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Food Quality & Safety

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Webinar
Date & Time:
June 23, 1pm EDT
June 23, 2pm BST
June 24, 11am CST

Linfeng Wu, Ph.D.
Agilent Technologies
Applications Scientist

Patrick Batoon, Ph.D.
Agilent Technologies
Product Manager of Triple Quadrupole LC/MS

Who should attend

Lab managers in service labs providing routine analysis for Food & Environmental Safety

LC/MS users doing routine analysis for Food & Environmental Safety

LC/MS users interested in combining class-specific LC/MS methods into a single multi-residue method.

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From The Editors

"Those who cannot remember the past are condemned to repeat it."
George Santayana, 1905

There are lessons to be learned from the past. Much—if not all—of our food safety, quality, and sanitation systems are built on learnings and hard lessons. The *Salmonella* outbreak attributed to Schwann's ice cream products in 1994 taught the industry two lessons. The first was the importance of ensuring that tankers are cleaned and properly sanitized prior to being used. This message also led to the establishment of validation procedures for tanker wash facilities. The second lesson was more subtle but extremely important: Quickly acknowledge and react to a food safety problem. Schwann's quickly initiated the necessary recalls, acknowledged the problems, and took care of people who had problems.

The 2006 outbreak of *E. coli 0157:H7* associated with spinach sickened more than 200 and resulted in some deaths. The true cause of the outbreak was never confirmed, but the produce industry got a bit of a "black eye" because they were unable to promptly and quickly track the source of the suspect spinach. This was one of the incidents that prompted the enactment of FSMA and underscored the importance of rugged tracking and traceability programs.

It is also important to seek continual improvement. Consider a quote from Woody Allen's movie "Annie Hall": *"I think a relationship is like a shark. It has to constantly move forward or it dies."* When people accept the status quo and do not strive to improve, people or other companies pass them by. This is why programs such as third-party audits, internal audit programs, and management reviews are so important. They not only serve to verify that programs are working through an independent set of eyes, but they encourage managers to continuously improve. Each and every manager should come to a management review meeting with improvement plans aimed at enhancing operations: how the program could be improved, timelines, budget information, and details on who will manage the program.

So, look to the past to establish programs that help ensure production of safe and wholesome foods, but be sure that you fully understand that part of maintenance is constant verification and a need to seek out more ways to make your programs more effective and efficient. Don't be like that shark that forgets to keep moving forward and sinks to the bottom of the sea.

Richard Stier
Co-Industry Editor

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FARM TO FORK SAFETY

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NEWS & NOTES

For more breaking news on COVID-19 and the food industry, visit foodqualityandsafety.com.

Food Processing Worker Union Demands Increased Safety for Meatpacking Plants During COVID-19 Pandemic BY KEITH LORIA

Since early March 2020, 14,000 confirmed COVID-19 cases have been tied to 181 meat processing plants across the U.S., and, at press time, at least 54 plant workers had died. In response to these outbreaks, approximately 30 meatpacking plants have shut down for some period of time, with approximately 45,000 workers impacted.

President Trump signed an executive order stating that all meatpackers must reopen their doors on April 28, even though many of these plants were still dealing with employees sick from the virus, and no new safety precautions were put in place to control the spread of the disease.

The United Food and Commercial Workers International Union was quick to chastise the president for this order. The UFCW, which represents the more than 250,000 meatpacking and food processing workers across the country, views this action as seriously troubling, not just for the safety of employees but also, possibly, for the food supply.

"America's meatpacking workers are putting their lives on the line every day to make sure our families have the food they need during this pandemic," says Marc Perrone, UFCW's international president. "Meatpacking plants did not close because anyone wants them to close; these plants closed because workers died and more than 10,000 workers have been infected or exposed to COVID-19."

The union believes that mandating all plants to stay open without including proper safety improvements endangers the long-term security of the nation's food supply. The union is calling for the White House Coronavirus Task Force to prioritize five safety actions targeted toward the meatpacking industry: increasing worker testing, offering priority access to PPE, halting line speed waivers, mandating social distancing, and isolating workers with symptoms or those who test positive for the virus.

Paula Schelling, acting president of American Federation of Government Employees Council 45, adds, "Without protective equipment and testing of all workers, more employees will get sick and the safety of our food supply will be compromised."

FSPCA Announces New Executive Advisory Board

The Food Safety Preventive Controls Alliance (FSPCA) has reorganized its governance structure with the establishment of a new executive advisory board (EAB) consisting of industry, academic, and government stakeholders. FSPCA is internationally recognized as the trusted source for curricula, training programs, and outreach for the prevention-oriented standards of the Food Safety Modernization Act (FSMA). Created in 2015 with support from an FDA FSMA cooperative agreement, FSPCA developed and executed standardized training curricula for preventive controls for human and animal foods, foreign supplier verification programs, and intentional adulteration. With development and FDA funding completed, FSPCA is focusing on new initiatives and funding to address emerging issues and drive high-quality FSMA training as the global leader in excellence. The new EAB will focus on new strategies to develop, improve, and market core curricula, products, and services for the food industry in order to promote compliance with FSMA rules, as well as maintain high-quality instruction by lead instructors. Visit ifsh.iit.edu/fspca to view the new board and management members.

Researchers Identify Seasonal Peaks for Foodborne Infections

Each year, thousands of pounds of food are wasted and billions of dollars in food sales are lost due to recalls tied to foodborne infections. Using a newly developed approach, researchers at Tufts University Friedman School of Nutrition Science and Policy in Boston have identified seasonal peaks for foodborne infections that could be used to optimize the timing and location of food inspections.

To characterize the timing and intensity of infection peaks, the researchers developed an analysis method that robustly determines which specific pathogens are likely to cause an outbreak at a given time. Using their new analysis method, the researchers found that although foodborne outbreaks typically peak in July, food recalls are delayed by one to two months, peaking from mid-August through mid-September. These findings were consistent across examined states and pathogens.

Next, the researchers aim to refine their analysis method by exploring specific foods and food groups linked to foodborne outbreaks. They also plan to examine relationships between outbreaks for particular pathogens with food preparation practices and other factors.

Washington Report

USDA Purchasing Programs

The agency moves to bridge the gap between food waste and food needs during the coronavirus pandemic

BY **LORI VALIGRA**

News images of farmers dumping milk, depopulating animals, or plowing under vegetables, and of people lined up at food banks form indelible reminders of how deeply the novel coronavirus has affected producers and consumers in the United States.

U.S. Secretary of Agriculture Sonny Perdue is trying to bridge that disconnect. On May 4, 2020, USDA released details of purchasing $470 million in surplus food during the fiscal quarter that ends on June 30 and distribute it to communities nationwide.

The purchases are part of the $4.89 billion in American-grown and produced agricultural products USDA will buy and distribute for the remainder of this fiscal year.

Included in that purchase is a $3 billion USDA pledge announced April 17 to buy farm products as part of the $19 billion Coronavirus Food Assistance Program (CFAP). USDA's Agricultural Marketing Service (AMS) will procure $100 million per month each of fresh fruits and vegetables, dairy products, and meat products to provide a pre-approved box to food banks and other nonprofits through the Farmers to Families Food Box Program.

The remainder of CFAP consists of $16 billion in direct support to farmers and ranchers based on actual losses where prices and market supply chains have been affected. The money is aimed at assisting them with losses in demand and the short-term oversupply for the 2020 marketing year caused by COVID-19.

USDA says the program came about because the U.S. food industry has high inventories related to lesser demand from closed food service establishments, restaurants, and schools. In addition, prices producers typically receive have declined. At the same time, food banks, food pantries, and other organizations across the country are seeing unprecedented high demand.

"America's farmers and ranchers have experienced a dislocated supply chain caused by the coronavirus," Perdue says. "USDA is in the unique position to purchase these foods and deliver them to the hungry Americans who need it most."

AMS will spend the new tranche of $470 million on a wide variety of fruits, vegetables, meat, dairy, and seafood products under Section 32 of the Agricultural Adjustment Act of 1935. The highest purchase amount, $120 million, will go to dairy products, followed by $50 million each to the potato and turkey industries. The foods will go to USDA's nutrition assistance programs, including to food banks that serve as the nation's food safety net.

The purchases from the agriculture sector are being determined by industry requests, market analysis, and food bank needs. AMS will begin issuing solicitations in June and intends to start deliveries in July. More information is on the "Selling Food to USDA" page on the AMS website.

Solicitations will be posted to the AMS Open Purchases Request website once it is available. USDA says it also will consider industry requests for future purchases using Section 32 funds.

Good Start, More Needed

These USDA programs are helpful to food service providers, but more is needed in almost every sector to ensure that the food industry as a whole will emerge from the COVID pandemic able to continue doing business.

Chicken. The purchase program certainly benefits chicken producers, rural America, and U.S. agriculture, says Tom Super, senior vice president of communications at the National Chicken Council in Washington, D.C. (USDA will buy up to $30 million in chicken products in this round of purchases.)

"But the real winners are financially-stressed families, food banks, disaster-relief operations, schools, and Americans needing food assistance, where these products are being distributed," Super says. "The program also helps improve continuity in the supply chain by diverting some chicken products once destined for food service into other much-needed channels."

Super says more federal help is needed, because chicken farmers were left out of the most recent federal COVID-19 assistance package. "Because of this, the National Chicken Council has been and will continue to advocate for federal funds in any next aid package for farmers who have experienced fewer flocks, reduced placements, or increased downtime due to COVID-19," he says.

Potatoes. The National Potato Council in Washington, D.C., welcomed the $50 million in purchases for its industry, but also says more is needed. "Due to mandated shutdowns, the U.S. potato industry has been reeling from an oversupply of processing potatoes left over from the 2019 harvest," says Kam Quarles, the organization's CEO. "While we welcome the $50 million potato purchase, we see it as a partial down payment on the industry's overall relief needs. More investments are needed to keep struggling family farms operational."

Quarles says that with 60 percent of all potatoes grown in the United States destined for food service customers, the nationwide closure of restaurants, bars, schools, and entertainment venues dried up the potato supply chain. "We've calculated that the industry needs an additional $300 million in USDA potato purchases to help reduce the backlog and stabilize market prices, and we are working with Congress to see that this funding is included in the next economic relief bill," he says.

Without USDA intervening on a more significant scale, Quarles says the industry will be faced with a 1.5 billion-pound oversupply of potatoes from the 2019 harvest, which would fill the U.S. Capitol 14 times over.

Pork. Rachel Gantz, communications director at the National Pork Producers Council in Washington, D.C., says one-quarter of pork produced in the United States goes into the retail sector, where COVID-19-related closures at restaurants, schools, and food banks resulted in a backup in the pork supply chain. (USDA will buy $30 million of pork from producers this round, and pork producers will receive $1.6 million in direct payments from the CFAP.)

But Gantz says the relief falls short of what's needed to sustain thousands of affected producers. "Our hog farmers are facing a significant financial and emotional crisis and are set to lose more than $5 billion collectively as the value of hogs has plummeted," she says. "They also face significant costs associated with depopulation and disposal."

The council is urging the U.S. Senate to adopt companion legislation that includes the livestock agriculture measures included in the Health and Economic Recovery Omnibus Emergency Solutions Act, also known as the HEROES Act. It passed in the U.S. House of Representatives on May 15, and the senate is slated to begin work on it in the coming weeks. The measures in the act include compensation for euthanized livestock that can't be processed due to COVID-related packing plant capacity reductions, expanded direct payments, increased funding for animal health surveillance and laboratories tapped to perform COVID-19 testing during the human health emergency, and mental health assistance for farmers who face an unimaginable animal welfare crisis.

Unlike the USDA program, the HEROES Act does not mandate payment restrictions, ensuring that relief is extended to farmers who are most heavily invested in pork production, she says. "Pork producers are facing a significant financial crisis as a result of COVID-related plant shutdowns and slowdowns. Without prompt government assistance, many generational family farms will go bankrupt," she says, adding that hog farming generates more than 500,000 jobs and $23 billion in personal income.

Dairy. The dairy industry, which will see $120 million in purchases from USDA under the most recent plan, faces similar challenges. In a recent statement, the National Milk Producers Federation (NMPF) in Arlington, Va., thanked the House for supporting critical measures for dairy farmers and their industry partners in the HEROES Act.

Dairy farmers have suffered significant losses because the collapse of food service markets has diminished demand. Losses have been high because of milk's perishability, NMPF president and CEO Jim Mulhern said when the act was passed by the House. "The dairy industry continues to grapple with difficulty and uncertainty

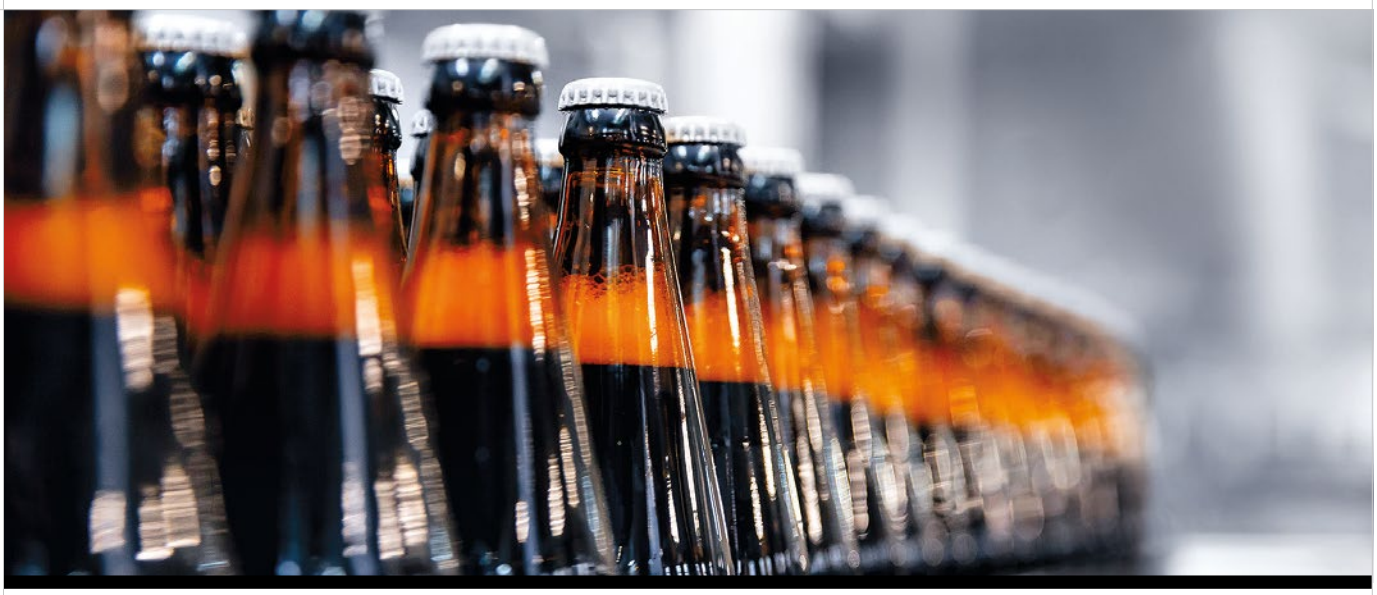
(Continued on p. 17)

How USDA Will Spend $470 Million

Commodity	Purchase Amount
Asparagus	$5,000,000
Catfish Products	$30,000,000
Chicken	$30,000,000
Dairy Products	$120,000,000
Haddock, Pollock, Redfish (Atlantic)	$20,000,000
Orange Juice	$25,000,000
Pears	$5,000,000
Pollock (Alaska)	$20,000,000
Pork	$30,000,000
Potatoes	$50,000,000
Prunes	$5,000,000
Raisins	$15,000,000
Strawberries	$35,000,000
Sweet Potatoes	$10,000,000
Tart Cherries	$20,000,000
Turkey Products	$50,000,000
Total	$470,000,000

SOURCE: USDA

Market Initiatives



Here's to Alcoholic Beverages

Product quality and safety are priorities for brewers, winemakers, and distillers

BY **LINDA L. LEAKE, MS**

Many words are used to describe beer, wine, and distilled spirits, but "new" isn't one of them, generally speaking. History suggests that both beer and wine may have been produced as early as 8000 BCE. Distillation was first developed around 4000 BCE. Amazingly, in just 6,000 to 10,000 years, the ancient concepts of beer, wine, and distilled spirits have all skyrocketed into multibillion-dollar global industries.

Beer

Tapping into government and industry data, the National Beer Wholesalers Association notes there were 6,400 reporting brewery facilities/locations in the United States in 2019. Neary 25 percent of these breweries were classified as brewpubs that only brew beer for direct-to-consumer sale on brewery-restaurant premises. In 2019, the U.S. beer industry shipped the equivalent of more than 2.8 billion cases of 24 12-ounce containers. The U.S. beer industry sells more than $119.3 billion in beer and malt-based beverages to U.S. consumers each year. And U.S. consumers 21 years and older consumed 25.9 gallons of beer and cider per person during 2019.

The quality of beer for draft dispensing can be degraded at the retail bar level in a number of ways, according to biochemist Charles Bamforth, PhD, a distinguished professor emeritus of malting and brewing sciences in the department of food science and technology at the University of California at Davis. "A recipe for disaster is the presence of too many different taps," Dr. Bamforth says. "As a result, all the beers are not necessarily moving with sufficient turnover. Thus, they linger and age, which dramatically diminishes quality." Even worse, Dr. Bamforth continues, unless the bar staff properly cleans and disinfects the dispensing lines as frequently as daily, there is a tremendous risk of developing bacterial spoilage populations that create terrible off flavors. "To minimize such problems, responsible brewers ensure that bar staff are properly trained," Dr. Bamforth says.

Freshness Matters

Most beers deteriorate in their flavor from the time they are packaged, Dr. Bamforth notes. "The enemies of beer are oxygen in the air, light, and heat, and heat speeds up the changes that take place in beer," he explains. "The problem is particularly acute for those brewers who ship their beer long distances, including internationally. Whilst the beer remains safe to drink, it most decidedly does not taste as it was intended to taste after it has traveled halfway across a nation like the U.S. or across the globe."

To maximize product stability, brewers need to invest in the most up-to-date packaging equipment that will minimize air ingress during packaging, Dr. Bamforth says. "They should also be looking to distribute and warehouse beer under refrigerated conditions, as relatively few brewers currently do this," he adds.

Wine Produced in All 50 States

There were more than 10,000 licensed wineries in the United States through 2019, according to Wines Vines Analytics, based on U.S. Alcohol and Tobacco, Tax and Trade Bureau (TTB) data, and there are wineries in all 50 states. In 2018, U.S. wine sales totaled 406.5 million 9-liter cases with a retail value of $68.1 billion, as per San Francisco, Calif.-based Wine Institute, a public policy advocacy organization representing 1,000-plus California member wineries and affiliated businesses. California produces 80 percent of U.S. wine at 4,000 wineries.

According to TTB, in 2019, the U.S. produced 817,503,758 gallons of still wines. After California, Washington, Oregon, New York, Texas, Pennsylvania, Virginia, Ohio, Michigan, and North Carolina round out the top 10 wine-producing states.

Focus on Quality and Safety

Product quality and safety is a central focus of the California wine industry, according to Tracy Genesen, JD, vice president and general counsel of the Wine Institute. "We have one of the few standing technical committees in the global alcohol industry," Genesen says.

