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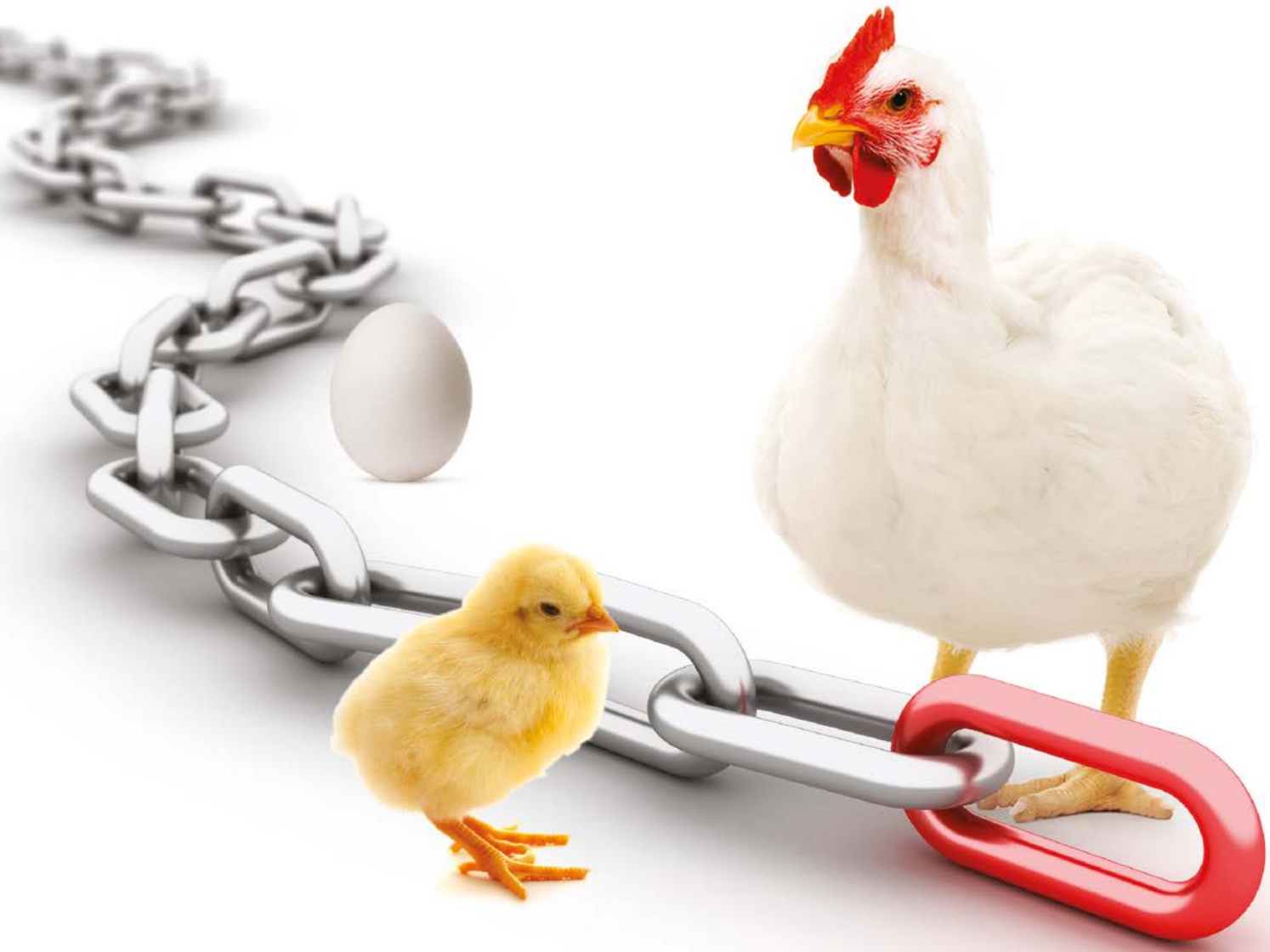

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Contents

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Features

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Features Cont.

Quality

Testing

Manufacturing & Distribution

Food Service & Retail

Columns

Washington Report

Industry Insights

Around The World

Departments

Exclusive Online Content

To read these articles, go to the current October/November 2015 issue on www.foodqualityandsafety.com:

- QAC: A Contaminant or a Useful Disinfectant?
- Food Grade Lubricants' Role in Processing
- The Hard Truth About Hard Cheese Authenticity

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From The Editor

On September 21, Peanut Corporation of America's (PCA) former CEO Stewart Parnell was sentenced to 28 years behind bars, a virtual life prison term for the 61-year-old, for his role in the 2008-2009 *Salmonella* outbreak related to peanuts that killed nine and sickened hundreds. Stewart was convicted of felony fraud, conspiracy, and knowingly allowing contaminated food to be sold in interstate commerce.

In addition, PCA peanut broker and Stewart's brother Michael received a 20-year term and quality assurance manager Mary Wilkerson received five years in a federal women's prison.

