins observed in this study was similar to the ones observed for ultra-high temperature milk. **Journal of Food Processing and Preservation, Vol. 44, No. 3, March 2020, e14348.**

## ARTICLE: Cocoa Quality and Authenticity Control

Cocoa (*Theobroma cacao* L.) and its derivatives are commodities of high economic value worldwide. Wide ranges of conventional methods have been used for years to guarantee cocoa quality. Recently, however, demand for global cocoa and the requirements of sensory, functional, and safety cocoa attributes have changed. On the one hand, society and health authorities are increasingly demanding new more accurate quality control tests, including not only the analysis of physicochemical and sensory parameters, but also determinations of functional compounds and contaminant. On the other hand, increased production forces industries to seek quality control techniques based on fast, nondestructive online methods. Finally, an increase in global cocoa demand and a consequent rise in prices can lead to future cases of fraud. For this reason, new analytes, technologies, and ways to analyze data are being researched, developed, and implemented into research or quality laboratories to control cocoa quality and authenticity. Regarding nondestructive methods, spectroscopy is the most explored technique, which is conducted within the near infrared range, and also within the medium infrared range to a lesser extent. It is applied mainly in the postharvest stage of cocoa beans to analyze different biochemical parameters or to assess the authenticity of cocoa and its derivatives. **Comprehensive Reviews in Food Science and Food Safety, Vol. 19, No. 2, March 2020, Pages 448-478.**



## ARTICLE: Manipulation of Sensory Characteristics and Volatile Compounds in Strawberry Fruit through the use of Isolated Wavelengths of Light

Consumers consistently note that there is room for improvement in the flavor of commercial strawberries. Fruit flavor and aroma are affected by both genetics and environment. This work tests the hypothesis that sensory quality may be manipulated using postharvest light treatments. Individual detached fruits representing two different cultivars received a 24-hr treatment of 100  $\mu\text{mol m}^{-2} \text{s}^{-1}$  blue LED light while the control was kept in complete darkness. Following treatment, samples were analyzed for flavor volatiles, sugars, acids, firmness, and sensory differences in human trials. Fruits were rated for overall liking, texture, sweetness, sourness, and overall strawberry flavor intensity (OSFI) on the sensory and hedonic versions of the global intensity scale (GIS). A positive treatment effect was observed for “Strawberry Festival” fruit for the overall liking rating. A triangle test revealed a significant treatment effect, as light-treated fruit tested higher in many flavor volatiles including those known to contribute to sweetness in strawberries. Levels of several volatiles were consistently higher in the treated fruit across all four harvests: acetic acid hexyl ester, butanoic acid octyl ester, methyl isovalerate, and pentanoic acid ethyl ester. The results show that postharvest light treatment can be used to modulate sensory quality of fruit, perhaps offering a means to complement genetic efforts in fruit flavor and aroma improvement. **Journal of Food Science, Vol. 85, No. 3, March 2020, Pages 771-780.**



## ARTICLE: Reduced-Sodium Cheeses: Implications of Reducing Sodium Chloride on Cheese Quality and Safety

Sodium chloride (NaCl) is broadly used to increase the storage stability and the palatability of foods. In recent decades, use of table salt in foods is a major concern among the health agencies of the world owing to ill effects of sodium (Na) that are mostly linked to hypertension and cardiovascular diseases. As a result, food scientists are working to decrease the sodium content in food either by decreasing the rate of NaCl

addition or by partial or full replacement of NaCl with other suitable salts such as potassium chloride (KCl), calcium chloride (CaCl<sub>2</sub>), or magnesium chloride (MgCl<sub>2</sub>). However, in cheese, salt reduction is difficult to accomplish owing to its multifaceted role in cheese making. The purpose of this study is to provide an insight of NaCl reduction on sensory, physicochemical, and technofunctional attributes of RSCs with an aim to explore

various strategies for salt reduction without affecting the cheese quality and safety. Based on the understanding of conceptual and applied information on the complex changes that occur in the development of RSCs, the quality and safety of RSCs can be accomplished effectively to reduce the DSI from cheese. ***Comprehensive Reviews in Food Science and Food Safety, Vol. 19, No. 2, March 2020, Pages 733-758***

## How to Tackle Quality ... (Continued from p. 43)

video is all that is needed to communicate important mixing or product behavior. A video of a previous batch may show similarities or differences with current conditions. Careful observation of a video timed with a stopwatch may even provide a way to measure the rotational speed of a mixer without a tachometer.