"The committee's mandate is to address quality, safety, authenticity, and technology issues for the wine industry," says Tim Ryan, PhD, senior director of regulatory affairs and compliance for E. & J. Gallo Winery, Modesto, Calif., and TAC chair. "To that end, we have working groups that focus on five areas—namely, wine components; wine labeling; food safety and product integrity; U.S. and international technical regulations; and education, communications, and outreach." Dr. Ryan points out that product safety and integrity currently centers on making sure Golden State wineries comply with the Food Safety Modernization Act (FSMA).

During 2017 and 2018, Wine Institute hosted 10 eight-hour training sessions throughout California to make sure that member wineries would be in full compliance with FSMA. "In 2017, some 216 California wineries were audited for FSMA, and a total of only four minor issues were cited on the audit reports," Genesen says.

Dr. Ryan emphasizes that wine is microbiologically safe. Relative to potential physical contaminants, TAC is currently developing a good manufacturing practice for minimizing the risk of glass in product, including filtration and monitoring. "Chemical residues are not typically an issue with wine, but in consideration of consumer demand, we monitor crop protection chemicals to make sure chemicals used in our wineries meet all regulatory requirements," Dr. Ryan says. "This is especially important for international trade. Pesticides are well-regulated in California, but as tolerance levels get lower in Europe, we must lower our levels."

To maximize product stability, brewers need to invest in the most up-to-date packaging equipment that will minimize air ingress during packaging.

As a member of FIVS, a France-based organization that serves the global wine, spirits, and beer sectors on public policy issues, and the World Wine Trade Group (WWTG), which includes Argentina, Australia, Canada, Chile, New Zealand, Republic of Georgia, South Africa, Uruguay, and the U.S., the Wine Institute collaborates on efforts to standardize international regulations for product safety and trade. "The goal of these organizations is to eliminate technical barriers to trade," Dr. Ryan relates. "In recent years, the WWTG has issued a series of regulatory principles based on best practices that enhance trade and minimize regulatory requirements such as testing and certification. Member governments of WWTG endorse these principles and use them in regulation of wine."

Currently, the biggest challenge for producers of wine, distilled spirits, and beer is getting used to and complying with the FSMA requirements, according to Anna Katharine Mansfield, PhD, associate professor of enology in the department of food science at Cornell University in Geneva, N.Y. "The alcohol beverage industry is accustomed to answering primarily to the TTB," she points out, "so to also have to deal with a whole new set of guidelines coming from a different regulatory organization is confusing to many producers."

The Cornell Enology Extension Lab offers an online certification program called EnoCert that is intended primarily for winery employees in any geographic location who want to expand their practical knowledge of winery operations. "As part of this program, the course called EnoCert 203, Sanitation and Safety, covers all of the sanitation and safety basics required for FSMA," Dr. Mansfield says. "In April 2020, we also presented a FSMA-specific webinar for wineries and other TTB-permitted producers, which is posted on our website for free access."

Distilled Spirits

The U.S. produced 239 million 9-liter cases of distilled spirits in 2019, according to the Distilled Spirits Council of the United States. U.S. distilled spirits suppliers tallied 2019 gross revenue totaling $29 billion in four categories: value, premium, high end, and super premium. Some 45 states exported distilled spirits in 2019.

Amid the COVID-19 pandemic, the distilled spirits industry is mostly concerned about keeping their staff and the public they serve safe, while promoting their businesses to the extent allowable under current restrictions, according to Kevin Atticks, DCD, executive director of the Maryland Distillers Guild, Maryland Wineries Association, and the Brewers Association of Maryland. "Maryland's distillers have risen to fill the need for hand sanitizer, prioritizing hospitals and other healthcare facilities, first responders, and prisons," Dr. Atticks says. "The Maryland Distillers Guild consolidated requests from interested parties, including hospitals, assisted living facilities, first responders, government agencies, and matched each request with one of the 17 distillers (of the state's 30 licensed distillers) producing sanitizer. Maryland brewers and wineries contributed beer and wine to be distilled by the distilleries, providing a much-needed base alcohol."

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The European Perspective

Wine and spirits are the EU's top exports, according to FoodDrinkEurope. The organization's *Data & Trends of the European Food Industry 2019*, published in October 2019, reports that 2018 EU exports of wine totaled 11.572 billion million euros, with the top three destinations being the U.S., Switzerland, and China. Total 2018 EU exports of spirits reached 11.342 billion euros; the top three destinations were the U.S., Singapore, and China.

For the past three decades, European spirits producers have dealt with continuously changing regulatory requirements and standard quality and safety guidelines for an ever-increasing level of consumer protection, according to Teodora Coldea, PhD, a lecturer in the department of food technology at the University of Agricultural Sciences and Veterinary Medicine in Cluj-Napoca, Romania. "In the EU, production of spirit drinks is regulated by the European Commission, with additional rules in each member state," she says.

Dr. Coldea points out that, while fruit spirits, in particular, are very popular worldwide, the Eastern and Central European countries of Poland, Slovakia, Hungary, Bulgaria, Romania, and Czech Republic are arguably among the most notable nations for producing fruit distillates. Two categories of fruits are typically used for distilled spirits, Dr. Coldea says, one with stones (plums, cherries, sour cherries, apricots and peaches, etc.) and the other without stones (pears, apples, and other berries).

Volatile Compounds Influence

The most important quality and safety parameters of fruit spirits are associated with the content of volatile compounds, including ethanol, esters, aldehydes, higher alcohols, methanol, furfural, heavy metal compounds, and hydrogen cyanide (HCN), Dr. Coldea notes. "While naturally occurring in fruits, or produced during fermentation or distillation, excessive amounts of these compounds can be toxic to humans when consumed," she says. "Thus, the maximum allowable amounts in each type of distilled beverage are all specified in the EC regulations."

"The legal limits of contaminants in alcoholic beverages are sometimes accidentally exceeded," Dr. Coldea says. "The European Food Safety Authority recommends a limit of 1 mg/L in stone fruits spirits, but some European countries have regulated this content to even lower levels."

Dr. Coldea emphasizes that all distilled spirits processed through industrial channels in Europe are tested for contaminants in accredited laboratories. "In some European countries, fruit spirits are often homemade and are not sufficiently tested for contaminants, which poses a risk for consumers," she relates.

To solve the problems associated with both unintentional chemical contamination and intentional adulteration of alcoholic beverages, European spirits producers urgently need rapid, budget-friendly, in-house testing solutions, says Dr. Coldea. "At present, chemical analyses are possible only in testing laboratories, which can be particularly costly for smaller sized spirits distillers," she adds. ■

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

Legal Update

COVID-19: Legal Implications for the Food Industry

Employer liability lawsuits and contractual liability are two critical challenges facing food industry companies in the days ahead

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

The COVID-19 pandemic has killed 100,000 Americans so far, left millions jobless, and caused one of the greatest economic crises in history. As we write this, in late May 2020, the first bits of good news are beginning to percolate into the public sphere. In New York, efforts to flatten the curve appear to be working, and cases that were once increasing exponentially are now on the decline. By all indications, social distancing efforts have been more effective than anticipated and, despite the grievous loss of life, there is reason to hope that the direst predictions will not come to pass.

Despite the good news, a great deal of uncertainty remains. That uncertainty extends to all aspects of our lives, from health to economics to education to national security. Meanwhile, food companies, from restaurants to grocers to manufacturers, are experiencing extreme duress due to disruptions caused by mandatory closures, travel bans, and quarantines. Even as some businesses are experiencing unusually high demand, others are pausing operations due to the emergence of illness.

Unfortunately, it is all but certain that we will continue to face extraordinary challenges in the weeks and months to come. This article will discuss two of the many legal issues, challenges, and changes that have been brought to the forefront by the COVID-19 pandemic.

Employer Liability Lawsuits

Food companies have been confronted with the difficult question of how to safeguard employees from COVID-19 while remaining fiscally viable. This is an extremely complex issue without easy answers. Food companies must balance the safety and well-being of employees with the economic realities and the needs of the nation. Unlike in some other business sectors, working remotely is simply not feasible for most food industry positions.

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Moreover, the industry at large simply does not have the liberty of instituting a wholesale shutdown.

One of the most perplexing issues facing the food industry is that of employer liability for COVID-19 illnesses. More specifically, the question is to what extent can companies be held liable if their employees become infected in the course of their employment. Many legal analysts are predicting an onslaught of lawsuits in the months to come. These lawsuits would ostensibly take many forms. One common type of lawsuit would be for injunctive relief, meaning, for instance, that employees could sue to demand the employer implement certain protective measures. Another type of suit would be for claims that an employee was sickened at work because of their employer's negligence. Finally, employers may face class action lawsuits brought on behalf of a group of employees alleging an unsafe work environment.

To be sure, there are many legal and factual hurdles to overcome for such cases. For one, workers' compensation statutes pose a significant hurdle for claimants seeking to bring tort claims against employers. In most states, injuries suffered at work do not give rise to tort liability. The question with COVID-19 is whether it constitutes a work injury. Some states have already enacted legislation to address this, but most have not. In Wisconsin, for example, the state has enacted a temporary law providing that when a first responder is injured by COVID-19 and had at-work exposures to infected individuals, the injury is presumed to be employment related.

COVID-19 is an unprecedented event. Food companies in particular have had to navigate the manifest difficulties of implementing new and frequently changing policies that have fundamentally reshaped how we move about the workplace and the world

Although worker's compensation benefits are typically the exclusive remedy available to injured workers, there are certain exceptions that COVID-19 could conceivably fall into. For instance, many jurisdictions allow an exception for an employer's intentional conduct toward employees. If a plaintiff's attorney can establish that the aggrieved conduct was willful or deliberate, i.e., by arguing that the employer willfully chose not to implement OSHA's COVID-19 guidance, a judge could rule in favor of the plaintiff.

Even if a plaintiff were able to overcome the legal intricacies associated with worker's compensation statutes, they would still have an uphill battle. This is because the nature of viral spread would make proving causation especially difficult. COVID-19 is different from *Salmonella* or *Listeria*, where genetic fingerprinting can establish definitive connections between case-patients. Thus, it would presumably be difficult to prove an employee contracted the virus at work, as opposed to in the grocery store or at the park, for instance.

Nevertheless, defending lawsuits is expensive regardless of merit. The legal issues, like the virus itself, are novel. Because courts have not previously rendered judgment on these questions, it will take a substantial amount of time and effort to adjudicate the issues. That will translate to high costs. To prevent this from happening, commercial lobbying interests are advocating for a legislative solution. They want Congress to enact a COVID-19 liability shield that would preclude companies from being sued in relation to COVID-19. Similarly, the U.S. Chamber of Commerce is seeking a safe harbor from negligence claims for businesses that followed governmental guidance on COVID-19 in the workplace. Whether Congress will enact such a liability shield is unclear, and the topic remains the subject of bitter partisan rancor.

Attorneys tend to be leery of liability shields. One of our society's abiding legal principles is that for every harm there is a remedy. In simple terms, this means that when a person's unreasonable conduct causes injury, that person is legally responsible for redressing the injury. With the pandemic, however, a limited liability shield may be appropriate. COVID-19 is an unprecedented event. Food companies in particular have had to navigate the manifest difficulties of implementing new and frequently changing policies that have fundamentally reshaped how we move about the workplace and the world. While many businesses closed, food companies had to remain open. Despite the challenges, the food industry performed remarkably well in the face of extraordinary challenges. Given that fact, it would seem unjust to subject these companies to retrospective liability for reasonable conduct based on the best information available at the time.

Whatever happens with the legislature or the courts, the best way to protect employees and stave off lawsuits is to ensure the company is monitoring and

observing governmental guidance and implementing responsible, science-based policies and procedures to safeguard employees.

Contractual Liability

Another area of potential concern relates to contractual liability. For the first time in modern history, the food industry is having to fundamentally reimagine the way it does business. The challenges of implementing change while navigating the ongoing pandemic will continue to result in at least temporary shortfalls in production, increased costs, and prolonged maintenance delays. Consequently, many businesses will not be able to meet their contractual obligations. Breaching a contract can result in a troubling array of business losses. Fortunately, from a legal standpoint, there are defenses available when a contractual breach is caused by an extraordinary event such as COVID-19.

Force majeure is a legal term of art, meaning "superior force." In simple terms, it is a provision frequently incorporated into contracts that discharges the parties of their performance obligations in the event of an extraordinary event like COVID-19. Force majeure clauses do not protect against foreseeable risks such as market fluctuations or other common business risks. A pandemic, on the other hand, is precisely the type of unforeseeable event force majeure protects against. Thus, where a contract contains a force majeure provision and a party is unable to perform due to COVID-19, it is likely the provision would allow the party to be discharged of its contractual obligations.

Importantly, even when a contract does not contain a force majeure provision, a party may still have a valid defense based on a similar legal doctrine. The common law doctrine of supervening impracticability also permits a party to discharge its contractual duties. This defense is only available to the extent the party is not at fault for the impracticability. This defense is not available, however, if the contractual language specifically bars the parties from asserting it.

COVID-19 has fundamentally changed our lives in just a few short months. The food industry has done an incredible job of protecting workers while maintaining a safe and wholesome food supply, but additional challenges surely lie ahead, and there will likely be significant additional legal changes as time goes on. To prepare, companies should continue to monitor legislative developments, enact sensible and reasonable procedures and policies to combat the risk of illness, and review contractual relationships to identify potential problems. ■

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USDA Purchasing Programs *(Continued from p. 11)*

on a scale we have not seen in our lifetimes," Mulhern said.

And while he also appreciated USDA's direct assistance plan to farmers, he said current aid levels are not sufficient for milk producers and other agricultural sectors facing massive losses. "All that USDA can do to buy and quickly distribute dairy products to those in need will immediately help lift depressed markets," he said, adding that USDA projects $8.2 billion in losses for dairy producers, placing them among the hardest-hit U.S. agricultural commodities.

Alan Bjerga, senior vice president of communications for NMPF, agrees that USDA purchases have been crucial to restoring some of the lost food service supply chain. But while supply chains are adjusting and the country is reopening, which has somewhat restored the markets and curtailed milk dumping, more help is needed.

"Even the aid already allocated, while welcome and robust, doesn't make dairy whole," he says. "It will, however, help some producers make it through the crisis who may not have made it through otherwise."

What's Next?

USDA's financial programs are ongoing throughout the end of its fiscal year in September, and Congress and the administration continue to consider additions to federal assistance to food producers.

But Cathy Burns, CEO of the Produce Marketing Association in Newark, Del., says food insecurity didn't begin with the COVID-19 pandemic, and it won't end with it. "The pandemic has amplified these challenges, and the USDA program is one effort to address the immediate need," she says.

Burns says the word "unprecedented" has been used a lot over the past few months, and it really is the best way to describe the impact on the produce industry and many others. "While we have seen great disruptions in the supply chain in the past influenced by environmental issues, geopolitical factors, or safety concerns, we have never seen a situation where every point of the supply chain across the entire world has been impacted at once," she says.

She says the aid packages are aimed at helping farmers continue to grow fresh fruits, vegetables, and flowers, but they also help farmers get products to consumers who need them.

The cost of COVID-19 has been enormous: Burns cited projections that net farm income will be down more than $20 billion in 2020, with different commodities feeling different levels of impact. The agriculture economy was originally expected to grow 2.8 percent this year, she says, but now is expected to drop 2.2 percent compared with 2019.

"When it comes to fresh produce, products that have higher utilization in food service, like lemons, are likely to suffer greater losses than avocados or bananas," Burns says. "I believe we'll be calculating food waste and the impact to the industry for some time to come." ■

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Allergen Control

Allergen-Free Labeling and Novel Foods

The use of "allergen-free" claims is largely unregulated and requires careful consideration

BY **PHILIP JOHNSON, PHD, RICHARD GOODMAN, PHD, MELANIE DOWNS, PHD, JOSEPH BAUMERT, PHD,** AND **STEVE TAYLOR, PHD**

Consumer desires for simple, less processed, "natural" food products have led to the current increased popularity of "clean label" foods. Part of this trend includes the use of "free-from" labeling, pertaining to genetically modified components, gluten, allergens, or other attributes.

While generally appealing, free-from allergen claims can be particularly challenging because these foods especially appeal to consumers with food allergies who are at risk of suffering adverse reactions if these label claims are false or misleading. Free-from allergen claims, with the exception of gluten free, have no regulatory basis for, or even industry consensus on, what "allergen free" actually means. The potential for immediate, severe health impacts from incorrect allergen labels raises the bar for decisions about using such claims.

Because free-from allergen claims are not regulated, food companies may voluntarily choose to use such label statements. Sometimes, application of such claims is simple, e.g., canned tomato paste is probably, and always has been, peanut free and gluten free. But, if breaded tomato products are made in a shared facility with the tomato paste, then the decision becomes more complex. Our goal is not to advocate for or against the use of free-from allergen claims but instead to raise awareness of the issues that must be examined as the use of such claims is considered.

Food Allergy

Food allergy prevalence estimates vary but could be as high as 10 percent in the U.S., EU, Canada, Australia, and New Zealand. The prevalence of food allergies is unknown in many other parts of the world but is likely growing worldwide. Food allergy is typically controlled by avoidance, with many countries requiring the labeling of major allergenic foods by law. The lists of major allergenic foods vary among countries, but it is important to note that the allergenic foods that require labeling are not the only foods that may be allergenic. In the U.S., labeling of the "Big 8" allergenic foods is commonly thought to cover 90% of all food allergies in the country. Legislation requires labeling the presence of particular identified foods in a defined fashion but does not give guidance for indicating absence, or free-from-type claims. One exception is gluten free, which does have a regulatory definition. Gluten-free foods have been marketed for decades before the establishment of the regulatory definition, while other terms that have also been used for decades, such as "dairy free," have no regulatory definition. However, recent dietary trends have

precipitated a rise in the use of free-from-type claims for food allergens, including gluten free and dairy free.

Free-From Claims for Food Allergens

A number of free-from claims have gained in popularity in the U.S., EU, and elsewhere. Some claims are more definitive than others. Here, we list examples of some claims that are found in the marketplace, along with a few observations. Although such label claims are not regulated, they must not be false or misleading.

Free-from (specific allergen) (e.g., 'peanut free'). Given the need, under law and regulation, that certain allergens be labeled, the additional free-from claim implies additional precautions were taken to ensure the allergen indicated is not present. While the degree of care needed to support a free-from claim is not specified, prudent precautions might include assurance or testing to indicate that no ingredients contain the allergen, an absence of cross-contact risk if the allergen exists in the manufacturing facility, and the lack of agricultural comingling with the allergen.

Allergen free or free from allergens. In the absence of other information, these terms imply the absence of any risk of allergic reaction from any source. In current practice, corporate definitions might be restricted to absence of any major allergen, such as free of the Big 8. As discussed above, many foods not on the Big 8 list of allergens may cause allergic reactions. Thus, a corporate definition of the meaning of allergen free is recommended. Generic allergen-free claims are not allowed in Canada.

Allergen friendly. This label is similar to the allergen-free claim above, but with more nebulous language. In this case, not only is the meaning of the word "allergen" ambiguous, but "friendly" is too. As with the allergen-free designation, it is recommended that allergen-friendly claims be accompanied by a manufacturer's definition.

Dairy free. This is a frequently used claim and is of note because, in many cases, its use predates the current free-from consumer trend. Dairy-free labeling was originally used to support lifestyle choice or to enable lactose-intolerant consumers to avoid lactose. Currently, many dairy-free choices are not suitable for milk-allergic individuals, due in part to the very low amounts of milk needed to cause allergic reactions in highly sensitive individuals.