This sentencing is one of the harshest punishments concerning a foodborne illness outbreak in U.S. history and is seen as a turning point on how the justice system will now be holding companies responsibility on the safety of the nation's food supply.

"Those who choose profits over the health and safety of U.S. consumers are now on notice that the FDA, working with the Department of Justice, will strive to use the full force of our justice system against them," warns Dr. Stephen Ostroff, FDA acting commissioner.

"The momentous decision by the jury and judge marks a milestone in food safety history," says Deirdre Schlunegger, CEO for the nonprofit STOP Foodborne Illness organization. "These individuals are accountable for causing illness and death from a foodborne illness related to their product, and there are consequences."

Earlier in the month, the U.S. FDA finalized two FSMA rules for preventative controls for human and animal food to further help avoid deadly outbreaks like these from occurring in the future. (The remaining FSMA rules are expected to be finalized in 2016.)

However, many in the industry are quick to point out that these rules will result in improvements in public health only if the FDA has sufficient funding to fully implement them—there's concern that House and Senate appropriations bills for FY2016 fall short of what is actually needed to make this happen.

"FSMA represents a comprehensive system of preventative measures so it is essential that FDA be appropriately resourced to effectively implement and enforce all of the food safety mandates set forth in the law," according to a statement by the Grocery Manufacturers Association.

If FSMA's funding is decreased, then will the law's impact on saving lives also be diminished?

Marian Zboraj
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Food Quality & Safety
FARM TO FORK SAFETY

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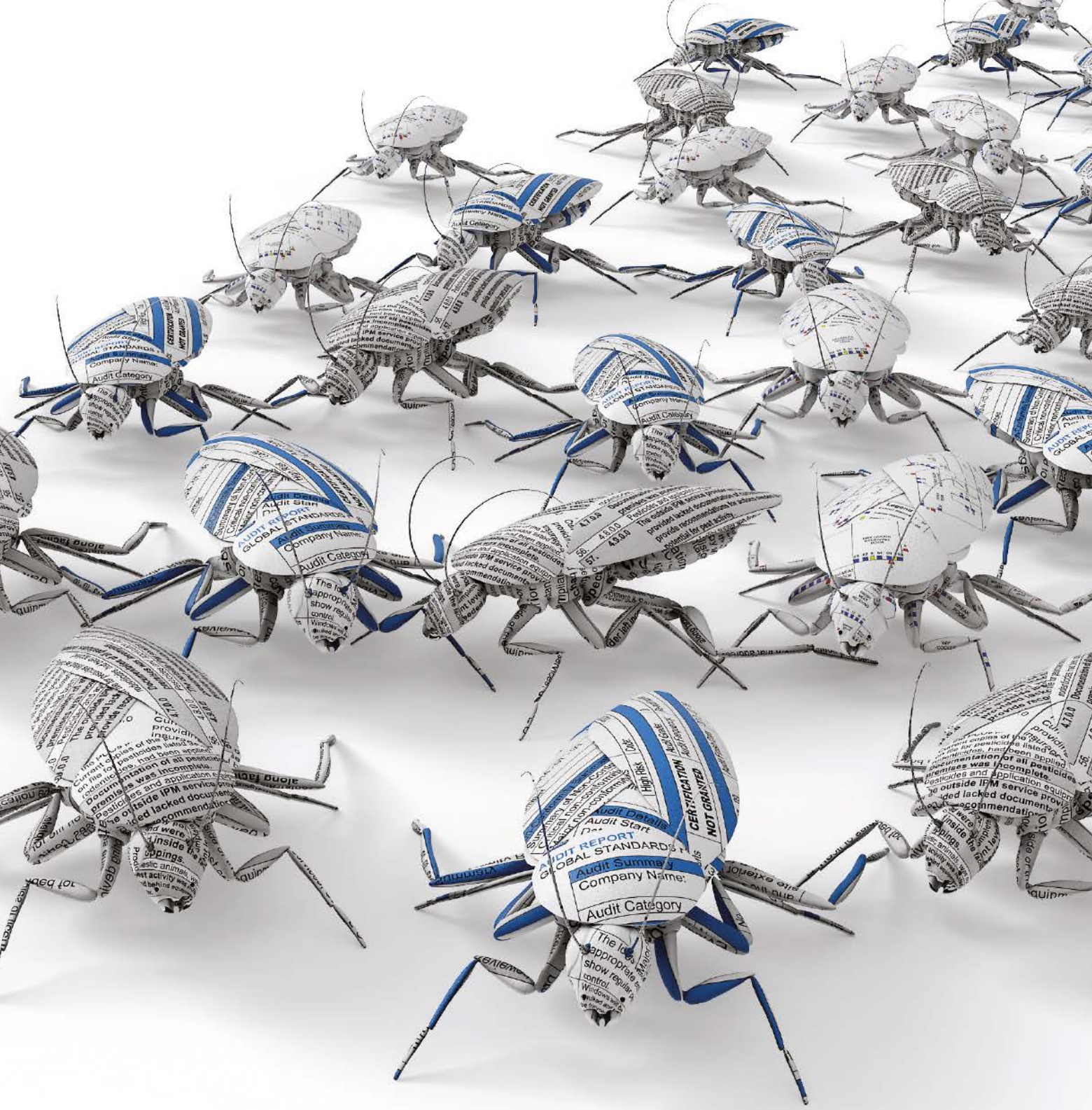