If the storage and handling conditions for ingredients are subject to question, consumer weather instrumentation may provide temperature and humidity information compatible with a digital computer. Humidity can always affect the handling of powdered ingredients. One of the most common measurements that is overlooked is the initial temperature of the ingredients or process water.

Food ingredients and processes typically are cost sensitive. Cost limitations are justification for greater creativity in

the use of technology. For instance, if a photo or video of a mixing operation may be beneficial, an expensive camera is probably not the best option. People take cell phone pictures of their food at restaurants all of the time. Why not record what food looks like when it is being made? Videos at each ingredient addition or process change may provide a more complete view of the process steps. Time stamps on photos or videos, may provide information about how long the process took. Every photo taken with a cell phone has a date and time in the details about the photo. For a continuous video of the process, a basic security camera with an overhead view and a digital recording device may provide information about the entire process at a minimal cost. Observation and recording can be as extensive as appropriate to monitor success in produc-

tion. If you are still experiencing inconsistencies, you have not identified important differences in the process.

### No Excuses

Mixing is an empirical process, which means that results are obtained by observation. Sophisticated computers and instrumentation may provide more detailed information than is necessary for success. If you experience process problems, learn about your products and operations through observation. Many problems and potential improvements may become obvious. Remember, you can't keep doing the same thing and expect different results. Something needs to change. ■

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## Mass Spectrometry ... (Continued from p. 45)

for linearity, sensitivity, recovery, and repeatability and approved by the AOAC International Expert Review Panel on Selected Food Allergens for the Stakeholder Panel on Strategic Food Analytical.

This foodomics-based analytical method is another tool in the arsenal for food analysis. It provides an accurate and precise way of performing the analysis to detect and quantify markers of multiple allergens in single samples of diverse and complex foodstuffs. This method should contribute to improving food safety by reducing the likelihood of food products

being marketed containing undeclared allergens. Not only will this potentially save lives, but it can also confer substantial cost savings by reducing the main reason for food product recalls.

Furthermore, in the long run, improved food safety should contribute to improved quality of life, as well as lower rates of morbidity and mortality attributed to food allergies. By empowering individuals with food allergies with the ability to more confidently select and consume their food, better guaranteed food safety facilitates better nutrition and health, and can

help these individuals realize a lifestyle that incorporates a diet designed for personalized health. ■

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Dr. Hyland is global technical marketing manager for food and environmental at SCIEEX.

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1-2

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2-5

#### IAFP Annual Meeting

Cleveland, Ohio

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### Aug. 31-Sept. 4

#### Conference for Food Protection

Denver, Co.

Visit [foodprotect.org](http://foodprotect.org).

### SEPTEMBER 2020

11-17

#### AOAC Annual Meeting & Expo

Orlando, Fla.

Visit [aoac.org/annual-meeting-exposition](http://aoac.org/annual-meeting-exposition) or email [aoac@aoac.org](mailto:aoac@aoac.org).

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Chicago

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### OCTOBER 2020

19-22

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8-11

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10-11

#### European Food Sure Summit

Milan, Italy

Visit [foodsureeurope.com](http://foodsureeurope.com).

### MARCH 2021

1-3

#### Beef Industry Safety Summit

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Visit [bifsc.org](http://bifsc.org).

6-10

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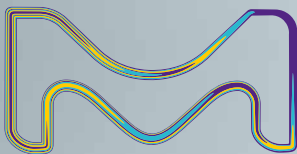
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