Lactose free is a preferred term when the product has no detectable lactose but contains milk proteins (casein or whey). Because lactose-intolerant consumers can tolerate small doses of lactose, the degree of care needed to manufacture lactose-free products is more achievable.

> "Free-from" allergen label claims are voluntary but must always be truthful and not misleading.

Non-dairy is a related claim and is unique among these examples as its use is covered by regulation in the U.S. Somewhat counter-intuitively, non-dairy ingredients and products must contain derivatives of milk, specifically caseinates, making them unsuitable for milk-allergic consumers.

What Does "Free From" Mean?

In the absence of regulatory definition, "free from" is most commonly taken to mean the absence of detectable residues. Regardless of whether an allergen-free claim is specific to one allergen or is more general, such a claim must be true within any definitions set by the manufacturer. Due to the positive nature of the claim, and the marketing of such products to a sensitive population, additional product testing for allergens is often included as a part of quality criteria. For multiple or general allergen-free claims, this may involve multiple tests for each product. In some cases (most notably for some tree nuts specified as allergens by FDA in the U.S.), commercial detection methods may not exist. It should also be noted that the sensitivity, specificity, and utility of analytical methods can vary greatly when used in different food matrices. Where methods are unavailable, or perform poorly, particular care must be taken to ensure that the possibility of contamination of the food with these allergens is negligible.

Novel Foods and Allergen-Free Claims

Novel foods, made with non-traditional ingredients and often targeting clean label consumer groups, are a tempting target for allergen-free claims. The novel foods in question may also be inherently suited to such claims by virtue of containing ingredients that are meant to replace known food ingredients (e.g., plant-based milks). Although such foods may not contain major known food allergens, most if not all have the capacity to cause allergic reactions in some individuals. Our previous article, "Will Novel Foods Cause Allergies? (*FQ&S* February/March 2020, p. 18), discusses the potential allergenicity of novel foods. Some novel foods may cause reactions in individuals sensitized to food allergens that the novel foods do not actually contain (cross-reactivity). The ability of insect-derived foods to elicit reactions in those sensitized to shellfish is relatively well known. Less well known, and still requiring further study, is the ability of some legumes (such as pea) to cause reactions in some peanut or soy-allergic subjects. Would a "free from shellfish" claim be suitable for a product containing insect protein? While there is scant guidance in regulation as to the treatment of cross-reactive foods, knowledge of the potential for cross-reactivity should be sought.

Additional Information for the Consumer

As we can see, allergen-free claims come with a set of issues arising largely from a lack of regulatory standards. Defining what is meant by claims and how they are verified and communicated to the consumer is key. This additional information cannot, in most cases, be adequately conveyed on product packaging. Many manufacturers making allergen-free claims therefore use their websites to provide additional detail. In this instance, an issue arises in a situation where consumers may see a claim on packaging, but may not refer to the website for additional detail that may be important to informing their product choice. Systems such as smart labeling technology, where information from a smartphone-scanned code on a label immediately produces relevant information and definitions, may help to address the

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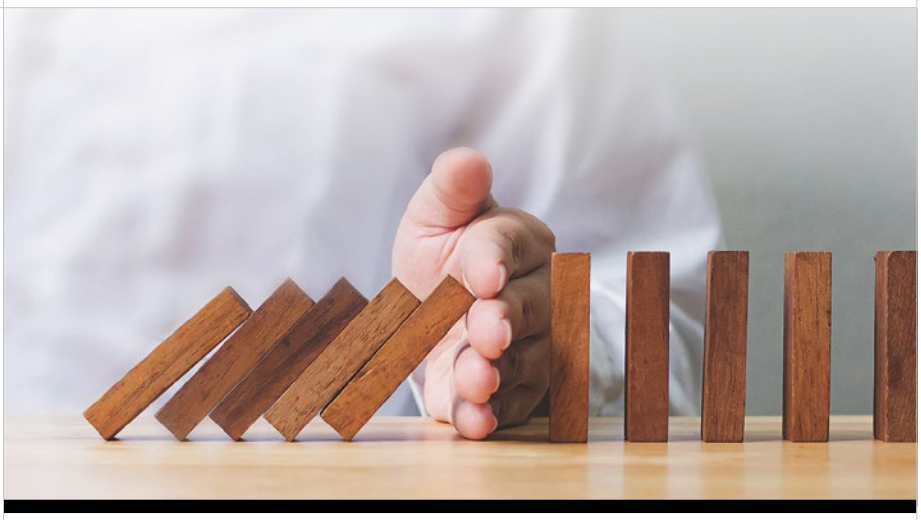
Food Defense



Food Defense Lessons Learned from COVID-19

How to prepare and respond to a future public health crisis involving our food supply | BY DAVID K. PARK

In January 2020, the U.S. was experiencing a growing economy and the lowest unemployment in years, and borrowing was at record low rates. We were on one of the "best rides" in recent years of economic growth when, abruptly, we were faced with a sweeping pandemic that we knew little about. Officially, American deaths from this disease have now reached a staggering 100,000; 40 million Americans have filed unemployment claims. Many Americans have unbridled accumulation of medical supportive care costs and are experiencing rampant food insecurity. Additionally, the U.S. government issued a massive federally funded economic assistance package, and at least one more package will soon follow.

A 2019 report from the Brown University Watson Institute of International and Public Affairs Cost of War Project entitled "United States Budgetary Costs and Obligations of Post-9/11 Wars through FY2020: $6.4 Trillion" stated that al-Qaida spent an estimated $400,000 to $500,000 to plan and carry out the successful terrorist attacks on New York City and Washington, D.C. For Americans, it has cost much more. The report estimated that War on Terror has cost the U.S. a total of $6.4 trillion through 2020. It is quite probable that the estimated cost impact of COVID-19 on domestic public and economic health may exceed the wartime costs that resulted from the 9/11 attacks, with some analysts conservatively estimating the cost to be $7 trillion.

For our food supply, managing public health outbreaks depends strongly on well-structured food safety and food defense systems, clear communication, and access to information—key components that determine an appropriate public response to global incidents as we have seen in past events, such as the melamine contamination that occurred in 2007 and 2008.

In any important food protection event, there is an urgent need to quickly provide the best available scientific information and knowledge about any incident. One food defense lesson we continue to learn is that there is never enough time to completely understand the magnitude of the problem, identified or unidentified, before choosing to inform the public health authorities and the public at large. Such preemptive actions can save lives and help to control the harmful extent of an outbreak.

While the fast-spreading, highly transmissible novel coronavirus caught most of the world by surprise, the scenario itself was not new. Through previous viral outbreaks in world history, we have learned that businesses large and small and, in particular, retailers (i.e., restaurants), which constitute approximately 20% of consumer spending in the U.S., would have been more prepared if they had had response and recovery plans in place. A disaster plan would include policies, including those preparing for a response to communicable disease, designed to keep employees safe and help keep businesses viable. Advanced preparation for such a pandemic would have reduced the number of illnesses, deaths, and business failures that have affected healthcare workers, first responders, and the general public.

Lacking clear policy and direction from political leadership, society has responded with massive intervention of medical supportive care, attempts to dismantle social unrest, and administeration of business and political triage.

Critical Infrastructure

It is a good moment to remind my readers that agriculture is designated as critical to public health and the nation's economy. According to the U.S. Government Accountability Office, the sector annually produces more than $300 billion worth of food and other farm products, provides a major foundation for prosperity in rural areas, and is estimated to be responsible for providing one out of every 12 U.S. jobs. As such, several directives have established national policies to defend food and agricultural systems from various types of emergencies.

Homeland Security Presidential Directive-9 (HPSD-9). In January 2004, President George W. Bush established a national Homeland Security policy to defend the food and agriculture systems

against terrorist attacks, major disasters, and other emergencies. HSPD-9 assigns federal agency responsibilities to enhance the nation's preparedness for food and agriculture emergencies. For example, HSPD-9 assigns USDA responsibility for four efforts related to emergency response and recovery, including serving as co-lead with the U.S. Department of Health and Human Services (HHS) to enhance recovery efforts.

USDA Emergency Support Function #11. Agriculture and Natural Resources organizes and coordinates federal support for the protection of the nation's agricultural and natural and cultural resources during national emergencies. As defined in the USDA Emergency Support Function (ESF) #11, USDA works during actual and potential incidents to provide nutrition assistance; respond to animal and agricultural health issues; provide technical expertise, coordination, and support of animal and agricultural emergency management; ensure the safety and defense of the nation's supply of meat, poultry, and processed egg products; and ensure the protection of natural and cultural resources and historic properties.

Homeland Security Presidential Directive-7 (HSPD-7). HSPD-7, entitled "Critical Infrastructure Identification, Prioritization, and Protection," established a national policy for federal departments and agencies to identify and prioritize critical infrastructure and key resources and to protect them from terrorist attacks.

Specifically, the policy was established in light of the following points:

1. Terrorists seek to destroy, incapacitate, or exploit critical infrastructure and key resources across the U.S. to threaten national security, cause mass casualties, weaken our economy, and damage public morale and confidence.

2. America's open and technologically complex society includes a wide array of critical infrastructure and key resources that are potential terrorist targets. The majority of these are owned and operated by the private sector and state or local governments. These critical infrastructures and key resources are both physical and cyber-based and span all sectors of the economy.

3. Critical infrastructure and key resources provide the essential services that underpin American society. The nation possesses numerous key resources, whose exploitation or destruction by terrorists could cause catastrophic health effects or mass casualties comparable to those from the use of a weapon of mass destruction or could profoundly affect our national prestige and morale. In addition, there is critical infrastructure so vital that its incapacitation, exploitation, or destruction, through terrorist attack, could have a debilitating effect on security and economic well-being.

It is not possible to protect or eliminate the vulnerabilities in all critical infrastructures and throughout the country by implementation of fail-safe improvements in food defense. From what we have learned with COVID-19, we can make it more difficult for a wide-scale attack to succeed and can lessen the impact of any intentional attacks on our food attacks that may occur.

NIMS. The Federal Emergency Management System released a refreshed version of the National Incident Management System (NIMS) doctrine on October 2017. NIMS provides a common, nationwide approach to enable the entire U.S. community to work together to manage all threats and hazards. NIMS is structured to apply to all incidents, regardless of cause, size, location, or complexity.

NIMS guides all levels of government, nongovernmental organizations, and the private sector to work together to prevent, protect against, mitigate, respond to, and recover from incidents. The doctrine provides stakeholders across the whole community with the shared vocabulary, systems, and processes to successfully deliver the capabilities described in the National Preparedness System. NIMS defines operational systems, including the Incident Command System, Emergency Operations Center structures, and Multiagency Coordination Groups that guide how personnel work together during incidents. I encourage you, as food industry, government, and academic readers, to re-review these important national incident management programs as they relate to your important role in the protection of food and agriculture.

COOP. Prepandemic, businesses that possessed a disaster response and continuity of operations plan (COOP) playbook are faring far better than others in facing these uncertainties. COOP is defined in the National Continuity Policy Implementation Plan and the National Security Presidential Directive51/Homeland Security Presidential Directive20. The model is a federal effort residing within individual executive departments and agencies to ensure that primary mission essential functions continue to be performed during a wide range of emergencies, including localized acts of nature, accidents, and technological or attack-related emergencies. Those who had no contingency planning have fared worse in this pandemic.

Preparing for the Future

So, what else can we do to learn from our COVID-19 experience and prepare for the continuing global disaster? Consider some of the following lessons learned from this pandemic so far, that are also useful as food defense lessons:

1. Whether you are faced with a natural disaster or unintentional or intentional attack on your food business, a pre-event preparedness, disaster, and COOP (i.e., resilience) plan is a business essential.

2. Leadership is particularly required in crisis and is critical to formulating and implementing disaster policy and procedure in both the government and private sector.

3. To maintain credibility and trustworthiness with the public, involve applied science and risk communication subject matter experts in conveying the facts to the public.

4. Do not speculate on what "might be" the facts of the event when communicating with the public.

5. Government mistrust generates citizen complacency in responding to a true public health threat.

6. Delay in decision making adds to the severity and public health mistrust in managing the given situation.

7. Clear and concise instructions must be communicated to all stakeholders in preparing for and responding to a public health emergency and must be consistently reinforced by all public officials.

8. Prompt coordination and communication among specific appropriate federal, state, and local government agencies in preparedness and response are absolutely required, based upon the actual public health event.

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Cannabis Corner

Testing, Testing ...

Measures to assure the safety of cannabis-infused foods and drinks are still in the early stages

BY **LORI VALIGRA**

Cannabis, a relatively new part of the well-established agriculture industry, brings with it novel challenges to the assurance that its use in foods and drinks for medicinal and recreational purposes will be safe for consumers. Businesses are showing a lot of interest in using various parts of the cannabis plant in edibles and beverages; one example is Ben & Jerry's, which said in 2019 that it planned to offer a cannabis-infused ice cream. U.S. sales of drinks infused with cannabidiol (CBD), a non-intoxicating chemical obtained from hemp, are expected to grow to more than $1.4 billion in 2023, up from $86 million in 2019, according to researcher Zenith Global's Beverage Digest. That's on top of sales of medical and other cannabis edibles.

Hemp and marijuana are in the same cannabis plant family, *Cannabis sativa*. The difference between them lies in the amount of the psychoactive ingredient tetrahydrocannabinol (THC) that they can contain. A key issue in widespread adoption of cannabis-infused products is that, on a federal level, cannabis and CBD-infused foods still aren't legal. That's partly due to health and safety concerns such as potential liver injury, drug interactions, male reproductive toxicity, and side effects such as drowsiness.

States where cannabis is legal each have their own requirements for product testing and remediation. That means a mold or yeast level in a cannabis flower may be acceptable in one state but not another. Mold and yeast are two of the main culprits causing cannabis products to fail a state safety test, but laboratories also test for other microbes, mycotoxins, pesticides, heavy metals, water content, residual solvents, and terpenes, which are the flavor and scent components of cannabis.

"A lot of regulations have been made in a very short period of time that aren't really based on too much scientific fact," says Ketch DeGabrielle, a cannabis consultant with Qloris Consulting in Boise, Idaho. Formerly, DeGabrielle was operations manager at Los Suenos Farms, a large-scale cannabis farm in Avondale, Colo. He specializes in designing harvest and processing systems.

DeGabrielle says that most states look at total numbers of yeast and mold in cannabis; however, some yeasts live compatibly with the cannabis plant and keep dangerous molds from taking hold, he adds. "So, looking at everything in totality, we're not really getting a whole picture that way," he says. "We're just saying it can't have 'x' amount of a certain fungus." But not all fungi or bacteria are harmful or will cause a health problem if infused into food or drinks.

Any moist cannabis plant can develop yeast or mold, just like other agricultural products, he says. When the cannabis plant is harvested, the bud or flower is wet, and it's important to lower the moisture content within seven days after harvesting. Cannabis and hemp are dried in different ways because the sun degrades the THC potency, and heat can diminish the taste and scent of the plant's terpenes.

Some states also test for *Aspergillus*, *Salmonella*, and *E. coli*, which DeGabrielle says is good practice because those microbes are all dangerous to people. But he and others say more specific testing of microbials needs to be done.

The Cannabis Microbiome and Testing

Brianna Cassidy, PhD, an analytical chemist at CDX Analytics, a cannabis testing laboratory in Salem, Mass., says there's a lack of knowledge of what is actually present in the microbiome of cannabis, because it is comparatively recent to the agriculture industry. "It can host a plethora of different microorganisms, but there's only been a few decades for this plant to be heavily studied," she said. "So, we have to figure out what living things are present that need to be tested for."

Two main testing methods currently are used for cannabis: DNA-based and growth-based methods. Growth-based methods involve plating so the microorganisms on the product can be grown, seen, and counted. The process can take weeks, but it is the gold standard in agriculture, Dr. Cassidy says.

Still, because it takes a while to grow microbes, that method has its limitations, she says. DNA-based methods are faster because they can detect microorganisms without requiring them to grow. "What we are doing is cracking open the cells of these microorganisms, getting the DNA, and quantifying it using fluorescence technology, which is extremely sensitive," she says. CDX Analytics also tests for 12 cannabinoids.

Massachusetts, where her company is based, requires certain tests at certain parts of the process. While a plant-infused product will be tested for potency, microbials, and mycotoxins, the plant itself will be tested for those three plus metals. "We see a lot fewer microbes on processed products than we do on raw plant materials," Dr. Cassidy says. "When you use an extraction process on a living plant the heat process helps kill any microbes that were present."

If a test fails, the cannabis grower can have the product retested or remediated. Remediation options include using light or ozone treatments or extracting the cannabinoids from the plant, she says.

Some growers choose to conduct their own pretests before submitting their product to a lab like CDX Analytics, which adheres to state testing requirements. "Our tests are being used in testing labs, but some growers are also buying our products now so that they can do a pretest before they send it out to be tested," says Heather Ebling, senior applications and support manager at Medicinal Genomics, a Beverly, Mass., company that makes quantitative PCR tests for testing labs to isolate DNA from a cannabis flower.

She says the pretests are a "heads up" as to whether or not the cannabis is going to pass, and if it's not, to conduct some remediation to decrease the number of microbes that are present. "Once you get a failing test you can actually ruin a whole batch or crop. It's pretty detrimental," Ebling says. "Some states do allow remediation, and they'll let growers have a second chance."

Like others in the cannabis industry, she recommends more species-specific testing of mold, yeast, and other microbes.

In Massachusetts the limit for a total yeast and mold test is 10,000 colony-forming units (CFUs) per gram, she says, adding, "So you could have 9,000 CFUs of *Aspergillus*, and it still will pass. But you don't know if its Aspergillus because while the microbe is triggering your total yeast and mold test, the test isn't telling you what the microbe is."

Remediating Cannabis

There are many products and techniques on the market that can help with remediation. Some are used as preventive measures, as a last step before the cannabis is tested. Others are used after a test fails.

The most common and cost-effective technique is to process the plant and extract the THC or CBD or both, says DeGabrielle. "That removes everything except the desired elements from the plant materials," he says. "Using fractional distillation, you can essentially remove impurities." It's a common technique in any type of agricultural product extraction, he adds.

Willow Industries, a Denver, Colorado-based cannabis remediation and decontamination company, sells systems that use ozone to mitigate mold and bacteria by essentially introducing a kill step. "Cultivators typically implement our technology as the last step in their production process, and then they send the product out to be tested to the licensed lab," says Jill Ellsworth, founder and CEO of Willow Industries. She says the ozone gas degrades microbial contaminants on the product.

> Mold and yeast are two of the main culprits causing cannabis products to fail a state safety test, but a mold or yeast level in a cannabis flower may be acceptable in one state but not another.

The company's product treats only the flower, which is the raw product, before it is tested to ensure that there are no pathogens remaining and that it will pass testing.

Other companies use other gases. For example, ClorDiSys of Somerville, N.J., uses chlorine dioxide gas and ultraviolet light to decontaminate all or part of a contaminated grow facility. Grow rooms, for example, are common locations for mold to spread from plant to plant, according to the company's website.

DeGabrielle recommends buying cannabis products from reputable companies that use testing labs. "With no federal guidance or oversight, consumers need to research their state's testing and see if it protects them. If not, they should advocate with the state for better testing," he says. "We need to develop systems and techniques that keep things from happening. We've successfully done that with pretty much every agricultural product we consume." ■

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COVID-19 TESTS THE FOOD SUPPLY CHAIN

The pandemic has pressured the food industry to quickly adapt to a rapidly changing world

BY **MARY BETH NIERENGARTEN**

For more news and analysis on how COVID-19 is impacting the food industry, visit foodqualityandsafety.com

The food industry isn't immune to disruptions in the supply chain. From weather events such as droughts and flooding that reduce crop yields to food contamination that mandates pulling a product from market, disruptions frequently occur. But the COVID-19 pandemic is uncovering a different type of interruption—one that doesn't affect just a single part of the supply chain or geographical location but is pervasive and unpredictable in its scope and duration.