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NEWS & NOTES

The Opening of Mars Global Food Safety Center

Mars, Inc. opens its Global Food Safety Center, a facility for pre-competitive research and training that aims to raise global food safety standards through collaboration. Located just north of Beijing in Huairou, China, the center will employ approximately 30 associates working on food safety research and training, plus a variety of sabbatical positions open to academic and regulatory researchers. It is intended to drive global focus on addressing the challenge of food safety, leading to better access, availability, and nutrition, as well as reduced food waste and an increase in overall quality of life.

How Consumers Respond to Foodborne Disease Outbreaks

USDA's Economic Research Service releases a case study, "How Much Does It Matter How Sick You Get? Consumers' Responses to Foodborne Disease Outbreaks of Different Severities," that suggests consumers make some distinctions among pathogens and health risks. Evidence points to consumers reacting after a 2011 recall of cantaloupe due to listeriosis. Expenditures on cantaloupe were $3.9 million (6% to 7%) lower than normal and cantaloupe purchases were 6.2 million pounds lower over a 4-week period. A year later, when federal health officials recalled some cantaloupe for *Salmonella* contamination, consumer response was more muted.

Guidance Document for Veal Slaughter Establishments

FSIS releases a guidance document "Sanitary Dressing and Antimicrobial Implementation at Veal Slaughter Establishments: Identified Issues and Best Practices for Veal Slaughter Establishments." FSIS developed the guidance to help veal slaughter establishments to implement effective sanitary dressing procedures and antimicrobial treatments and to properly assess microbial testing results. Test results show that the percent positive for STEC from trimmings produced from veal appears to be higher than that for trimmings produced from other cattle slaughter classes. FSIS identified common deficiencies: inadequate sanitary dressing, ineffective antimicrobial intervention implementation, and failure to use microbial data in decision making.

FDA Finalizes Two Rules Under FSMA

As reported by Reuters, the U.S. FDA finalized two rules in early September requiring human and animal food companies to identify possible food safety hazards and outline steps to prevent or minimize them. The rules are the first of seven following the passage of FSMA. The first two rules focus on food manufacturing processes. They require companies to develop written food safety plans that indicate potential hazards that could affect the safety of their products. The remaining five rules are expected to be finalized in 2016. They include a proposal that would place greater requirements on importers to verify the safety of the products they import.

Public-Private Partnership to Tackle Food Safety in Asia

Food Industry Asia (FIA) has announced a commitment to scale-up food safety capacity building in ASEAN and China by signing an agreement with the World Bank for the Global Food Safety Partnership and making an initial contribution of U.S. $150,000. The Partnership, which was launched and convened by the World Bank in 2012, seeks to improve capacity-building and training programs for food safety practitioners in the public and private sectors. Representatives from FIA, the World Bank, United Nations Industrial Development Organization, and China Food and Drug Administration were present at the announcement during a meeting at the Vienna Food Safety Forum where the agreement was signed.

ASA to Develop West African Poultry and Feed Market

USDA selects the American Soybean Association's World Initiative for Soy in Human Health Program and key partners to implement a major poultry development project in the West African country of Ghana. U.S. soybean growers, as well as Ghana's poultry and feed industry, and its protein-seeking consumers, will all be expected to benefit. The USDA Foreign Agricultural Service's Food for Progress Program helps developing countries and emerging democracies modernize and strengthen their agricultural sectors. As a result, it improves agricultural productivity and expands trade of agricultural products.

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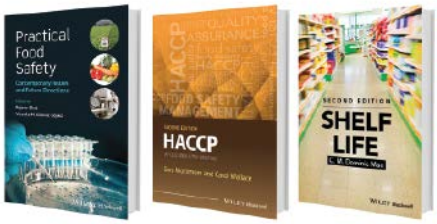

safety and all other aspects of food science and technology. Alongside *Food Quality & Safety*, Wiley publishes some of the major scholarly journals in this subject area as well as a huge range of book titles aimed at industry professionals, students, and researchers. If you have an idea for a new book or another publishing project, please send details to David McDade, executive editor, at david.mcdade@wiley.com.

NEHA Receives a FDA Food Safety Cooperative Agreement

The National Environmental Health Association (NEHA) has been awarded a five-year, $5 million cooperative agreement to develop and implement critically needed training for state, local, territorial, and tribal food safety agencies. This training will assist the FDA in meeting the requirements of Section 209(a) of FDA's FSMA and fully develop an integrated food safety system (IFSS). Under the agreement, NEHA will also research training needs for IFSS food and feed inspectors and regulators, train instructors to meet FDA-identified competencies, oversee/audit course instructors, deliver IFSS food-related training courses, and develop new courses based on feedback from the training needs assessment responses. Training records will be maintained for course participants and instructors; course certificates will be issued to those who successfully complete training.