"It's all new and confusing," says Kevin Paap, president of the Minnesota Farm Bureau, of the pandemic's effects. "It's unique in agriculture, as typically there have been strains and problems in one area of agriculture, but now it is best described as 'we're all in this soup together.'" As a fourth-generation corn and soybean farmer in Blue Earth County in southern Minnesota, Paap knows firsthand the stressors farmers face. He describes the current strain the pandemic is forcing on the food industry as a series of traffic jams and logistical challenges along the supply chain that continues to morph and pressure farmers and the food industry as a whole to adapt quickly.

He sees these challenges as a series of waves, with the first wave caused by the rapid change in consumer behavior as the demand for food shifted away from food service and restaurants toward retail amidst fears of the virus and stay-at-home mandates. This was followed by a wave of slowdowns in food processing and manufacturing plants as they restructured to deal with this shift in consumer demand.

The latest and third wave, says Paap, is the closure of plants as workers fall ill with COVID-19, disrupting the market for livestock and processing. Closures of pork and meat plants are a prime example of the challenges facing a sector of the industry that relies on a "just in time" inventory. Large hog farms operating on an "all in and all out" capacity, in which up to 18,000 to 20,000 pigs are slaughtered per day are now having to euthanize healthy pigs.

Paap underscored the emotional toll this has on farmers. "The last thing farmers want to do after caring for and spending money on animals is to euthanize a healthy animal and go through the emotional and financial strain of that," he says. A further strain on hog farmers is the responsibility of having to bear the cost of animal disposal.

Crops are also taking a hit, as is dairy, with reports of farmers plowing over acres of lettuce fields and dairy farmers spilling excess milk, all due to disruptions to the food supply chain caused by shifts in consumer demand and outbreaks of the disease among plant and field workers.

Although Paap echoes the prevailing message from USDA and FDA that food remains safe and secure, the food industry is feeling the acute challenge facing the world at large: how to balance the health risks of the disease with the economic disruptions of closing or slowing down production.

Worker Safety at Meatpacking Plants

"Over the years, meat processors have been better equipped to deal with food safety issues that arise from the food itself," said Rong Li, assistant professor of supply chain management at Syracuse University in New York, in an April 14, 2020 story in Food Safety News. "This pandemic, however, forces them to be equipped to deal with food safety issues that come from the employee and the shortage of labor."

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The number of workers falling ill bear this out. According to the United Food and Commercial Workers International Union (UFCW), the union that represents most workers in meatpacking and food processing plants, at least 5,000 meatpacking workers and 1,500 food processing workers have been directly affected by the virus, as of the end of April 2020. These numbers include those who have tested positive for COVID-19, those awaiting test results, those in self-quarantine and missing work, and those with symptomatic disease or in the hospital. Overall, at press time, the union reports 72 worker deaths from the virus.

But, the effects are much broader and deeper. More than a dozen meatpacking plant closures over the last few months have led to a 25% reduction in pork and 10% reduction in beef slaughter capacity that in turn has affected 45,000 workers. Another growing problem is absenteeism as workers simply stop showing up for work out of concerns of getting the virus under plant conditions they deem unsafe.

Ensuring the safety of workers is a main talking point heard from industry and government leaders. Chris Young, executive director of American Association of Meat Processors, says that the industry is working diligently to mitigate risks to employees, with many plants implementing preventive practices beyond the usual safety measures of complete daily sanitation of plants and use of virus-killing soaps and detergents. Extra measures include screening everyone who enters the plant and requiring masks. Some plants have implemented policies on social distancing on the slaughter floor or on production lines, but these remain challenging, he adds.

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These are some of the measures recently recommended by CDC and the Occupational Safety and Health Administration in their published interim guidance for meat and poultry processing workers and employers. The guidance emphasizes the need to identify a qualified workplace coordinator responsible for COVID-19 assessment and control planning whom workers can contact with concerns.

Still, more safety is needed. Social distancing is nearly impossible to implement in meat packing plants, given the close quarters in which workers labor. Common sense prevention measures such as mandating workers to stay home if they feel sick may be difficult given the multiple challenges of workers who often can't afford to lose wages and don't have health insurance or any type of safety net.

UFCW wants virus testing prioritized for food industry employees. The union is also requesting that meatpacking companies provide full sick leave for any worker infected with COVID-19, as well as adequate protective gear. It also wants companies to enforce social distancing among employees.

On April 28, 2020, President Trump signed an executive order stating that all meat processing plants were to reopen and stay open, designating them as critical infrastructure under the Defense Production Act. Under the order, plants will work with USDA to ensure compliance with the recent CDC/OSHA guidelines. Whether or not this will prioritize more testing and protective gear for workers is yet to be seen.

> Some of the biggest challenges are staffing and personnel concerns and how to manage a crew who will be planting, working in the greenhouse, and then harvesting and packing while maintaining social distancing guidelines.
>
> **ANNALISA HULTBERG, MS**
> **UNIVERSITY OF MINNESOTA**

Impact on Produce Farms and Smaller Processing Plants

Amid the headline news of how COVID-19 is affecting the meat industry are the ongoing acounts of what is occuring among produce farmers and small food processing plants that need to adapt as well due to shifting consumer demands, labor shortages, and changing markets.

Rong Li underscores that consumer shopping behaviors are changing, with more people consuming products deemed healthy, such as fresh foods, and most preferring local brands over international ones. Additionally, more people now prefer to shop online for groceries. "This means that the food supply chains should adjust rapidly, on product line and quantity, to meet the new customer behavior," she adds.

Farmers and processors are adapting. Tom Atherstone, founder of Glass Onion Catering and Gourmet Foods in Richmond, Calif., says that his mid-sized food processing plant, which produces fresh short-shelf life, premade products such as salads, wraps, and parfaits for major retail grocers, has seen a substantial 65% drop in business as their "grab and go" products are less in demand. "People are not on the go now; they are at home, so most aren't buying premade salads or wraps," he adds. To adapt to the loss, six administrative staff have been furloughed, as well as approximatetly 15 of 139 plant workers. The remaining 124 workers are working fewer hours. Luckily, he says, no employee has contracted the virus, but the concern weighs heavy on everyone. The usual preventive measures—including use of gloves, washing hands often, donning clean smocks, and using door sanitizer—are in place, but he acknowledged that "stepping it up a notch or two has been a little challenging." The company does constant intense clean up and sanitization, including a full plant sanitation after production hours that prioritizes traffic areas such as the lunch room and restrooms. He is also trying to obtain temperature gauges and masks but is having difficulty given the high demand and low supply.

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Atherstone says his 40,000-square foot USDA Safe Quality Food (SQF) Level 2 facility has seen an increase in a smaller catalog part of the business that provides frozen food online to retailers such as Williams Sonoma. One of the biggest challenges overall, he says, is adjusting to the unpredictable fluctuations in demand. "You really are living day by day," he said. "What we are doing here is focusing on today, celebrating a new purchase order when it comes in, and getting to tomorrow."

Produce farmers are also concerned about markets and sales, as well as worker safety. "Fruit and vegetable producers in Minnesota are facing similar struggles as many other industries right now," says Annalisa Hultberg, MS, an educator in food safety through the On-Farm GAPs Education Program at the University of Minnesota in Minneapolis. "Some of the biggest challenges are staffing and personnel concerns, and how to manage a crew who will be planting, working in the greenhouse, and then harvesting and packing while maintaining social distancing guidelines." Larger farms that employ many workers, including those with H-2A visas, are particularly worried about finding adequate labor to plant, weed, and harvest produce.

Many of the farmers she talks to are being proactive in mitigating the risk of COVID-19 to their operations, she says. On top of the usual safety measures, many are limiting the number of visitors and trying to implement physical distancing among workers. Some U-pick operations, like berry farms and apple orchards, are adjusting by limiting the number of people allowed to pick at one time, enforcing physical distancing, and increasing handwashing stations while they await guidelines for further direction.

For some farmers, sales are increasing. Protein farmers and fruit and vegetable CSA (community supported agriculture) members are seeing more interest in their products, with an increase in pre-orders, says Hultberg.

Some Good News

Peter O'Driscoll, executive director of Equitable Food Initiative (EFI), a Washington, D.C.-based consortium of food industry stakeholders, says the growers in his network have not yet seen large disruptions due to the virus. Members of the consortium, which sells to both foodservice and retail buyers, have shifted sales to retail with the collapse of foodservice demand. He says that EFI-certified growers have not seen outbreaks among workers that have led to labor or produce shortages. These growers are being proactive to protect workers and avoid labor shortages. "A number of suppliers we work with have encouraged older workers to stay home with pay, which is huge," says O'Driscoll. Some suppliers are also trying to identify workers at high risk of contracting severe illness from COVID-19 and offering them the option of staying home with reduced pay or reducing their work load or exposure.

When asked about the financial sustainability of this approach, he emphasizes measures put in place prior to COVID-19 that strengthened EFI growers' ability to implement social distancing measures in response to the pandemic. A key measure and aim of EFI is to drive workforce development within the produce industry, he said, which includes a new approach to labor.

As in many sectors of the economy, COVID-19 has laid bare the impact of worker vulnerability on the food supply chain. "For the produce industry to survive the pandemic, you need to professionalize the workforce," says O'Driscoll. One way to do this is for farms to create a worker-management committee to solve problems that arise, such as COVID-19. These teams are comprised of members from across the workforce, such as pickers, sprayers, quality control individuals, irrigators, and managers, and are trained by EFI in problem solving, conflict resolution, and communication strategies. "This was our basic tool before COVID-19," said O'Driscoll. "When COVID-19 hit, our growers said they had the worker-manager dialogue piece ready to go and they were able to talk to their leadership teams about the crisis and how to make the real mitigation steps work."

Going forward, and as the pandemic plays out, more innovative ideas about strengthening and improving the food supply chain will undoubtedly emerge. As in other sectors of society, the current public health and economic upheaval is uncovering multiple weaknesses and vulnerabilities along the food supply chain, providing, and even mandating, new thinking on some very old problems.■

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Setting Up Environmental Monitoring Programs

Best practices for integrating an EMP into your food safety efforts

BY **JOHN DAVID**

Food safety programs have depended on hazard analysis and critical control points (HACCP) programs to ensure the safety and quality of food products. Processors start by conducting an analysis of potential hazards, whether that be contamination by pathogens, allergens, or other contaminants that could compromise the integrity of the product, and then work to identify a specific critical control point (CCP) for any given hazard of concern. The specific parameters that allow for effective control of the target hazard at the given CCP are firmly and clearly established and then are monitored on a defined timeline.

As most food safety professionals are well aware, HACCP has long required "prerequisite programs" be in place to ensure that the food safety and quality systems being implemented are working correctly. These prerequisite programs can include anything from proper sanitation procedures to good employee hygiene practices to pest control. If even one of those prerequisite programs relied on to keep food safe isn't applied correctly, however, or if the system of prerequisite programs in a processing facility is not designed comprehensively or verified to be effective, this leaves a window open for food contamination.

The food industry and consumers have become increasingly concerned with food safety and quality. As a result, the food industry and its regulators have more recently heightened their emphasis on environmental monitoring programs (EMPs). Conceptually, environmental monitoring may serve as either validation or verification of specific prerequisite programs or may be more generally seen as a strategy to monitor the environment for unhygienic conditions.

The increasing importance of EMPs is particularly well illustrated by recent changes to regulatory approaches to food safety. The Food Safety Modernization Act (FSMA) and similar regulations in other countries have elevated the importance of prerequisite programs. For example, in the FSMA Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Food Rule (PC Rule), many of the specified "preventive controls" represent programs that would have previously been classified as prerequisite programs. However, FSMA preventive controls include a requirement for verification of the preventive controls, which was not in place for prerequisite programs.

Additionally, the FSMA PC Rule includes a specific recognition of environmental monitoring as a key verification strategy for certain nonprocess preventive controls such as sanitation. The rule states: "Environmental monitoring, for an environmental pathogen or for an appropriate indicator organism, if contamination of a ready-to-eat food with an environmental pathogen is a hazard requiring a preventive control, by collecting and testing environmental samples." This pro-

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vision demonstrates the growing consensus on the importance of environmental monitoring programs as an essential part of food safety and quality systems.

Effective EMPs

Exactly how EMPs should be designed and executed—from the frequency and process of sampling to which test method or technology is fit for the purpose to how results are reported and acted upon—is highly variable depending on each facility, the prerequisite programs used, the product(s) produced, and other factors. Regardless of the specifics of the program, the effectiveness of any environmental monitoring program and, by extension, a total food safety program, is most often determined by a company's willingness, engagement, and commitment to taking a preventive mindset toward food safety.

John Butts, PhD, a member of the *FQ&S* editorial advisory panel, president of FoodSafetyByDesign, and advisor to the CEO of Land O'Frost, has described a model for control of *Listeria monocytogenes* in meat processing called "seek and destroy" and an overarching concept of microbiological or environmental process control. Environmental process control contains three steps: elimination of the resident organisms of concern from the processing environment, management of the vectors and pathways within that environment, and use of process control methodology to measure and predict loss of control.

Environmental process control uses environmental monitoring as a key tool. Environmental monitoring measures the risk present in the processing environment and also assesses the hurdles established to control entry of pathogens. This requires multiple sites in the processing environment to be sampled individually and in conjunction with one another. These results indicate the level of control in the facility and help identify when failures occur or when interventions or additional actions are required to bring the process back with control parameters.

However, achieving a high level of environmental process control is not an easy task and requires full cooperation throughout the organization. The relationship between effective EMPs and an organization's culture is more significant than most food safety practitioners and business leaders realize.

As such, concern can spread quickly throughout a food company when positives are detected through verification activities, especially in cultures where food safety activities are largely completed by food safety professionals. Food safety in these stages is crisis management driven, with leaders stressing the importance of "doing things right" while conducting investigations that fail to get to the root cause.

The development of such effect-driven behaviors that wait for a crisis to engage operations professionals is harmful to consumers, brands, and overall company financial performance. No matter the industry, for an EMP to be as successful as possible, organizational alignment from the food safety experts all the way to the

C-suite should ensure that the primary goal of any monitoring program is to proactively and transparently find, correct, and verify problems before they happen, and positive tests are a necessary part of that process. Linking EMPs to organizational and food safety culture can create a "line of sight" to the corporate vision and values, down to individual behaviors, enabling a preventive mindset to help protect consumers, brands, and financial performance.

Effective EMPs, particularly those linked to specific goals such as sanitation validation and verification, can significantly reduce the risk of contamination and associated recalls. For example, good environmental monitoring data are often essential to allow companies to limit recalls to a single lot, production day, or production week. Without appropriate validation and verification data, it is challenging to sufficiently prove that finished product contamination on a given day could not have been transferred to subsequent lots. In addition to food safety hazards, spoilage issues (including problems caused by organisms introduced from the environment in processing plants) represent a growing business risk for food companies. Consumers often use social media platforms to communicate food spoilage issues and pressure companies into action.

Therefore, the business needs for EMPs represent another benefit to food companies. It's widely known that recalls are extremely costly for companies; despite this given, quantification of the benefits of EMPs is still often considered challenging. As foodborne disease surveillance systems continue to improve, companies are being placed at an increased risk of being identified as the source of an outbreak.

However, food companies have also seen that effective EMPs can facilitate extended run times, thereby improving production efficiency. For example, environmental monitoring may identify difficult-to-clean areas that can be eliminated through equipment redesign, which will subsequently allow for longer production runs.

With renewed industry focus on the programs underpinning HACCP and a greater understanding of the important role environmental monitoring plays in delivering safe products to consumers, it is imperative that food manufacturers regard EMPs as critical and invest the resources necessary to ensure effective execution. Once implemented, it is also vital that the programs evolve with the organization to continuously improve and to foster an effective and positive company culture surrounding food safety.

For more detailed guidance, Cornell University and 3M recently partnered to develop the first comprehensive Environmental Monitoring Handbook for the Food and Beverage Industries, a free resource to guide any processor on how to create a rigorous environmental monitoring program that's mindful of employees, regulators, and consumers in this safety-conscious time. ■

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Developing a HACCP Plan

This science-based, systematic approach to food safety continues to provide a valuable process for manufacturers

BY **THOMAS AUER**

The hazard analysis and critical control points (HACCP) system was established in 1959 by NASA to protect food for astronauts in space. It is a science-based systematic approach and risk assessment tool designed to identify and assess specific hazards, including chemical, microbiological, physical, and, now, often radiological hazards. Its focus is on control and prevention throughout the food production process, instead of reliance on finished product testing alone.

As a result of its initial success, the process was soon adapted to include not only "space food," but also traditional food production. Given the fact that HACCP was first developed more than 60 years ago, is this method now an outdated risk assessment tool?

Over the years, the approach to HACCP use has changed slightly. In the past, a large number of critical control points (CCPs) were often identified and defined in food facilities. Now, the tendency is to limit these CCPs and ensure that they are each continuously under control.

To conduct a HACCP assessment, the Codex Alimentarius suggests 12 steps:

1. Assemble a multidisciplinary team;
2. Describe the product;
3. Identify the indented use, including consumer groups and vulnerable groups such as infants;
4. Construct a flow diagram;
5. Perform an on-site verification of the flow diagram;
6. Conduct a hazard analysis;
7. Determine the CCPs;
8. Establish critical limits;
9. Establish a system to monitor and control the CCPs;
10. Establish corrective action for any case in which the CCP is not under control;
11. Establish a verification procedure to confirm that the system is working effectively; and
12. Establish documentation concerning all procedures and records appropriate to these steps.

Based on the questions most often asked by manufacturers, a number of these steps warrant additional consideration and clarification in the development of your HACCP plan.

How do I conduct the hazard analysis?

As defined by the Codex Alimentarius, the analysis needs to be conducted by a multi-disciplinary team. The team approach is important to bring different experiences, knowledge, and backgrounds to the process. Involving a technical manager will provide different experience and areas of focus than that of a production manager. A quality manager can then include points from literature and scientific information, which are necessary in a HACCP study

to demonstrate that more than just site knowledge is used to inform the process. This diverse team approach supports completion of a well-rounded analysis.

To ensure a good understanding of the basics of the HACCP philosophy, training is also key. The first group in need of training is the core HACCP team, as they will need a detailed understanding of the hazard analysis process and each step of the assessment. The next training group will be those responsible for conducting CCP controls, as they need to know why they are conducting the check and how to best do so. They will also need to know the consequences of improperly completing the check, which may lead to severe health issues for consumers. It is also crucial for this group to understand that if there is any problem or issue related to a CCP, they may need to withhold or recall products from distribution and also then work with their teams to adequately address the problem. To fully implement your HACCP plan, all production employees will need to have completed basic HACCP training so that they understand why such a risk assessment is done and the consequences if it is not properly executed.

Is it sufficient to check only for the intended use of the product? While the intended use should be the focus of your plan, unintended uses should also be taken into consideration. This does not mean that you'll need to check every bizarre idea about the potential use or misuse of the product. You will, however, need to consider those that are likely to occur. A good example of a likely unintended use is marshmallows. These fluffy treats are not only directly consumed; they can also be heated by microwave or grill, and recipes are published regarding this use. The hazard analysis process should take this unintended use into consideration. If there could be a risk from this heating process, the formula may need to be changed or a warning will need to be published on the product label, stating that the product is not intended for heat treatment.