ISO 9001:2015 Now Available

The latest edition of ISO 9001, ISO's flagship quality management systems standard, has now been published. This concludes over three years of revision work by experts from nearly 95 participating and observing countries to bring the standard up to date with modern needs. ISO 9001 helps organizations demonstrate to customers that they can offer products and services of consistently good quality. It also acts as a tool to streamline their processes and make them more efficient at what they do.

Get the Scoop Online

Go to the eUpdate section at www.foodqualityandsafety.com/eupdate to keep up with the latest food industry news, including stories on irradiation, agricultural drones, the PCA trial, and more hot topics!

Have you heard? *Food Quality & Safety* is now on Twitter: @FQSmag.

Washington Report

Striving for VIP Status in VQIP

The industry comments on what can be gained and lost in becoming certified in FDA's Voluntary Qualified Importer Program

BY **TED AGRES**

Food industry representatives appear to be largely supportive of FDA's Voluntary Qualified Importer Program (VQIP), a provision of the Food Safety Modernization Act (FSMA) designed to expedite the review and importation of foods from certified facilities. This voluntary, fee-based program will reward importers that have demonstrated a "high level of control over the safety and security of their supply chains," according to FDA.

In June 2015, FDA published draft guidance for and requested comment from industry about the proposed VQIP standards, which will become a key complement to the Foreign Supplier Verification Program (FSVP), the final rules for which are to be published by Oct. 31, 2015. The 28-page VQIP document outlines expected benefits, eligibility requirements, procedures, and user fees associated with the program, which is slated to begin in fiscal year 2018. The comment period closed in late August.

Among other benefits, VQIP-identified food products will be immediately released at the port of entry with FDA limiting its examination or sampling of such imports only in "for cause" situations, such as when a food may be associated with a public health risk. When sampling is required, the agency will do so at the final destination point or at a location preferred by the VQIP importer and will expedite any necessary laboratory analysis. "Expedited entry incentivizes importers to adopt a robust system of supply chain management and further benefits public health by allowing FDA to focus its resources on food entries that pose a higher risk to public health," the draft guidance document says.

Most of the comments submitted by 51 trade associations, organizations, and individuals generally supported VQIP, but also identified areas of potential concern. Many of these revolved around overly restrictive qualifications, prohibitive fees for small- to medium-sized businesses, duplication of efforts, and excessive recordkeeping.

"We have great expectations that preventive control assurances brought about by the FSVP rule and VQIP will speed border crossings, reduce border bottlenecks, and facilitate international trade," wrote James R. Gorny, PhD, vice president at Produce Marketing Association, in his comments. But he said it was unclear whether the estimated $16,400 VQIP annual user fee would be refunded if FDA rejected a firm's application. He also criticized FDA's plan to limit participation to only 200 firms during the program's first year. That number "will be infinitesimally small compared to the overall food import volume" of 12 million line-entries to 88,000 consignees annually, Dr. Gorny wrote.

The Fresh Produce Association of the Americas (FPAA), whose membership includes more than 100 companies involved in growing, shipping, and distributing fresh fruit and vegetables from Mexico to rest of North America, also expressed concerns over the proposed user fee. Lance Jungmeyer, FPAA president, urged there be some flexibility in the requirement that firms have a three-year history of importing food into the U.S. because companies often merge or form new entities. Jungmeyer also objected to strict requirements that the imported food not be subject to an import alert or a Class 1 recall and that all firms involved not be subject to an ongoing FDA administrative or judicial action. In both cases, he said, these actions could occur at no fault of the importer's. "It would be punitive, for example, for a grape importer to lose VQIP eligibility because it works with a non-applicant entity that is under Import Alert for cilantro," he wrote.

A 'Heavy Lift' for Business

James Acheson, a business analyst at The Acheson Group, predicts the process of becoming VQIP certified will be a "heavy lift" for many businesses. "But if you are an importer of food, and if you have VQIP, I think you will look very attractive to any U.S. domestic customer who only wants to purchase from those that are best-in-class," Acheson says. "So my view is that the economic upside of this may not rest with fast implementation of food, but more with the ability to leverage your programs to your customers."

As part of FSVP and VQIP, in July 2015 FDA issued a proposed rule that would establish levels of industry user fees associated with third-party auditors/certification bodies (CBs) and accreditation bodies (ABs)—private companies or foreign governments that will be responsible for auditing and certifying relevant overseas facilities. FDA will recognize ABs to accredit CBs, which will perform the necessary audits and inspections and issue certifications under VQIP. The proposed user fees range from $18,853 for ABs to $35,850 for CBs, depending on the amount of work FDA expects to review an entity's application.

Also in July, FDA issued draft guidance on model accreditation standards required for the third-party auditors and certification bodies. These include education levels, training, and competencies required for auditors and other personnel. As mandated by FSMA, when drafting the requirements FDA took into account existing international standards for certification bodies in order to avoid duplication of efforts and costs. As a result, the proposed standards are based on (but are not identical to) those established by the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC standard 17021:2011).