How do I identify a CCP? The determination of CCPs can be done with the help of a decision tree. This process will guide the HACCP team through a series of questions to help define whether the step is a CCP or not and whether there is a further process step that can prevent, eliminate, or reduce the risk to an acceptable level. This important question helps focus the process on the critical production steps.

Are there rules for the monitoring of CCPs? For the monitoring and control system, a continuous control is often requested. This could involve a process such as permanent temperature control, including pasteurisation and sterilisation. However, controls such as strainers can also be regarded as permanently controlled units if they are checked prior to production and are also in good condition after the production run. This means that, throughout the duration of the production shift, the strainer was in place and all product was properly strained. However, to properly manage it as a CCP, the controls of that strainer need to be completed during the shift, before the product is released, and while it is still the responsibility of the facility. If the product is released automatically 24 hours after production, but the strainer is only checked at the end of the week, it is not an adequate and allowed control of a CCP. In this case, it would be required for the strainer to be checked following each shift, or daily, before the product is released.

Do corrective actions need to be predefined? Prior to any incident, it is mandatory for the HACCP team to clearly define the corrective actions that would be taken in case of a non-compliant CCP. The team will need to discuss and define the possibilities for either the retreatment or destruction of the product in question. For example, milk that isn't properly pasteurized could be sent back through the process to be pasteurized again, but only after the equipment is cleaned and working properly. Other products, such as one that passes through a free-fall metal detector and is packed in a metallized packaging material and cannot be unpacked and repacked again, will have to be destroyed, as there is no retreatment possible for that product. In a case where a rework is possible and not too costly, the control frequency of the metal detector should be much more frequent, as it should ultimately save product and resources. The advantage of defining these corrective actions prior to an incident is that it can be done in a calm environment, rather than the "panic" mode of an incident or crisis situation. Making senior management aware of this process will gain their support for the consequences of a failed CCP and the defined corrective actions.

What do the verification procedures include? The first verification check is the responsibility of a supervisor or other trained and identified individual or individuals on the team. These controls need to be completed as defined in the HACCP plan. This includes verification by set timelines, whether hourly, by shift, or otherwise as predetermined in your plan. The next level of verification is the control that the calibration of the equipment used is done in the defined frequency, such as the temperature probe calibration for a pasteurizer or the proper calibration of test probes for the metal detector.

The last level of verification/validation is the analysis of complaints that should have been eliminated by the defined CCP controls. For example, if the company has defined 2.5 mm as the critical limit for the metal detector check and there are no metal complaints larger than 2.5 mm, that means the system is working properly. However, if there are several complaints of metal parts between 1.0 and 2.5 mm, the HACCP team should further analyze whether the critical limit of 2.5 mm is an adequate limit to control the risk. For many companies, this verification/validation step is completed, but not necessarily to the required level to control the risk. This step is crucial to finish the cycle of the risk assessment and adequately define further control steps or other limits as needed.

Even though the HACCP method was first established more than 60 years ago, this science-based, systematic approach and risk assessment tool continues to provide a valuable process for manufacturers. By effectively identifying and controlling risks through the production process, the method can help ensure that food is safe. It also helps companies reduce the risk of product recalls and damage to their brands, saving them those costs and ensuring consumer trust in today's food supply chain. ■

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ATP Monitoring Can Help You Adjust to Food Safety's New Future

In the age of COVID-19, monitoring processes for cleanliness have never been more important

BY **FERNANDO MORA**

No evidence so far shows that SARS-CoV-2 can spread through food. While comforting, that fact has not prevented major changes in food supply chains, customer demands, and safety strategies since the COVID-19 outbreak.

In March 2020, the European Food Safety Authority (EFSA) declared that "experiences from previous outbreaks of coronaviruses ... show that transmission through food consumption did not occur. At the moment, there is no evidence to suggest that coronavirus is any different in this respect."

Fast forward from that statement to today, and there's still no evidence of foodborne transmission. However, consumers have been barraged by news and social media messages about how they could contract the virus, and many now distrust any supply chain, including food. As the world looks toward returning to a more normal, working, and economically thriving society, monitoring processes for cleanliness have never been more important.

Consumer Contamination Fears on the Rise

A recent Nielsen Global Intelligence poll showed that a sizeable number of respondents did not trust the source of fresh produce, meats, and other foods. The consultancy Campden BRI group reported that retailers are getting more questions about the national origin of their ingredients and the length of time a virus can last on surfaces, and that there is a general lack of understanding of how viruses are transmitted and what basic food hygiene steps have been in place for years. A smaller but still worrisome number of people claim to have taken to washing their fresh food with soap and water, a practice that is strongly discouraged by the World Health Organization (WHO), the U.S. Centers for Disease Control and Prevention (CDC), and other public health authorities.

At the same time, the food industry has faced major adjustments in response to the virus outbreak. Sales of shelf-stable foods and drinks have surged in the United States since March 2020, including an 84 percent increase in powdered milk during one week in February, according to another study by Catalina Research. At the same time, plant based, shelf-stable milk sales shot up 323 percent. Sales of bread, eggs, rice, beans, and frozen foods have also increased, while interest in fresh produce has dropped or has remained steady. In addition, since most restaurants are closed to sit-in dining, foods normally shipped to them have been diverted to grocery stores and consumer markets, creating new supply relationships and, with them, new challenges in maintaining safety. USDA has had to relax package labelling requirements to ensure a supply of food to grocery stores.

Start—but Don't End—with Handwashing

Standard hygiene practices such as washing hands, cooking meat thoroughly, and avoiding potential cross-contamination between cooked and uncooked foods are still the mainstay of food safety. But processors, retailers, and restaurants alike will have to do much more to prove to a suspicious (and potentially fearful) public that they can safely buy products.

"Consumers will be seeking greater assurance that the products they buy are free of risk and of the highest quality when it comes to safety standards and efficacy, particularly with respect to cleaning products,

antiseptics, and food items," wrote Regan Leggett, executive director of Nielsen. "In the short term, this intensified demand from consumers will require manufacturers, retailers, and other related industry players to clearly communicate why their products and supply chains should be trusted. In the longer term, and dependent on the eventual scale and impact that COVID-19 has on consumer markets, it may speed up a re-think on how shoppers evaluate purchases and the benefits that they see as the key factors to consider."

Regardless of the viral outbreak and its impact on food supply management, risks from bacterial, fungal, and other contamination have not disappeared. One in six Americans get sick from eating contaminated food every year, and FDA and USDA continue to report recalls and alerts about microbial outbreaks. Approximately 3,000 Americans die from food contamination each year, and illnesses cost businesses more than $15 billion a year.

ATP Maintains Current Safety, Helps Build Consumer Trust

Many methods help detect and remove the threat of foodborne infection, including visual inspections, cell culture, and whole genome sequencing. But these all come with disadvantages, ranging from the incompleteness of visual inspection, the expertise (and expense) needed to perform sequencing, and the time necessary to retrieve cell culture results.

One method of hygiene monitoring—detecting adenosine triphosphate (ATP), the energy-delivering molecule in every living cell—is a proven, simple, cost-effective, and rapid first line of defense in food safety monitoring and hazard detection.

Because viruses do not contain ATP—instead they hijack other cells' metabolic structure and reproduce using the host cell—ATP monitoring systems cannot detect viruses; however, reducing the possibility of bacteria and other host cells from surfaces reduces the risk of contamination, including viruses. In addition, because SARS-CoV-2, like other coronaviruses, is susceptible to strong disinfectant chemicals, a rigorous and thorough cleaning plan can help defend against COVID-19. In fact, CDC and WHO have advised businesses specializing in food, as well as airlines, hospitality companies, and offices, to adopt a more aggressive cleaning and disinfecting program. Environmental Protection Agency (EPA), along with providing a list of disinfectants approved for used against SARS-CoV-2, has also advised a three-fold reduction in contamination levels on all surfaces that contact products or members of the public.

Since viruses do not contain ATP, ATP monitoring systems cannot detect viruses; however, reducing the possibility of bacteria and other host cells from surfaces reduces the risk of contamination, including viruses.

Ideal Monitoring Systems

For food safety professionals, ATP monitoring delivers on several areas that they have prioritized—faster time to results, accurate readings, reproducibility, actionable data, simplicity of use, lower costs per test, and reliable equipment. Instruments like the Hygiena EnSURE Touch Monitoring System deliver ATP results, expressed in relative light units (RLUs), in 10 seconds.

ATP monitoring instruments are invaluable for their ability to fulfill these needs, and they generate reports, graphs, and charts that help management make cleaning improvements, train personnel, and clearly illustrate performance. Once testing has begun, results can be immediately analyzed to give feedback on cleaning performance and areas for improvement. This is crucial for adjusting methods to meet new supply chains and customer demands. A good ATP system should be easy to use and should include:

- Wi-Fi capabilities and wireless sync technology for secure data transfer to analysis software.
- Ample collection and storage of important testing data such as sample location, line name, cleaner used, date and time stamped, secured access, and surface type.
- Built-in screen sharing to train remote teams; ATP has been shown to be a valuable tool for education of staff and a powerful way to reinforce a facility's cleanliness and safety culture.
- A responsive shatter-proof touch screen that works while wearing gloves; this ruggedness expands the range in which it can be used.

Just as important as the measuring instrument are the test devices used to collect samples. These need to be convenient to use, have a low risk of cross-contamination, and be able to effectively collect residues. Test devices should be integrated, should be all-in-one and ready to use, and should contain liquid-stable reagents. Test devices should be available for solid surfaces and for liquid samples such as CIP rinses and other water samples. They should have a simple activation step and tolerate ambient temperature abuse.

Government and Public Expectations

USDA and FDA do not endorse a specific technology or brand-name product under the implementation of FSMA, but, like nearly all government agencies, they do mention in certain guidance documents the array of sanitation/cleaning monitoring technologies available, including visual inspection, bioluminescence tags, and ATP detection.

The agencies want to see actions taken when data is out of specification and documentation of efforts to prevent contamination, adulteration, allergen exposure, and other aspects of food safety. How efforts are carried out will vary with each food manufacturer, distributor, farmer, or other part of the supply chain (including import/export).

It's important to emphasize that ATP does not directly measure any specific microorganism (like bacteria, fungus, or molds) any more than it can detect a virus. Nor is a "zero" RLU reading particularly helpful by itself, because machines and surfaces are different and baseline values need to be set. However, as consumers become more selective in what food they purchase, quantifying and validating your cleaning efforts will be essential to maintaining a healthy supply line and, ultimately, to your brand's success. ■

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Quality

How to Ensure Quality in Frying

The key to producing high-quality fried food is maintaining the oil in the best condition for as long as possible

BY **RICHARD F. STIER**

Editor's note: *This is the first in a series of three articles on frying. Subsequent articles will be published in the August/September and October/November issues of* FQ&S.

Fried foods are enjoyed the world over. Each country has fried items that may be acknowledged as favorites or comfort foods. There are churros in Mexico, schnitzels in Austria, fish and chips in England, and dumplings in China. Yet according to Dr. Walter Clark, "The popularity of fried food persists in spite of public concern about calories, cholesterol, and saturated fat and that fat intake should be moderated as part of a balanced diet." This sound like a recent statement? You would be wrong. This is from a 1991 paper in *Food Technology*.

So, why do frying and fried food persist? There are two reasons. The first has already been alluded to: Fried foods taste good. Properly prepared fried foods have wonderful flavors, textures, smells, and mouthfeel. People simply enjoy good food. The second reason is more practical. Frying is a very efficient means for preparing foods, which not only will fully cook the food but will also help to ensure its overall microbiological safety. To fully cook a piece of chicken in an oven might take 30 to 35 minutes, whereas cooking that same piece of chicken in a deep-fat fryer might take 4 to 6 minutes. For a restaurant or foodservice operator, time is literally money. The phrase "properly prepared fried food" is used intentionally. The food industry at both the industrial level and for foodservice and restaurant operators relies on repeat sales, so food quality is an essential element for success. So, quality management in frying is an essential business tool. In fact, the importance of food quality, especially the sensory parameters, was underscored by the first of the eight recommendations that came from the 3rd International Symposium on Deep-Fat Frying in 2000 (see "Recommendations of the 3rd International Symposium on Deep-Fat Frying," p. 38).

> *"Principle quality index for deep-fat frying should be sensory parameters of the food being fried."*

At the 10th International Symposium on Deep-Fat Frying, held in Hagen, Germany in March 2020, participants emphasized the importance of food quality by citing the 2000 symposium and making the same statement the symposium's first recommendation.

Michael Blumenthal, PhD, was one of the first to look at frying using a systems approach. He described frying as a dehydration process and proposed that the process be defined using a five-phase frying quality curve (see Figure 1). The five phases are break-in, fresh, optimum, degrading, and runaway. To ensure the best quality food, processors and foodservice/restaurant operators should strive to maintain their oil in the optimum phase for as long as possible.

Elements of Frying Quality Management

So, how do fryer operators best maintain food quality? The key is properly managing the frying oil. There is a very simple equation: Bad oil equals bad food. Oil chemists have tended to focus on the degrading oil, but as Dr. Blumenthal's work emphasizes, the key is a systems approach. Understand how to manage the different elements making up fryer operations. Canadian scientist Dr. C.J. Robertson (1967, 1968) described six areas to ensure the quality of fried foods. These recommendations, seen below, are more than 50 years old but still apply to frying operations:

- Proper design, construction, and maintenance of equipment;
- Proper operation of equipment;
- Properly cleaning of equipment;
- Minimized exposure to UV light;
- Salt and other metals sources kept away from oil; and
- Regularly filtered oil.

In 1993, Stier and Blumenthal proposed that a seventh principle be added. They suggested that oil be tested regularly. This recommendation was reiterated in the 2000 recommendations shown in "Recommendations of the 3rd International

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Symposium on Deep-Fat Frying" (see p. 38). Of course, fryer operators must select the proper frying oil for their operation and ensure that the oil that is delivered to them meets the established specifications. Selecting the proper oil is a topic unto itself.

Let's examine these different elements and learn a bit more about quality frying.

Design, Construction, and Maintenance of Equipment

Buying equipment that is easy to operate, clean, and maintain makes everyone's life easier. This is especially important in foodservice and restaurant operations since the people who will be operating those units are not highly skilled. In industrial operations, fryers must be properly designed and sized for the product and scheduled volumes of food being fried. Operating an industrial fryer at less than capacity will damage oil, and hence, food quality. If an industrial operator is not sure of volumes, it would be better to buy a small fryer and operate at full capacity.

And, when purchasing equipment, potential buyers must look at basic principles of sanitary design to ensure safe and hygienic operations. The American Meat Institute has defined 10 basic principles for sanitary design of equipment. Any decisions to purchase equipment for industrial frying operations should incorporate these principles into the decision-making process (these are available at meatinstitute.org/ht/a/GetDocumentAction/i/97261).

Proper Equipment Operation

Each fryer, whether purchased for industrial operations or a restaurant, will come with a detailed operating manual. This must be followed to ensure the best quality food and efficient operation. One of the key elements when operating fryers is managing temperature. Ideally, fryers should be operated at temperatures as low as possible to ensure the production of high-quality foods. Raising temperatures by 10 degrees C will double the reaction rates and, therefore, the rate of oil degradation. So, increasing operating temperatures is never the answer to an operational issue. Another key element for maintaining oil quality is how down time is managed. It is best to drop the temperature in the fryer during lunch breaks or slack times in restaurants.

Properly Clean Equipment

It is imperative that fryers be properly cleaned when needed. The product mix, type of product, equipment operation, and frying processes all have an effect on how dirty a fryer might get. One of the major concerns is polymer formation on the surface, which means that aggressive cleaning chemicals such as sodium hydroxide-based cleaners must be employed. Most cleaning compounds contain materials such as sodium or calcium salts. The cleaning process must not only remove the soil, but also make sure that cleaning chemical residues be removed. The progression of cleaning, therefore, would be as follows: Empty the fryer, rinse to remove gross soil, implement caustic cleaning, drain the fryer, rinse to remove cleaner residue, and, finally, use an acid rinse to neutralize and remove any residual cleaner. The last step should be a water rinse. It is imperative that the system be properly drained. If any water remains in the fryer, there is a potential safety issue. If there is a significant amount of polymer on the surfaces of the fryer, it must be removed by scrubbing. If an operator fails to remove soap residues and moisture, that residue will react with the cooking oil and water to form soaps. Soaps will act as prooxidants with the potential to damage the oil and reduce its useable life.

Minimize Exposure to UV Light

UV light will catalyze oxidation of fats and oils at the double-bonds in the unsaturated triglycerides. The end result of these reactions may be compounds that will act as prooxidants that will further damage the oil. The answer to this issue is simple—select lighting that does not generate ultraviolet light. Avoid fluorescent lighting.

Keep Salt and Other Minerals from Oil

Metals will also catalyze oxidation reactions. When looking at the reactivity of metals, the progression of reactivity is:

Copper > Brass > Iron > Zinc > Stainless Steel > Magnesium > Calcium > Sodium

Equipment design and maintainance will contribute to the potential for exposure to metals. As an example, on an industrial frying line producing potato chips, the seasoning reel will be located far enough from the fryer so that seasoning will not get into the oil. In a restaurant, one should never season or salt fried foods while they are draining after being removed from the fryer.

All fryer, including those that are used industrially and those used in foodservice and restaurants, should be constructed from stainless steel. This must include all plumbing. If valves or fittings have to be replaced, replacements must be stainless. A sure way to destroy frying oil and the product being fried is to use a brass or bronze fitting instead of stainless steel.

It has already been mentioned that metals in cleaning compounds will react with oils in the presence of water to form

(Continued on p. 38)

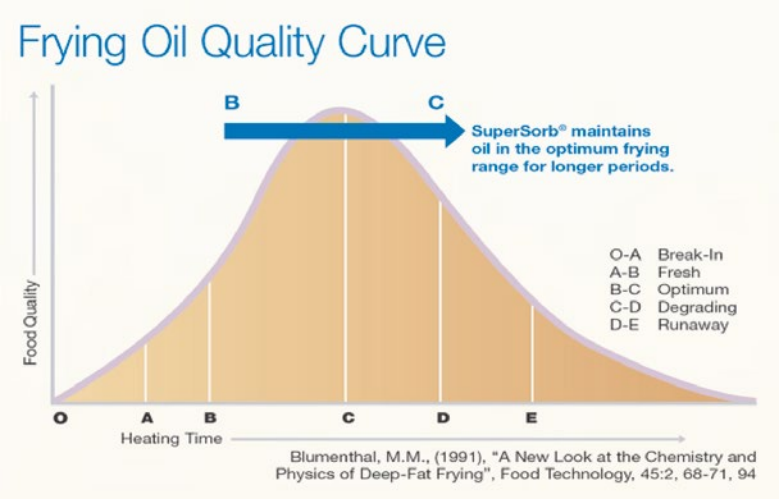

Figure 1. Blumenthal's Frying Oil Quality Curve

CREDIT: COURTESY OF FILTERCORP

(Continued from p. 37)
alkaline soaps, which are significant prooxidants.