Obtaining FDA approval as an auditor, certifier, or accreditor under VQIP is likely to be challenging. Third-party auditor/certification bodies must demonstrate that they have the necessary authority to access records, conduct onsite audits, issue, and suspend or withdraw certifications; have adequate personnel and staff with the necessary knowledge, skills, and experience; protect against conflicts of interest; evaluate and monitor their agents through a documented process; demonstrate the capability to meet the quality assurance requirements including periodic self-assessment with a written report in English; and have the ability to quickly implement corrective actions.

According to the draft guidance, entry-level auditors should have at least a Bachelor's degree in a food or relevant scientific discipline, 30 semester hours in the same, plus experience or additional education, or demonstrate successful knowledge and experience. Lead auditors should have at least five years of experience, at least two of which are in quality assurance or food safety, or an advanced degree with at least two years of experience. "This is quite a lift if you want to become an FDA-certified auditor," says David Acheson, MD, founder and CEO of The Acheson Group and a former FDA associate commissioner for foods. "How many certification bodies and auditors will want to go through with this? My take is that it will be entirely driven by market demand, which for VQIP may not be all that great, at least initially. But if FDA begins to classify a lot of imported food as high risk, and as such the imported food will require a certificate from an accredited auditor to be allowed into the U.S., this will really drive the program far and fast," Dr. Acheson says.

Objections from Europe

VQIP's requirements are raising numerous concerns in the European Union (EU). For example, the requirement that participating facilities be certified by a third-party auditor or certification body accredited by FDA "is an unnecessary complex approach in that it appears to be independent from, and unrelated to, all the internationally recognized certification and audit systems," complained Bernard Van Goethem, the European Commission's director for health and food safety, in written comments. The requirement also doesn't recognize the authority of existing government agencies because it makes them subject to the same rules and procedures as private organizations, he added.

Van Goethem also noted that VQIP's high cost and complexity would benefit larger importers to the detriment of small operators "who represent a large proportion of the EU exporters." Importantly, he added, importers are likely to pass the additional costs onto their suppliers. The net result "could potentially result in a comparative advantage for domestic [U.S.] sources," he warned. That statement carries ominous international trade overtones in light of the recent World Trade Organization ruling on country of origin labeling against the U.S. and in favor of Canada and Mexico.

In addition to objecting to the requirement for a three-year history of importing food to the U.S. and to the user fee, the Juice Products Association (JPA) raised concerns about parts of VQIP's quality assurance program that may duplicate requirements under Hazard Analysis and Critical Control Points (HACCP) and the U.S. Customs and Border Protection's Custom-Trade Partnership Against Terrorism program. Companies covered under HACCP, for example, are exempt from FSVP requirements. "The FDA should take steps to prevent importers from having to duplicate their efforts in order to comply with two similar programs," wrote Patricia Faison, JPA's technical director.

But having a valid HACCP plan and abiding by it are not the same. In the seafood industry, for instance, having a HACCP plan is only part of the food safety solution. "There also needs to be some level of verification that the HACCP plan is actually being effectively and successfully used in the facility," wrote Tom Chestnut, vice president, NSF International, an auditor and certifier of food safety standards under the Global Food Safety Initiative (GFSI).

"The unfortunate reality is that there are likely less than 5 percent of the facilities exporting to the U.S. that possess this level of compliance," Chestnut wrote. Verification of HACCP compliance could come by means of a comprehensive audit under GFSI or other internationally recognized standard. A simplified "stepped" process could involve remote desk audits that validate the HACCP plan and associated documents, combined with a low-cost consultative audit to evaluate HACCP implementation and provide training and coaching when needed.

The American Association of Exporters and Importers (AAEI), an international trade association, urged FDA to tailor FSVP requirements to the roles and responsibilities specific to participants in the supply chain. For example, risk-based controls for manufacturing food products will differ from those for distributors, which will differ still from those needed at farms. FDA should also "exercise caution in accrediting third-party auditors," wrote Marianne Rowden, president and CEO, AAEI, noting that the international trade community "is currently being bombarded from third-party auditor requirements for many statutory requirements," such as the conflict minerals prohibitions under Dodd-Frank and requirements of the Consumer Product Safety Improvement Act. ■

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

Industry Insights

Can Big Data Revolutionize Food Safety?

Big data isn't just about analyzing more data—it also involves a change in thinking for food science professionals

BY **MARTIN WIEDMANN, PHD**

"Big data" is being talked about everywhere, including increasingly in the context of food safety and food quality. For example, while only one symposium covered "big data" in the 2014 annual meeting of the International Association of Food Protection (IAFP), the recent 2015 IAFP annual meeting included at least four sessions that mentioned "big data" in the session title or abstract. While the potential of big data and data analytics to improve our ability to address food safety and quality issues is increasingly recognized, use of these tools in food safety and quality still appears to be limited. Even if "big data" are used in this space, many may argue that the amount of data used in these cases rarely qualify as truly being big data, rather these data may often simply be large traditional datasets. While big data may only be slowly making their way into food safety and quality, there is a need for food science professionals to critically discuss and contemplate the impact of big data and associated analytics to allow for timely and appropriate implementation and use of these tools in food safety and quality to achieve improved decision making.