Recommendations of the 3rd International Symposium on Deep-Fat Frying

1. Principle quality index for deep-fat frying should be sensory parameters of the food being fried.
2. Analysis of suspect fats and oils should utilize two tests to confirm abuse. Recommended analyses should be:
   - Total polar materials (<24%)
   - Polymeric triglycerides (<12%)
3. The use of rapid tests for monitoring oil quality is recommended:
   - Correlate with internationally recognized standard methods;
   - Provide an objective index;
   - Be easy to use;
   - Be safe for use in food processing/preparation area;
   - Quantify oil degradation; and
   - Be field rugged.
4. Affirming previous work: There are no health concerns associated with consumption of frying fats and oils that have not been abused at normal frying conditions.
5. Encourage development of new and improved methods that provide fats and oils chemists and the food industry with tools to conduct work more quickly and easily. Work should strive to develop methods that are environmentally friendly, and using lower quantities of less hazardous solvent systems.
6. Encourage and support basic research focused on understanding the dynamics of deep-fat frying and the frying process. Research should be cross-discipline, encompassing oil chemistry, food engineering, sensory science, food chemistry, and nutritional sciences.
7. One of the basic tools to ensure food and oil quality is the use of filtration. Filter materials should be used to maintain oil quality as needed.
8. Used, but not abused, oils, may be topped up or diluted with fresh oil with no adverse effects on quality. Abused fats and oils were defined in the first two recommendations developed during this program.

This event took place in Hagen, Germany in 2000.

Filter Regularly

Today, most fryers include a built-in system to filter oil. Filtration will remove charred materials, breading, and other materials that come from the food being fried. These materials will darken oil and may re-deposit on finished, fried foods, compromising their appearance. Removing particulate from frying oil will help extend oil life. Food particles often act as the focus for degradation reactions, which will damage oil and compromise food quality.

There are two kinds of filtration systems used in frying operations:

- **Passive Filtration**—These systems simply remove particulate from the oil through sieving. Some also call passive filtration simply filtration.
- **Active Filtration**—Active systems are much more complex. These systems not only remove particulates but will also remove oil soluble components. Active systems are also referred to as treatments.

A well-designed filtration or treatment system can significantly enhance oil quality and extend oil life. The frying oil quality curve in Figure 1 also shows how the use of an oil treatment product called Supersorb by Filtercorp extends the optimum frying period, thereby extending oil life and helping maintain food quality for a longer period.

Test Oil Regularly

As noted, testing oil regularly was suggested by Stier and Blumenthal as a tool for quality management. This is where the "rubber hits the road," so to speak. Dr. Robertson's six principles of quality will help maintain oil quality and, therefore, allow the fryer operator to produce high quality food, but the question is, "At what point does oil quality change to the point where food is now unacceptable?" Unfortunately, there is no such thing as one size fits all, since each and every fryer operator's perception of quality differs. It is up to each operator to conduct frying studies to establish the relationship between oil and food quality.

There are many chemical markers of frying oil degradation (see "Chemical Markers of Oil Degradation," below). There are also a number of rapid tests available that can be used in lieu of conducting a chemical test. It is up to the fryer operator to determine which chemical marker or markers correlate with optimum food quality and the point at which the oil degrades to the point that food quality is unacceptable. Chemical testing of the progressively degrading oil must be accompanied by sensory testing of the food. The processor or restaurant operator must be involved with the sensory work as they know what is acceptable better than anyone else.

Chemical Markers of Oil Degradation

- Total polar materials (TPM)
- Free fatty acids (FFA)
- Alkaline soaps
- Oil color
- Peroxide value (PV)
- Anisidine value (AV)
- Polymeric triglyceride

There are challenges when it comes to oil testing. One is determining the end point, the second is determining which test or tests to use, and the final is actually doing the test. It is much easier to test degrading frying oil in an industrial operation than it is in a restaurant. Restaurant operators must use a simple, quick test, as the people working in restaurant operations are generally not very sophisticated. Most foodservice and restaurant operators do no testing at all, but instead discard oil based on schedules.

The ultimate goal of frying is to produce good-tasting food. This goal is universal; that is, it applies to both industrial frying and foodservice or restaurant operations. The key to producing high quality food is maintaining the frying oil in the best condition for as long as possible—Dr. Blumenthal's optimum state. There are a number of means available to fryer operators to maintain and monitor oil quality. These include purchasing good equipment, operating that equipment properly, cleaning the fryers, filtering oil, and minimizing the potential for oxidizing the frying oil by keeping ultraviolet light and metals away from fryers. Unfortunately, there is no single end point for all fryer operators. Each operator will need to determine an end point for their own operations since everyone's concept of food quality is a little different. ■

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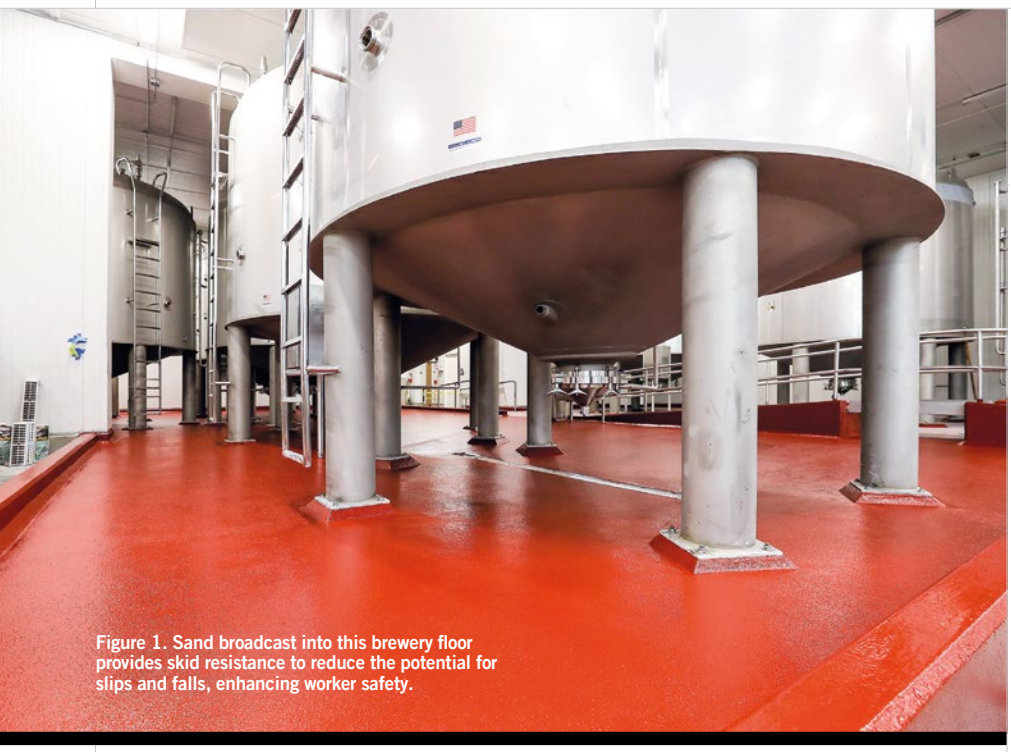

Figure 1. Sand broadcast into this brewery floor provides skid resistance to reduce the potential for slips and falls, enhancing worker safety.

Proactive Coating Evaluations

Think like an auditor to help minimize contamination risks, fines, and shutdowns | BY CASEY BALL

A compliance audit is often an anxious time for a food and beverage facility manager. The last thing that manager wants is a shutdown, let alone one that could have been avoided by making a simple proactive coatings repair, for example. Yet, violations of the Food Safety Modernization Act (FSMA) flagged by a third-party compliance auditor are common and can lead to major operations interruptions if the problems cannot be remedied quickly.

The likelihood of flagged issues and stalled operations has risen in today's environment of higher industry standards. This is evident in the amount of product flagged for contamination. Foreign-material contamination caused 23 percent of all recalls in 2018, up from 7 percent in 2015, according to a report published in *The National Provisioner*. Has the industry become more lax about allowing contaminants into food products? No; the more likely interpretation is that today's stringent regulations lead auditors—and facilities themselves—to catch potential dangers previously left unchecked.

With companies of all sizes now in compliance with the more rigorous FSMA, the question becomes how well they can maintain these standards. That will be determined, in part, by company culture. In some companies, teams will do the minimum to remain compliant, making incremental updates just before an audit or emergency corrections thereafter to avoid a shutdown. This may be especially true for mid-sized companies, where a plant manager does not have the time or expertise to identify the optimal coatings products to fix specific conditions, for example. Most generalist facility managers will not know which floor coatings offer a fast return to service to minimize downtime or which wall coatings are the most durable against chemical washdowns.

However, in other companies, teams will adopt a more proactive approach. The facility manager will not wait for an auditor to point to a problem or learn on the fly how to repair an area. Instead, the manager will work with stakeholders and a third-party coatings expert, for example, to spot not just current violations, but also future vulnerabilities, and to develop proactive repair specs so the facility can address any deficiencies before they become an issue. As such parties anticipate how a facility could someday risk contamination or hazards, the facility manger will not only minimize the facility's chance of FSMA infractions, but will also create long-term peace of mind.

Four Key FSMA Audit Areas

One way for a facility manager to plan ahead is to take on the mindset, and even the checklist, of an auditor. By performing self-assessment walk-throughs that consider hazard analysis, sanitation, equipment preservation, and warehouse and distribution matters, the manager will mirror the checklist an auditor uses when visiting sites. This approach allows the manager not only to see current problems, but also to envision and create a strategy for future issues. By inviting a third-party coatings expert to participate in the assessment, the facility manager can better identify potential vulnerabilities, learn what products will enable fast returns to service and long maintenance intervals, and develop a proactive plan for making repairs.

1. Hazard Analysis & Controls

Personnel, hand carts, forklifts, and other machinery create heavy traffic throughout a facility, so one aim of a FSMA audit is to minimize the risk of employee injury. A coatings specialist can be especially helpful to a facility manager here by suggesting products that will limit injury risks related to slips from flooring hazards or burns from hot surfaces.

Slips and falls are among the primary hazards to employees. Although FSMA

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does not set any specific floor skid-resistance standards, a facility manager will want to work with a coatings specialist to determine what surface treatments can reduce the chance of unfortunate incidents, yet still meet other facility objectives. Skid-resistance options range from aluminum oxide to sand (see Figure 1) to a quick-texture system, a splatter coat created by a hopper gun. The latter is especially advantageous, as it establishes skid resistance, but without the pointy profiles that occur with other broadcast aggregates. The rounded, quick-texture profile allows better drainage following wash-downs and is potentially more durable, as pointier profiles created by other aggregates may break off over time.

Tripping hazards can develop when floor quarry tiles or dairy bricks—which are commonly found in food facilities—become uneven, in some instances because water has ponded beneath them and worked them loose, leaving bumps and voids in the flooring. Beyond contributing to falls, such voids can become harborage points for bacteria, and a facility may fail inspection if these areas are not corrected. A facility manager can mitigate both slipping and sanitation concerns by installing a seamless resinous flooring system at the outset of a flooring installation or on top of quarry tile or dairy brick. Such floors offer better drainage, provided the floor has a proper slope, and eliminate grout lines, which trap moisture and promote bacteria growth.

Figure 2. A cant base creates a seamless transition from walls to floors to promote drainage and eliminate the typical 90-degree transition where bacteria can become trapped.

To minimize the risk of another hazard such as burns, a facility manager should look at any area where a worker may come into contact with a heated surface, from piping to tanks, and treat it with a heat-resistant insulative coating. Such coatings allow otherwise hot surfaces to remain cool to the touch without insulation applied, while also providing some insulative properties that will retain heat inside the pipe or vessel. Using coatings instead of insulation also removes the opportunity for

corrosion to develop beneath insulation, which can be a hidden and potentially dangerous development.

2. Sanitary Facilities & Controls

Bacteria and allergens are a serious concern for any facility because they jeopardize food products with contamination and cross-contamination potential, respectively. An FSMA auditor tests extensively for these unwanted contaminants, knowing that, despite cleaning protocols, nut material, for example, can get lodged in walls and floors, and then days later, potentially dislodge and end up in another product. For a facility manager developing a preventive maintenance program, the aim should be to eliminate any risks from bacteria and allergens. The focus for both will be to ensure proper water management and eliminate porous surfaces

Facilities are washed down regularly, but how much of the water and chemicals, potentially loaded with bacteria and allergens, make their way to the drains? It is critical to prevent these fluids from ponding behind the walls or under the floor. A coatings specialist can suggest the right products to create seamless systems for these surfaces. In a facility with block walls, for instance, a specialist might suggest using block filler to reduce any divots where allergens can rest before applying a smooth topcoat material designed for washdowns.

Consider also the transition from walls to floors. The crevice of a 90-degree transition makes it easy for bacteria to lodge there and remain there following cleaning processes. However, a cove or cant base, with its curved or 45-degree transition, respectively, from wall to floor (see Figure 2), creates a seamless floor-to-wall transition and slope that enables more thorough draining and better hygiene following cleanings.

Of course, the end destination for cleaning water is the drain, which is why the floor must have a proper slope that allows fluids to drain away. A cove or cant base helps with this movement at the wall, as does the design of the drain itself. For example, many facilities are transitioning from trench to box drains because the former has more surface area where water and microbes can lodge and allow bacteria to proliferate. Installing a box drain will limit contamination; however, to ensure proper drainage, the floor surrounding the box drain must be re-pitched a quarter inch for every foot that fluids must fall from the edge of the wall.

Fig 3. Metal ceilings, railings, columns, and other steel surfaces in food processing and storage areas should be coated and maintained to prevent rust and paint chips from breaking loose and contaminating products.

3. Equipment Preservation

Food and beverage facilities are rife with steel—metal ceilings, railings, columns, and more—found above and near production lines and packaging operations. As steel wears, rust and paint chips can break loose and potentially drop into products. This is one reason why an FSMA auditor closely inspects any steel along a product's path through a facility. A facility manager should also trace those paths, across every floor and up every stairwell, looking for exposure risks and treating the steel with proper coatings. Coated steel is not only better at resisting corrosion and rust, but also easier to clean.

FDA sets specific standards for which coatings may be applied to steel, and those conditions vary based on whether the steel has direct or indirect contact with food products. For example, grain elevators and storage silos, which store dry goods, must comply with the 21 CFR 175.300 standard. While a facility manager might not be familiar with the entirety of FDA regulations on these matters, a third-party coatings expert will be able to supply that knowledge and recommend appropriate products.

4. Warehouse & Distribution

At most food and beverage facilities, ingredients and finished products sit in a warehouse where high traffic and outdoor access might invite some undesirable agents such as dust mites, bugs, and rodents. In such areas, the right surfaces can help to stave off critters or identify their presence. For instance, sealer placed on a concrete floor makes the surface more cleanable, so dust comes up during washing, which minimizes mites. A run identification strip, a set of white lines painted on the floor around the perimeter of a warehouse, creates contrast so that workers can spot rodent droppings against the light floor surface. In addition, seamless flooring systems reduce the cracks and crevices that bugs nestle within. For each of these matters, a coatings specialist can recommend ideal solutions.

In cold storage and processing areas, a facility manager needs to be concerned about contamination from insulated metal panels (IMPs), as their factory-applied finish may flake off over time. One way to protect this material is to apply polyurea, a chemical-resistant waterproofing membrane that fills cracks and joints and limits flaking. However, not all contactors have the plural-component equipment needed to spray such coatings. A coatings specialist can help facilities identify contractors for the project, which can be completed in one weekend, even at low temperatures.

Establish a Proactive Plan

With so many ways to prepare ahead, there is no reason a facility manager should let an auditor's visit become a nail-biting experience. Instead, a manager can work directly with a coatings specialist to walk through the facility together, identify any areas of current and future concern, and create a proactive plan to rapidly address repairs as needs arise, especially if an auditor raises an issue. The proactive approach of thinking like an auditor will help the facility maintain compliance and avoid costly fines and shutdowns. ■

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An Organic, Non-Thermal Pasteurization Method for Nuts, Seeds, and Grains

Without pasteurizing low-moisture foods, there is no kill step to eliminate pathogens and ensure food safety

BY **AMIR HAMIDI, PHD**

Consumer preferences for plant-based foods and the growing popularity of vegan and paleo diets are driving demand for nuts, seeds, and grains. Market research projects the compound annual growth rate (CAGR) for nuts and seeds to be approximately 4.7 percent between 2018 and 2024.

To keep up with that growth, processors will need to increase output in the coming years. Companies that process nuts, seeds, and grains are also thinking about how to maintain food safety and the healthy characteristics of the food itself as they grow to meet demand. Consumers don't want to sacrifice the essential nutrition in nuts, seeds, and grains for price or availability. They want it all.

For some time, regulations have been in place that require pasteurization of common and high-risk foods such as dairy products. But, to maintain high food safety standards, pasteurization should be considered for many other types of foods, including nuts, seeds, and grains.

Pasteurizing Nuts, Seeds, and Grains Achieves Food Safety

There's a common assumption that dry or low-moisture foods don't have to be pasteurized. Low-moisture foods present fewer risks for foodborne illness, but they're not immune to the possibility. In fact, in 2016, CDC attributed an outbreak of *Salmonella* infections in multiple states to raw pistachios.

Indeed, low-moisture foods can become contaminated with pathogens such as *Salmonella* and *E. coli*. Although pathogens cannot successfully grow and multiply on low-moisture foods, the environment can be adequate for pathogens to survive. Without pasteurizing low-moisture foods, there is no kill step to eliminate pathogens and ensure food is safe for consumption.

Moreover, some nut varieties, such as almonds and pecans, are harvested in a unique way that can potentially expose them to contamination. Almonds and pecans grow on large trees and pass through many different stages during their maturation.

For example, in the last stage of development, the hull of an almond starts to crack, allowing air to dry it and the almond. To harvest the almonds from the hulls and the trees, farmers use mechanical tree shakers to shake the almonds from the shells. The dried almonds then drop to the ground and dry there for up to 10 days, during which time they can come into contact with debris, insects, and potential pathogens on the ground.

This is one of the reasons the almond industry began to self-regulate more than a decade ago. Now, the Almond Board of

California (ABC) requires that all almonds grown in California be pasteurized. Research conducted by the ABC also states that "there is a low-level presence of *Salmonella* in the soil across the California almond growing region, regardless of location, soil type, growing practices or age of orchard." As a result, in 2007, the board began regulating that all California almonds shipped within North America be pasteurized.

Researchers Danyluk and Brar note in *Microbiology Spectrum* that nuts and grains could be "contaminated with foodborne pathogens at any stage during production, processing, storage, and distribution." They state that sources of contamination can range from "soil, animal intrusion, contaminated harvesting equipment, harvest and preharvest handling, and storage conditions."

Enough evidence exists to make a case for nut, seed, and grain pasteurization.

Methods of Pasteurization

Pasteurizing low-moisture foods is challenging because they are not liquid. Processors utilize several technologies to pasteurize nuts, seeds, and grains. These include steam pasteurization, fumigation, irradiation, and emerging methods in non-thermal pasteurization.

The traditional approach has been a heat treatment, such as steam pasteurization, that uses high levels of heat to kill pathogens. However, heat treatment can be perceived as "cooking" the food to some extent, and changes the sensory and nutritional qualities of nuts, depending on the duration of the heat exposure.

Food is typically steam pasteurized in a batch system, which creates other potential drawbacks. Batch pasteurization increases dwell time, or the time the food is exposed to heat during the pasteurization process. During steam pasteurization, food is exposed to varying levels of heat for 40 to 60 minutes. As heat penetrates through the skin of nuts, reaching its core, protein bodies are distorted, oleosomes burst, and the endoplasmic network is destroyed. Also, the high temperature can potentially cause the skin of the nut to pull away, changing the mouthfeel of the product.