Big Data Introduction

While many definitions exist for "big data," a common definition reads along the lines of "Big data is a broad term for datasets so large or complex that traditional data processing applications are inadequate" (Wikipedia, accessed Aug. 3, 2015). Based on Douglas Laney's definition of data by the "3Vs," today a "4V" definition of big data is often used, which can be summarized as "Big data represents high volume, high velocity, high veracity, and/or high variety information assets that require new forms of processing to enable enhanced decision making, insight discovery, and process optimization." Often, "big data" also is linked to predictive analytics, as compared to the more typical use of data in food safety, which focuses on retrospective identification of associations and increasingly real-time or near real-time monitoring of processes. Most uses of large datasets and big data analytics in food safety and quality to date focus on providing improved root cause and retrospective analyses, but development and use predictive analytics in food safety is likely to grow quickly in the near future.

Big Data Sources for Food

Many of the early discussions on big data have focused on the use of genomics data as well as social media-related information in food safety. Whole genome sequencing (WGS)-based subtyping has been used for more than five years to create large sets of data that can be used for high resolution subtype characterization of foodborne pathogens (and spoilage organisms), which allows for better outbreak detection and source attribution. Importantly, WGS data for foodborne pathogens are also often rapidly released by public health and regulatory agencies,

Big Data in Food Safety and Quality – A Call to Action for Industry
Eliminate handwritten data (digitize)
Invest in IT systems and solutions, including data analysts
Demand better predictive analyses
Move from retrospective troubleshooting to prospective problem prevention
Use structured and unstructured sources of data
Ask questions and question assumptions
Train data scientists that can address food-related issues
Enter public-private partnerships that facilitate use of big data in food safety as well as food production, processing, and distribution
Develop strategies to assess and assure data quality
Define key questions where big data can have an impact and inform tangible actions that impact business bottom line

allowing for use of these data by industry. For example, WGS data for Listeria monocytogenes isolates identified as having been obtained from ice cream in Kansas became publicly available soon after a listeriosis outbreak linked to ice cream (with cases in Kansas) was reported in early 2015. Other omics datasets, such as metagenomics data, have also been used to identify and characterize food spoilage issues. It is likely that these types of data sources will also increasingly become available to the food industry.

Use of social media-related information has seen considerable early enthusiasm based on initial reports that suggested that "Google Flu Trends" can allow for early detection of flu outbreaks. Subsequent studies have suggested though that this tool may often inaccurately predict flu outbreaks. However, a recent CDC report suggests that mining of Yelp reviews can help public health agencies to identify foodborne disease outbreaks, which are linked to restaurants and may have otherwise gone undetected. Similarly, sales data, including data from shopper club cards and similar instruments, are also available to many retailers and companies and can be used to help detect and identify foodborne disease outbreaks, aiding in rapid initiation of product recalls and other consumer safety actions.

In addition to data sources briefly discussed above, food safety professionals can also have the opportunity to access a number of other structured and unstructured data sources, including often large amounts of data that are automatically captured through recording devices in food processing and retail environments (e.g., temperature data for heat treatment steps or refrigerated storage) and employment data (identifying the individuals that perform certain tasks, such as sanitation, on a given day). Unstructured data that could be mined for relevant information include, but are not limited to, video-captured data of facilities and employees.

It is also possible to rapidly acquire, often with no cost (other than computer and personnel time), large sets of metadata associated with samples that have been collected for microbiological or other testing. For example, public data sources are available that provide weather patterns (temperature, rain events, wind direction and speed, etc.) that are associated with a sample collection site and a specific sample collection date. These type of data can be used to rapidly determine whether out-of-spec samples (for example, samples positive for a pathogen or indicator organism) are associated with specific weather patterns (for instance, rain in the preceding day(s)), which can help in root cause analysis; for instance, associations with rain may indicate roof leaks or other water intrusions as a root cause. These same metadata could also be used for predictive analytics that may show an increased risk of pathogen findings or spoilage events after certain weather patterns, which could trigger enhanced preventive efforts.

Examples of Approaches in Food

One of the most mature examples of the use of large datasets in food safety is the use of WGS-based subtyping methods by both public health and regulatory agencies. In the U.S., the CDC and state partners are performing WGS on every human clinical *Listeria monocytogenes* isolate. Similarly, regulatory agencies such as the U.S. FDA are currently performing WGS of foodborne pathogen isolates obtained from foods and food associated sources. WGS will determine the sequence of virtually all 3 million nucleotides (A, T, C, and Gs) in the *Listeria monocytogenes* genome, typically with at least a 20-fold coverage, therefore creating 60 million data point per genome, which is used for extremely high resolution subtyping. Use of these WGS tools has significantly improved the ability of public health agencies to detect human listeriosis outbreaks, which allows for identification of more outbreaks than with previous subtyping tools (i.e., pulse field gel electrophoresis), including detection of smaller outbreaks (with less than five cases) that may also have gone undetected previously. As these tools are being applied to other pathogens, in particular *Salmonella*, the number of detected outbreaks caused by these other pathogens will likely increase considerably.