Another pasteurization process fading from popularity is fumigation. Fumigation uses propylene oxide (PPO) to reduce bacteria, yeasts, and mold on raw food. PPO has been classified as a potential carcinogen and could be a public health risk.

Irradiation, another approach that has lost support recently, uses one of three kinds of radiation: gamma rays, electron beams, or X-rays. It carries a negative stigma amongst consumers, and FDA requires irradiated food to be labeled.

As processors seek new approaches to satisfy today's consumer demand, there is an increased need for a better pasteurization technology for low-moisture foods. In turn, a new, non-thermal method for pasteurizing nuts, seeds, and grains gives processors an option to pasteurize foods in a manner that maintains the nutritional and sensory quality of food.

A non-thermal method for pasteurizing nuts, seeds, and grains gives processors an option to pasteurize foods in a manner that maintains the nutritional and sensory quality of food.

Non-Thermal Method Pasteurizes Food Using Organic Solution

Agri-Neo's organic, non-thermal pasteurization method, called Neo-Pure, gives processors a new way to achieve food safety and still maintain food quality. The method uses an organic liquid solution, paired with a continuous food processing system to pasteurize nuts, seeds, and grains. The technique uniformly destroys pathogens on food surfaces, including cracks and crevices, that can harbor pathogens.

The pasteurization process works by misting an organic liquid solution onto the surface of the food; the solution then biodegrades completely in a closed-loop food safety system. The integrated, continuous system can pasteurize a minimum of three metric tons of food per hour.

First, the dedicated food safety system disperses the organic solution, a fine mist, onto food. This approach allows the solution to uniformly cover the food, reaching cracks and crevices that can harbor pathogens. The solution is activated to kill pathogens as soon as it covers the food. It then begins to penetrate the cell walls of the pathogen cell in contact. Through this process, the pathogen cells start to disintegrate and die. Then, the food moves to a drying stage where dry air brings the food's moisture back to its original state.

Non-thermal pasteurization can achieve a 5-log (99.999%) reduction of harmful pathogens such as *Salmonella* that is validated by third-party process authorities. The system delivers many additional benefits for food processors, including cost, speed, and the quality of the food.

The non-thermal pasteurization process is validated on more than 15 low-moisture foods, including chia, flax, and cashews.

Pasteurized Nuts and Seeds Meet Consumer Nutrition Expectations

A person's sensory perception of food plays a vital role in food preferences and healthy eating habits. To meet the rising consumer demand, pasteurization processes should aim to maintain the four sensory elements of food that people experience when they eat it: appearance, flavor, odor, and texture. Sensory perception can contribute to a person's food purchasing patterns. Innovative non-thermal pasteurization methods maintain the nutrition and sensory elements that flourish naturally in low-moisture foods and support the health and well-being of the people who eat them.

Now, processors can stand by their claims to offer raw, pasteurized nuts, seeds, and grains and meet the expectations of today's consumers. Consumers deserve a better pasteurization solution for these foods, and processors are looking for more options to meet this consumer demand. ■

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In The Lab

Antibiotics in Vegetables

Using QuEChERS and liquid chromatography mass spectrometry to detect antibiotics | BY XIAOWEI LIU

A study analyzing 60 samples of vegetables obtained from local markets in China, including cabbage, cucumber, cauliflower, leek, and other commonly consumed vegetables, found that a 33 percent of the samples contained detectable levels of antibiotics (*Food Analytical Methods* 2018;11:2857–2864). The vegetables are likely to have absorbed the antibiotics from soil contaminated by antibiotics.

Antibiotics are still routinely added to animal feed to prevent or treat microbial infections, as well as promote animal growth in livestock production. Most (50 to 90 percent) antibiotics and their primary metabolites are rapidly excreted and ultimately end up in sewage and manure. Some of this is then spread on agricultural fields as fertilizer for growing crops. Vegetables elsewhere, including corn, potatoes, and lettuce, have also been found to contain antibiotic residues. Worryingly, there are currently no regulations to check and monitor for antibiotics in food products. Moreover, antibiotics have been detected in groundwater leading to concerns over their entry into food chain. Antibiotic residue levels should be monitored in fertilizer, the soil, and vegetables for risk assessment and control (*Environ Pollut.* 2006;143:565–571, *Scientific American.* January 2006).

Analysis

Despite efforts to curtail the use of antibiotics in the era of antibiotic-resistant microorganisms, antibiotics are still widely used to treat human and animal diseases. Antibiotic resistance poses a global threat to public health; antibiotic resistance is responsible for 25,000 annual deaths in the European Union and 23,000 annual deaths in the U.S. There are numerous causes of antibiotic resistance, including over-prescribing, patients not taking antibiotics as prescribed, poor infection control in hospitals, poor hygiene and sanitation practices, lack of rapid laboratory tests, and unnecessary antibiotic use in agriculture.

The analysis to detect the antibiotics in the vegetables used a novel highly sensitive method devised to detect 49 target antibiotics, which fall into different classes, including sulfonamides, quinolones, macrolides, beta-lactams, and tetracyclines. Of these 49 antibiotics, five were most commonly detected across 20 samples: oxytetracycline, doxycycline, sulfamethoxazole, enrofloxacin, and chlortetracycline.

The highest concentration was of oxytetracycline in cabbage, found to be 126 µg/kg and roughly 1% of the usual daily dose (1000 mg) for an adult. While this does not sound like much, it could become substantial if exposure is chronic. Oxytetracycline is a broad-spectrum antibiotic and is associated with gastrointestinal and skin-sensitivity side effects. It is contraindicated in pregnancy because it can cross the placenta and may have toxic effects on fetal tissues (*Natl Health Stat Report.* 2018;122:1–16). Although lower compared with the oxytetracycline, doxycycline, sulfamethoxazole, enrofloxacin, and chlortetracycline were also detected, at concentra-

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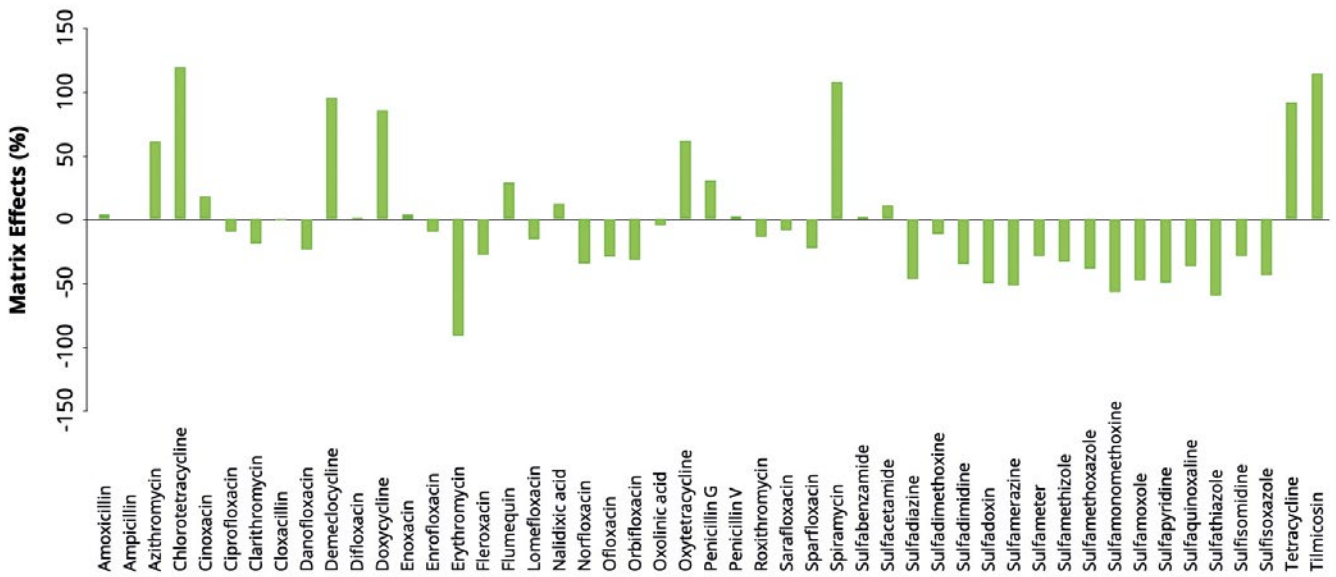

Figure 1: Matrix effects of selected antibiotics in cabbage

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tions ranging between 2.0 and 12.8 µg/kg in the vegetables (*Food Analytical Methods* 2018;11:2857–2864).

Method

The method used to detect and identify this wide range of antibiotics in vegetable samples is a relatively new one, involving the quick, easy, cheap, effective, rugged, and safe (so-called QuEChERS) procedure to prepare the sample for liquid chromatography and mass spectroscopic analysis using SCIEX ExionLC and QTRAP 4500 systems (*Food Analytical Methods* 2018;11:2857–2864). The QuEChERS technique is a simple, rapid, and cost-efficient method of extracting and preparing the sample for liquid chromatography tandem mass spectrometry (LC-MS/MS) (*Annals Chem.* 2012;84(13):5677–5684). It requires less time and solvent than other methods to detect antibiotics, including solid-phase extraction (SPE) after ultrasonic, vortex, or vibration extraction. For the LC-MS/MS analysis of multiple antibiotic residues in different vegetable samples, the extraction timing and buffer system, dispersive solid-phase extraction (d-SPE) clean-up, and other parameters, such as those controlling for matrix effects, were also optimized (see Figure 1).

Along with the improved extraction procedure, the research team also optimized the LC-MS/MS technique. It is common practice to use LC to separate out the analytes in the sample, and then transfer them into a triple quadrupole-based mass spectrometer (triple-quad) to further separate and scan the discrete analytes using a multiple reaction monitoring (MRM). However, using the triple-quad approach to detect and identify multiclass antibiotics can result in type I errors (false positives) due to interferences that have MRM transition signatures that coincide with those of the antibiotics. Type II errors (false negatives) may also occur, should the antibiotic analyte be present at a very low concentration, thus producing a weak response in the second transition (*Food Analytical Methods* 2018;11:2857–2864; *Annals Chem.* 2012;84(13):5677–5684). Therefore, the team used a quadrupole linear ion trap mass spectrometer, which combines the rapid, multiple scanning functionality of a triple-quad with the sensitivity of a linear ion trap mass spectrometer (*Food Analytical Methods* 2018;11:2857–2864; *Anal Chem.* 2007;79(24):9372–9384). With such an advanced hybrid system, the SCIEX QTRAP 4500, coupled with the SCIEX ExionLC ultra-high performance LC system, the team were able to develop and validate their method to simply and reliably detect and identify multiple antibiotic residues from different classes (*Food Analytical Methods* 2018;11:2857–2864).

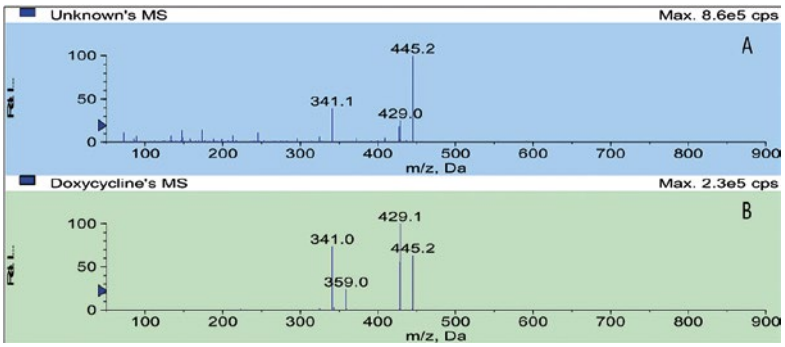

Figure 2: Doxycycline identified in sample through search against MS/MS library. A) EPI spectrum of doxycycline in vegetable; B) EPI spectrum of doxycycline standard in library.

The method was validated by analyzing 17 sulfonamides, 16 quinolones, 6 macrolides, 5 beta-lactams, and 5 tetracyclines, with 7 isotope-labelled internal standards for all the antibiotic classes tested. The QuEChERS-based LC-MS/MS method was confirmed to be highly accurate and precise with recoveries of 70–100 percent and reproducibility of less than 20 percent for relative standard deviation (RSD) for most of the sulfonamide, macrolide, beta-lactam, and tetracycline antibiotics. Although they are still considered acceptable at higher than the SANTE/11813/2017 guideline standard of 30 percent, the recoveries of the quinolones were lower than those of the other antibiotic classes in different vegetables. However, this was not unexpected as similar findings have been reported with both SPE and QuEChERS methods (*Food Analytical Methods* 2018;11:2857–2864). The reproducibility and thus, precision was especially good for the analyses of the macrolide and beta-lactam antibiotic residues, with RSDs that were lower than the other antibiotic classes, particularly at low concentrations of 5 µg/kg. The limit of quantification (LOQ) was 2 µg/kg for most (~74 percent) of the antibiotics tested, and 5 µg/kg for the remaining (~26 percent) residues. The method is accurate for a wide range of concentrations, with the linearity range being 1–200 µg/L. The coefficient of determination (r2) was the requisite value higher than 0.995 for each residue; which guarantees the accurate quantification of each of the 49 antibiotics through the application of this method (*Food Analytical Methods* 2018;11:2857–2864).

To confirm the accuracy of the qualitative results, the MS/MS spectra of the putative antibiotic residues in the positive samples were compared with the spectra of known target analytes housed in a reference library. This helped disqualify type I errors and confirm true positives. This final step, was facilitated by the simultaneous acquisition of the MRM scan data alongside the full scan MS/MS spectra in enhanced product ion (EPI) mode using information-dependent acquisition (IDA), which was uniquely possible with the use of the SCIEX QTRAP instruments. This final confirmatory step helps validate the utility and reliability of this method (*Food Analytical Methods* 2018;11:2857–2864).

Fulfilling a Need

According to research, antibiotic resistance may cause 10 million deaths annually by 2050 (*PLOS Medicine.* 2016;13(11):e1002184). The startling figures show that greater efforts need to be made to eliminate the injudicious application of antibiotics. Moreover, further research and understanding of the presence of antibiotics in the environment is required since antibiotics can leach from the soil into aquifers or groundwater due to run-off. All organisms—human, animal, or vegetable—are therefore susceptible to being exposed unnecessarily and unknowingly to antibiotics. As such, they can unwittingly contribute to the development of antibiotic-

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Using Electronic Discovery in the Food Industry

Make eDiscovery a standardized business process

BY **BRIAN SCHRADER, ESQ.**

Litigation is a constant concern in the food industry. Any number of situations can trigger a legal matter: instances of *Salmonella* or *E. coli*, labeling errors or unknown ingredients, even personal injury or product liability concerns.

In a typical lawsuit, the process of discovery takes place early on, giving both sides the chance to see what evidence might be presented in court. Today, this is a digitally focused process, given that most communication takes place by email, text messages, and other electronic platforms.

Electronic discovery (eDiscovery) providers dig through countless gigabytes of electronically stored information in search of pertinent documents for a legal matter. This multi-stage process involves identifying the parties who have the necessary data, acquiring that data, culling anything that's clearly irrelevant, and using a suite of tools to locate the most important documents and study them in more detail. After a final attorney review, any relevant documents are produced to the opposing party.

For food manufacturers, eDiscovery involves some additional and distinctive challenges, among them the high volume of data, the need to follow special industry rules and regulations, unique data types and systems, and the high rate of claims. Yet, despite those challenges, most businesses in the industry still treat eDiscovery as an afterthought—a rushed, panicked process that is more reactive than proactive, often starting eDiscovery

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from scratch with each new litigation. That approach only creates unnecessary disruptions and wastes huge amounts of time and money. There is a better way, and it's easier than you might think.

Although you can't predict when litigation is going to occur, it's a foregone conclusion that it's going to happen at some point. So why not prepare your company for what you know is around the corner? By establishing eDiscovery as a standard business process, you can ensure that you respond to each legal matter confidently and effectively while avoiding unnecessary stress and costly business and employee disruptions along the way.

Here are four steps to help your business rethink its approach to eDiscovery.

By establishing eDiscovery as a standard business process, you can ensure that you respond to each legal matter confidently and effectively while avoiding unnecessary stress and costly business and employee disruptions along the way.

Step 1: Establish an eDiscovery Process Framework

Although every legal matter is going to be different, it's possible to envision some likely scenarios and start developing a set of steps for how to handle them. Make sure that you establish a solid framework of how this process will be handled internally. Among the questions to ask are:

- Which employees will be involved in the process, what will their roles be, and how will this additional responsibility impact their existing workloads?
- How will your company issue legal holds and take the other steps required to meet your legal data preservation obligations?
- What data will be retained in expectation of a possible legal matter?
- Where will your organization store data collected for litigation, and what steps will be taken to secure it?
- How will you handle attorney document review of the collected and culled data?
- Will you enlist an outside review team to help, especially with larger cases?

Once the key players, roles, and processes have been established and a plan has been proactively laid out, businesses will find that litigation no longer creates the same level of upheaval in daily operations. Having successfully established the process, you can save existing data that has already gone through legal review can be saved for reuse in future cases, further simplifying the process and reducing your overall legal spend.

Step 2. Choose the Right eDiscovery Platforms

The eDiscovery process involves several stages in which data is collected, processed, culled, and reviewed, using a series of software platforms to accomplish specific tasks. For instance, one platform might be used to manage legal holds, preserve the data and make targeted data collections. The data is then culled and migrated to a separate document review platform, where your legal team searches and tags it before producing it to the opposing party.

Research to determine which platform best fit your needs. There is a risk, however small, of data being compromised as it moves from platform to platform. Of course, managing the data also requires time and personnel. Consider platforms that include a data repository; this will reduce your overall cost.

Step 3. Incorporate AI and Machine Learning Technologies

Some of the most powerful tools you can employ in eDiscovery are the various machine learning or artificial intelligence tools, often called technology-assisted review (TAR). TAR makes it possible to quickly examine large amounts of data to uncover relevant information, enabling human reviewers to easily identify similarities and trends. The newest TAR options now eliminate the need for an initial review set, allow rolling uploads of data, and find pertinent documents more quickly and accurately than any other approach.

TAR has become a customary element of the managed review process offered by many eDiscovery providers today. Almost any case can benefit from using some level of TAR, although depending on the type of data that's been collected, you might opt for a particular tool or suite of tools. As you plan for potential legal matters down the road, talk to an eDiscovery expert about how TAR can best help your particular situation.

Step 4. Leverage Your Legal Spend across Matters

As mentioned above, one benefit of incorporating eDiscovery into your day-to-day business operations is that you won't have to start from zero every time a legal matter comes up. If you've already collected and reviewed documents for one case, it's only logical to securely archive the results for use in a future matter. This comprehensive approach of reusing work product (e.g., previous legal hold notices, data collections, even document review) will help leverage your legal spend to the greatest extent possible and lower your overall costs.

You'll want to regularly organize and archive new data as it's created so that it's easily accessible when the next legal matter arises. As a company following that process, you'll gain an incredibly valuable side benefit as well; in examining the collected data for patterns and trends, you can recognize areas for improvement and build upon established strengths.