In addition to WGS, metagenomics-based tools also provide large datasets (often providing gigabases of sequence data), which can help characterize total microbial populations in samples. These tools have allowed for detection of new or previously unrecognized pathogens in clinical and food samples and have been shown to detect pathogens that were undetected by traditional microbiological methods. These methods also can facilitate detection and identification of spoilage issues and could be used as untargeted screening tools for raw materials streams and ingredients.

Use of geographic information system (GIS)-based datasets to predict and manage food safety risks are also rapidly gaining traction. For example, recent studies have shown how GIS data can be used to predict locations and time intervals that may represent a higher risk for foodborne pathogen contamination in fields.

The Challenges

While there clearly is considerable potential for big data-based approaches to facilitate improved approaches to food safety and food quality, a number of challenges remain for industry to take advantage of these tools. Most of these challenges are not unique to this industry, but some of them may be more pronounced. For example, data capture in the food industry

(Continued on p. 16)

(Continued from p. 15)
is still often manual and often involves paper records that cannot be used easily for data mining. Also, there are few trained data scientists who are also familiar with food systems type issues (or food systems scientists who can work with large datasets), which further affects the ability of industry to develop and implement effective systems that utilize large datasets to address food safety and quality issues. Based on these and other challenges, there is a clear need for the industry to take action to prepare to take advantage of big-data tools and solutions for food safety and quality dilemmas (see table, page 15).

What Could the Future Bring?

With the rapid advances in both collection and analysis of big data, it can be valuable to speculate on what the medium- and long-term future may look like as these tools are increasingly applied to food safety and quality. For example, the use of WGS for characterization of foodborne pathogen isolates by regulatory and public health agencies in the U.S. has gone hand-in-hand with rapid public release of full sequencing data. This puts industry in a position where it may soon be able to monitor subtype data for human clinical isolates and where it can then rapidly detect possible outbreaks, e.g. through comparisons with subtype data for isolates from processing facilities and other data (e.g., distribution pathways, purchase patterns). In the processing environment, integration of diverse data sources with historical microbial testing data may not only allow for improved and accelerated root cause analysis, but also for prediction of time intervals that may present lower and higher risk for spoilage or food safety issues; this information could be used to adjust food safety and operational practices in near real-time to include additional barriers and controls, including adjustments in preventative maintenance schedules, etc. Data sources that could be used in these analyses include weather patterns, environmental parameters in a facility (monitoring humidity, dews points, etc.), and equipment related parameters (vibration, flow rates, etc.).

With possibilities that may seem nearly unlimited, it's essential for industry to critically evaluate its needs and high impact areas and define specific questions and issues, rather than simply collecting increasingly large datasets and hoping that "something useful will come out of it." ■

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Around The World

Good Neighbors

Food safety is a shared priority among North America's big three buddies | BY **LINDA L. LEAKE, MS**

Editor's Note: *This is the sixth in a six-part series of articles that will showcase food quality, safety, and regulatory issues of each continent.*

Perhaps poutine is your thing, that ubiquitous Canadian fast food dish featuring French fries and cheese curds topped with light brown gravy. Maybe you take to tacos, tamales, and enchiladas, those iconic staples of Mexican cuisine. You could have an affinity for the all-American favorites, hot dogs, macaroni and cheese, and mom's apple pie à la mode.

Your personal preferences aside, these culinary delights are all popular mainstays in three wildly different countries that share three undeniable commonalities. They are friendly neighbors, they are important food trade partners, and they are devoted to food safety.

O Canada/Ô Canada

The Canadian food safety system is a mature one, where the shared responsibility paradigm between industry, consumers, and government oversight is well illustrated, says Samuel Godefroy, PhD, professor of food risk analysis and regulatory systems with University Laval's Faculty of Agriculture and Food Sciences in Québec, Canada.

Dr. Godefroy believes several factors contribute to the trustworthiness of the food safety system north of the U.S. border.

"For starters, Canada's food safety system has been under regular review with the purpose of updating and strengthening it," he begins. "The recent food safety events either at the international level, especially the 2008 melamine contamination issues related to dairy products and other food fraud scandals in various parts of the world, or at the domestic level, massive beef recalls in 2012 and a 2008 listeriosis outbreak, are still in the memory of Canadian consumers, producers, and regulators. As a result, there has been more emphasis on enhancing the food safety system in the country through major government investments, but also through added emphasis by the food industry itself to instill and maintain a food safety culture."

Moreover, Canada's food regulatory agencies have been subjected to a number of reviews and audits, the latest of which was a 2013 Auditor General report that reviewed the country's food recall systems, Dr. Godefroy continues. "As a result of these reviews and audits, a number of actions have been undertaken to modernize the system and address shortcomings," he points out.