All of these steps are reasons why it's advisable to choose a single, comprehensive eDiscovery platform to handle all your cases. In an industry where litigation is a certainty, it doesn't make good business sense to treat data collection and eDiscovery as an afterthought. By establishing a predictable, repeatable model for data collection and review, food manufacturing companies can greatly reduce the uncertainty of the process and improve their chances of presenting a complete and accurate case when future legal matters occur. ■

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Food Service & Retail

The Power of Education

The importance of teaching foodservice employees all about food safety | BY KEITH LORIA

Prior to the COVID-19 pandemic, the restaurant and food service industry employed approximately 11.9 million people in the U.S., according to the Bureau of Labor Statistics. While these numbers have fallen in recent months, restaurants are beginning to reopen across the country, and we will likely soon reach the pre-pandemic volume of more than 130 million meals served daily in restaurants.

With so many meals, foodborne illnesses and other food safety issues are of concern, which is why foodservice companies put so much effort into food safety training and education.

Chicken Salad Chick is a fast-casual restaurant chain of chicken salad restaurants based in Auburn, Ala., with 139 franchise restaurants and stores in 16 different states. Jim Thompson, VP of operations, says the company has been committed to food quality and safety since its founding in 2008. "From cooking chicken to chilling of product, we educate all employees in the proper preparation of our made-fresh daily food," he says. "From day one, employees are trained in product handling, and employees specifically working with raw chicken undergo their own individual training."

As a result, Chicken Salad Chick has established operational procedures and equipment standards based on a hazard analysis of the menu that identified three areas where critical control points were required for food safety: avoiding the potential for cross contamination when handling raw chicken, properly cooking chicken to a minimum internal temperature of 165 degrees Fahrenheit, and properly cooling prepared chicken salad within a required time.

"To prevent cross contamination, raw chicken is only handled at the end of the prep team's day, when all other items have been prepared," Thompson says. "Team members wear plastic aprons and yellow gloves when handling raw chicken and are trained not to touch anything else while wearing these. The yellow gloves serve as a visible reminder and help to reinforce the training they receive. Additionally, a separate cart identified with yellow markings is used when preparing raw chicken, and it is not used for anything else."

Nancy Ward, chief people development officer at Captain D's, a chain of fast-casual seafood restaurants headquartered in Nashville, with 539 locations in 25 states, notes that during orientation, the company puts all employees through an efficient course that instills company and federal safety protocols while producing an interactive learning environment. "In the past year, our brand has implemented a new training course for all levels of management, which breaks down the food code into 10 modules covering all federally mandated food safety training," she says. "The new program cut course completion time in half, making modules more efficient for employees to study and enabling them to virtually apply protocol to Captain D's scenarios."

In just a year, the company went from 70% of all managers holding a nationally accredited food safety manager certification to more than 93%. "Captain D's believes in repeated application to form good habits, exemplified through our monthly safety focus newsletters," Ward adds. "Some safety focuses have included unloading food in the summer months and storage/food labeling tips."

Along with these newsletters, each team member of a location receives a daily challenge." Ward says that, as each employee's shift is beginning, they are "talked into position" by being given a specific focus on a product or platform that includes food quality and safety. At the end of the shift, they are "talked out of position," giving the shift leader an opportunity for follow-up and recognition. "To reinforce safety, we believe in rewarding management teams who excel in health inspections with monetary bonuses," Ward said. "There is also an audit system in place for safety checks, in which each restaurant is reviewed quarterly and annually."

Training Programs

There are multiple avenues for food safety education available to businesses.

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Suzi Gerber, executive director of Haven Foods, an international food and beverage restaurant consulting firm, noted that the issue of training and food safety is a constant focus among her work for her clients. She always recommends ServSafe, a food and beverage safety training and certificate program administered by the U.S. National Restaurant Association. "ServSafe is the golden standard for training, and when companies send their key employees for manager training and their operators to food handler training, a marked improvement can be witnessed in following SOPs and overall fluency, and enforcement, of food safety guidelines," she says.

Kyle Michael Townsend, PhD, a clinical assistant professor of hospitality at Georgia State University in Atlanta, who specializes in private club management, food and beverage operations, and quality service in the hospitality industry, said ServSafe is one of the most valuable training programs. "There are multiple levels of this training designed for food handlers and servers, as well as managers and a section on safe service of alcohol," he says.

In addition, StateFoodSafety and the National Registry for Food Safety Professionals offer similar training online, including advanced levels that provide food allergy training as well. "Online programs are a great addition to their portfolios. We use the online systems for our students here at GSU as they allow us to work them into the somewhat hectic schedule of an academic semester," Dr. Townsend says. "This same flexibility is a huge asset to restaurants as they can be done on an at-your-own-pace schedule and don't require taking employees out of production for certification and recertification."

At the beginning of 2016, Chicken Salad Chick partnered with Steritech, an online company that evaluates food safety practices using criteria that are based on FDA's model Food Code and other regulatory authority standards, and contracted them to work with restaurant management to help them adopt critical food safety practices. "Using the data supplied from evaluations, the operations team develop an action plan to correct any concerns and improve future performance," Dr. Thompson says. "These plans are then reviewed by either the restaurants franchise business consultant or their district manager for approval. As a result, we achieved Best in Class scores and improved food safety performance throughout all restaurants in the system. Not only have the overall scores improved, but the number of critical violations also has decreased to some of the lowest in the industry."

Captain D's utilizes a learning management system that tracks completion of orientation and basic training courses such as food safety and personal safety, and managers are alerted to missing or overdue courses. "To ensure consistent food safety protocol, we are on the cutting edge of technology, beta testing with a mobile platform where managers capture temperatures and troubleshoot issues," Ward says. "This mobile platform is designed specifically for Captain D's equipment and menu. Supervisors are also notified of missing or outside range results. Additionally, our skilled quality assurance department has the ability to virtually track products and distributor quality from point of inception to trained employees delivering fresh food daily."

Defining a Culture of Food Safety

Fostering a culture for food safety begins at the top, Dr. Townsend says, with both front- and back-of-the-house management. "Some effective methods include data collection on pertinent issues like food temperatures in house and when receiving, and doing this provides an additional level of impact when dealing with local health inspectors," he adds. "Ultimately, management oversight is huge here too, as food safety often seems an afterthought until a serious issue develops, and by then, it is just too late."

Steve Ozbolt, owner of Emerald City Catering and Events in Milwaukee, Wis., agrees that the management of food safety comes from the top down. "If the chef is not taking the proper steps to ensure food safety—cross contamination, improper holding temperatures, cleanliness, etc.—the employees will not do so either," he says. "We work to explain that these are serious issues and must be taken seriously. Not only the foodborne illness, but [also] the possibility of cross contamination for someone who may be allergic can cause a very serious problem. Continuing education is important, but not as essential as best practices."

A big part of a successful food safety program is fostering a culture of smart practices among employees and ensuring that everyone stays compliant with rules and regulations.

"Not only are our products made fresh daily with attention to quality, but we have also implemented special equipment and procedures when preparing food," Thompson says. "Also, all of our team members complete, as one of their first training classes our food safety online training program. We also employ a company to assist in evaluation and training of the management teams to ensure safe food is delivered to our guests."

According to Ward, Captain D's thrives on a company culture of preparedness and safety, instilling each of these values in its employees from day one. "Through repeated application and practice of real-life scenarios, we're able to not only train our employees but [also] help them form good habits," she says.

Gerber notes that a hazard analysis and critical control points (HACCP) plan that clearly outlines the procedures is crucial for any manager in maintaining and documenting proactive measures. "Publishing guidelines in an onboarding manual to make sure all new hires are trained into good practices is also crucial," she adds. "Posting rules of thumb for refrigerator temperatures, working-time timers, and cooking thermometers are is effective." ■

Food Safety Education Resources

Here are some important online resources focused on food safety best practices for the foodservice industry.

- USDA Food Safety Education: fsis.usda.gov.
- The Safe Quality Food Institute: sqfi.com.
- National Restaurant Association's Food Safety Guidelines: restaurant.org.
- HACCP: fda.gov.
- Servsafe: servsafe.com.

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Allergen-Free Labeling ... *(Continued from p. 19)*

disconnect between packaging and additional information. However, there is an obvious need for food companies to ensure the accuracy of their product information in an environment that allows or demands modification of recipes.

General Guidance for Allergen-Free Labeling

Much as was the case with gluten-free labeling prior to the adoption of regulation in the U.S., food manufacturers currently rely on international guidance, scientific evidence, and common sense to dictate their policies on allergen free-from labeling. In the case of the gluten-free label, manufacturers were guided by the international Codex Alimentarius Commission. This is not currently the case with allergen-free claims; however, we can summarize some best-practice guidance, drawing largely from non-U.S. regulatory bodies:

- Free-from allergen label claims are voluntary but must always be truthful and not misleading.
- Always remember that any free-from allergen claim is a deliberate and positive statement, made—in part—to a particular set of consumers who may suffer severe health consequences or even death should they consume their particular allergenic food.
- Required allergen labeling lists, regardless of locale, are in fact not exhaustive lists of all allergenic foods. A food that is "Big-8 free" may contain other allergenic foods and may cause allergic reactions in some consumers.
- Free-from claims lack regulatory definitions, though guidance is available in Canada and the EU. Given the lack of regulatory definition, we would recommend that food manufacturers clearly state what they mean by allergen-free or similar claims in such a way as to reach and to be understandable to their consumers.
- Consider known or likely cross-reactivities when considering free-from claims.
- A free-from statement or similar in conjunction with precautionary labeling, e.g., "free from allergens; may contain peanut" is often confusing to the consumer and may be misleading. A free-from statement should be regarded as a stronger claim than the absence of allergen labeling, and, this being the case, it is difficult to justify the use of a positive claim where precautionary labeling is warranted.

A Need for Clarity

Established regulations around gluten-free claims have increased consumer confidence regarding labeling and have expanded the range of products available to celiac sufferers by removing barriers to food manufacturers. Perhaps properly considered regulation around allergen-free labeling would have a similar effect. A key component of such regulation would have to be, as is the case for gluten, an upper limit for the amount of a food allergen that could be present and still be safe for food allergic consumers. Regulation on free-from labeling does not appear to be high on FDA's priority list. In the meantime, food manufacturers must exercise particular care when considering usage of such labels. ■

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Food Defense Lessons ... *(Continued from p. 21)*

9. As in any risk assessment, predetermine the severity and criticality of high consequence threats (even with low probability of occurrence) that could take your food business down; consider preemptive you could take to mitigate irreparable business damage.

10. What is the effect of supply chain interruptions and redistribution pathways on your ability to find materials required in manufacturing your products?

11. How can you simplify your operations where there are limited available resources, including labor and raw materials, along with loss of customers?

12. What additional business and operational food defense vulnerabilities might arise when normally available resources dwindle or manufacturing operations change?

13. How can you quickly and creatively assist employees, customers, and suppliers using your disaster resources?

14. Pre-plan for the safety and protection of your employees and their families in the event of any disaster—they are the heart of a successful sustainable business.

15. How can the business help others in time of crisis?

16. What reserves are available that would help the business to respond to, mitigate, and recover from a significant event (e.g., labor, cash reserves, self-insurance coverage, financial assistance, deferred payments, production scale-up, production modifications)?

17. How might supply chain interruptions affect the ability of your business to sustain basic operations and elements of the contingency plan, and how might sourcing and procurement be affected?

18. What front and back-office back-up communication and data storage systems are available to activate in the event of an emergency

19. If you are a significantly-sized employer, make sure disaster planning and response and recovery discussions and planning include local, state, regional, and national (federal) policy decision-makers.

Most importantly, with what we have witnessed with COVID-19 in a few short months, how should we prepare and respond to a future public health crisis involving our food supply? ■

Park is the principal for Food-Defense, LLC. He has practiced food protection technical management consulting for 46 years, is an FDA-recognized international management processing authority, and is an FSPCA PCQI lead instructor. Reach him at dpark72@aol.com.

NEW PRODUCTS

FT-IR Spectrometer

The LactoScope FT-B instrument delivers component testing and adulterant screening for liquid dairy products such as whey, raw and skim milk, shelf stable milk, and cream with a lower than 40% fat content. Featuring a smaller footprint, this FT-IR spectrometer combines modern optics with software and delivers results in less than 45 seconds. For large processors, the instrument can serve as a second instrument in milk intake areas to help ease liquid sample throughputs in addition to PerkinElmer's Lactoscope FT-A system, which analyzes milk along with yogurt, ice cream, concentrates, and creams with up to 55% fat. For smaller to mid-sized dairies and milk intake points with high volumes, the LactoScope FT-B instrument also features low cost of ownership. Integration with the Results Plus software provides rapid implementation with minimal training and delivers fast, secure analysis and reporting that is compatible with the Lactoscope FT-A solution, PerkinElmer's DA 7250 NIR Analyzer, and LIMS systems. This provides easy maneuvering among different platforms and instruments across liquid and solid dairy testing. The instrument ties into the PerkinElmer NetPlus cloud solution to enable remote configuration and team collaboration. **PerkinElmer, perkinelmer.com/category/dairy-testing-solutions.**

Conveyor Door

The Sure-Seal Conveyor Door is designed for automated storage and retrieval environments (ASRS). Combining speeds of up to 100"/second and an energy-efficient R-4 insulated panel, the door helps maintain secure separation within and between storage areas and conveyor operations. Its high-speed functionality ensures minimal air infiltration, while a perimeter sealing system provides secure closing. In addition, the standard I/O expansion board and System 4 programming allow seamless integration capability with existing ASRS control and monitoring systems. The door is specially engineered for high-cycle applications where reliability and energy savings are critical. The conveyor door provides a solution for non-live-traffic interior environments where speed, dependability, and low maintenance are essential, and is available in sizes up to 6' wide by 13' high. **Rytec, rytecdoors.com.**

Trailer Refrigeration Unit

The Vector 8611MT multi-temperature trailer refrigeration unit is designed for trailers split lengthwise with a center dividing wall. The unit creates two refrigerated compartments without requiring a remote evaporator. Introduced in limited production in 2019, the Vector 8611MT unit incorporates dual evaporators and fans into a single unit for two-zone cooling, with side-by-side compartments for perishable and frozen goods. Eliminating the need for a remote evaporator simplifies installation is simplified. The Vector 8611MT unit uses E-Drive technology, in which the diesel engine runs a 21-kVA generator that powers the all-electric refrigeration system. Vector units have the advantage of built-in electric standby capability, so when parked for loading, unloading, or staging, they can be operated via a separate power source, providing full refrigeration capacity while eliminating refrigeration unit engine noise, emissions and fuel consumption. The unit provides 55,000 BTU of cooling per hour at a setpoint of 35 degrees Fahrenheit and excels at freezing temperatures. For customers who want to add a third refrigerated compartment, the system is pre-configured to enable installation of a remote evaporator. **Carrier Transicold, transicold.carrier.com.**

Carbon-Filtered Workstation

The MicroFlow I Workstation is a ductless carbon-filtered workstation equipped with activated carbon filtration, designed to collect small amounts of non-hazardous fumes and odors. The workstation is self contained and can be easily moved from station to station, with an integral recessed work surface to contain spills. It features a clear hood surround with a safety viewing sash for the user, which can be conformed for use with a microscope. A variable speed fan control provides the options of high and medium speeds, or low flow for sensitive operations. The workstation operates on 115v AC, or 230v international, and conforms to UL, CSA, and CE requirements. The electrical cord port exits left side. Filter life varies with usage. **Hemco, 800-779-4362, hemcocorp.com/mfi.html.**

resistant bacteria and other microbes (*Scientific American*, January 2006).

Not only is there a need for better standards and regulation, there is also a need for tools such as the method described here to allow scientists, regulators, farmers, retailers and even consumers to identify antibiotics in their food. A united effort needs to be made to protect our environment as well as human and animal health, while maintaining food safety. This could include the exploration of other ways to combat bacterial infection, using innovative new technologies such as clustered regularly interspaced short palindromic repeats (CRISPR) and the development of precision medicines (*Nature Medicine*. 2019;25:730–733). The development of our methodology, using QuEChERS and LC-MS/MS, is just one tool in the arsenal in the fight against antibiotic resistance. ■

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SCIENTIFIC FINDINGS

For access to complete journal articles mentioned below, go to "Food Science Research" in the June/July 2020 issue at foodqualityandsafety.com, or type the headline of the requested article in the website's search box.

ARTICLE: Microbial Quality and Safety of Milk and Milk Products

With the advent of metagenomic studies, our knowledge on the microbiota of milk and milk products, especially as affected by the environment, production, and storage parameters, has increased. Milk quality depends on chemical parameters (fat and protein content and absence of inhibitory substances), as well as microbial and somatic cells counts, and affects the price of milk. The effects of hygiene and effective cooling on the spoilage microbiota have shown that proteolytic and lipolytic bacteria such as *Pseudomonas* or *Acinetobacter* spp. predominate the spoilage bacterial populations. These bacteria can produce heat-stable proteases and lipases, which remain active after pasteurization and, thus, can spoil the milk during prolonged storage. Additionally, milk can become contaminated after pasteurization and therefore there is still a high demand on developing better cleaning and sanitation regimes and equipment, as well as test systems to (quantitatively) detect relevant pathogenic or spoilage microorganisms. Raw milk and raw milk cheese consumption is also increasing worldwide with the growing demand of minimally processed, sustainable, healthy, and local foods. In this context, emerging and re-emerging pathogens once again represent a major food safety challenge. This review aims to provide an overview of the major microbial hazards occurring in the 21st century. *Comprehensive Reviews in Food Science and Food Safety*, published online on May 23, 2020.

ARTICLE: High-Protein Rice Flour in Development of Gluten-Free Muffins

Hypoallergenic rice flour is typically used in gluten-free (GF) products. New rice varieties with greater protein were recently developed. Physicochemical and sensory properties of white and brown high-protein rice flours (HPRFs) and muffins were compared to commercial rice flours. The sensory color of white high-protein rice muffin was favored. Other attributes were not statistically different between samples. HPRF muffins had greater frequencies of "just about right" levels for muffin crumbliness, moistness, and softness compared with the commercial control. Purchase intent was greater for both HPRF muffins than for commercial brown rice muffins. Purchase intent increased further, by 9 to 12 percent, after information that the products were gluten free and made with naturally higher protein rice flour was displayed. This study shows that greater protein content rice flour can be used to make GF muffins that are acceptable to consumers. This information could be used to market GF food products if increased protein ingredient claims are included. *Journal of Food Science*. Vol. 85, No. 5, May 2020, pages 1397-1402.

ARTICLE: Edible Coatings to Inactivate Foodborne Pathogens on Fresh-Cut Apples

Multiple formulations of edible coating solutions were developed and evaluated for their ability to maintain the quality of and minimize populations of foodborne bacteria on fresh-cut apples. Fresh-cut apples were artificially inoculated with *Salmonella* spp., *Escherichia coli* O157:H7, and *Listeria monocytogenes*, and dip-treated with coating solutions. Changes in populations of pathogens and molds and yeasts (M&Y) were evaluated after solution treatments and during storage at 4°C for 35 days. Changes in color, texture firmness, and weight loss during storage were also determined. Among the formulations, the solution containing 1 percent of three organic acids (acetic, lactic, and levulinic acids), 2 percent N-acetyl-l-cysteine or L-cysteine with 0.5 percent chitosan demonstrated the best effectiveness for the simultaneous reduction of pathogenic and spoilage microorganisms, control of browning, and maintenance of the quality of fresh-cut apples. The treated apple slices had nondetectable pathogens and M&Y (<1 log CFU) and the least quality changes for 35-day storage. The developed solutions can be used in processing plants, retail stores, or homes to protect fresh-cut apples or other fresh-cut fruits and vegetables from microbiological and quality deterioration. *Journal of Food Safety*, published online ahead of print on April 6, 2020.

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