Add to that, Dr. Godefroy says, Canada's food safety legislation was subjected to a recent amendment to Canada's Food and Drugs Act and the development of new legislation, the Safe Food for Canadians Act.

Like the U.S. FDA Food Safety Modernization Act (FSMA), the new Canadian legislation and subsequent regulatory provisions are to focus on preventive measures taken by industry to manage and mitigate food risks during production from farm to table, Dr. Godefroy explains.

"This overhaul will result in major enhancements and clarification of regulatory requirements associated with food production," he says. "In parallel, the Canadian Food Inspection Agency has embarked on a major food inspection modernization process aiming to create a more uniform approach to inspect and enforce food safety legislations and regulations."

(Continued on p. 18)

(Continued from p. 17)

Southern Ally/Aliado al Sur

Every growing season, nearly 200,000 trucks cross the border from Mexico into the U.S. to deliver more than 3 million metric tons of fresh fruits and vegetables to U.S. markets, according to Cristóbal Chaidez, PhD, director of the National Food Safety Research Laboratory of the Research Center in Food and Development, a government agency based in Culiacán, Mexico.

"The presence of *Salmonella* remains a major cause of detention and rejection by the U.S. of shipments of Mexican fresh produce," Dr. Chaidez mentions. "Other important microbial issues are recently arising in Mexico, such as the presence of *Cyclospora* on cilantro."

Dr. Chaidez says a key strength of the Mexican food system as it impacts the quality and safety of food produced in Mexico is national institutions such as the country's National Agro-Alimentary Health, Safety, and Quality Service (SENASICA).

"SENASICA is putting in place an initiative named Contamination Risk Reduction System from initial production through to the packing and transportation of fruits and vegetables," he relates. "This initiative covers 16 elements, including company registration, business history, water use, hygienic practices, traceability, fertilization, and damage to wildlife, among others."

A big plus is that Mexican produce growers are organized, Dr. Chaidez says. "The industry effort to maintain the safety and credibility of their brands compelled them to develop and implement food safety programs on their own," he points out. "A major example is Eleven Rivers, an initiative of Sinaloa growers."

"Eleven Rivers is designed to implement, verify, and apply a certification scheme in food safety through a periodic review by independent bodies oriented towards ensuring consumer health, but also promoting the systematization of safe food production processes in the food chain with social and environmental responsibility," Dr. Chaidez adds.

"In the Eleven Rivers regulatory scheme, companies certify their modules of agriculture production, packing, and shelter facilities," he explains. "This scheme is not only focused on food safety but it also seeks to comply with the best industry practices, including process quality, traceability, and corporate responsibility. Participating growers agree to be subject to a seasonal certification, and weekly compliance verification, conducted by independent certification and verification organizations."

Stars and Stripes Status

The three main food safety issues impacting the U.S. today are produce, imported foods, and bacterial contamination of high fat foods, according to Michael Doyle, PhD, the regents professor of food microbiology and director of the Center for Food Safety at the University Georgia, Griffin, Ga.

"One-third of the outbreaks of foodborne illnesses in the U.S. during the past five years, according to the CDC, are linked to contaminated produce," Dr. Doyle says.

Imported foods, especially ingredients like spices, are an ongoing food safety concern, he continues. "Lots of ingredients in processed foods can be contaminated with *Salmonella* but they are typically hard to pick up in foodborne illness outbreaks," he mentions.

Sadly, some of the most popular and widely consumed, albeit high fat, foods in the U.S. can be guilty of harboring pathogens and causing illness with ease, Dr. Doyle points out, citing peanut butter, ice cream, and chocolate.

"The fat protects the bacteria from the acid in the stomach, and since they are protected, a smaller dose, as few as 10 to 100 cells, is required to cause illness," he explains.

PulseNet

Driving U.S. foodborne illness surveillance capabilities, Dr. Doyle says, is the CDC's PulseNet USA system.

Established in 1996, PulseNet is a national laboratory network comprised of 87 public health and regulatory (FDA and USDA) laboratories, at least one in each state. PulseNet connects foodborne illness cases together to detect and define outbreaks using DNA fingerprinting of the bacteria making people sick.

"PulseNet, in collaboration with FDA's GenomeTrakr, is rapidly adopting whole genome sequencing as its next generation fingerprinting method," Dr. Doyle says. "This will enable more rapid detection of outbreaks, along with increasing CDC's ability to identify outbreaks having only a few cases."

Whole genome sequencing allows scientists to trace pathogens right to the source, Dr. Doyle elaborates. "One recent example is the *Salmonella* contamination of frozen raw-scraped ground tuna that infected 425 people in 28 states in 2012 and was traced to India," he relates. "The genome sequencing led to this discovery."

Recalls

Food recalls are one of the biggest food safety concerns in the U.S. right now, says Pam Coleman, MBA, vice president of research services for Mérieux NutriSciences, Chicago, Ill. "We still have huge, devastating recalls and they always seem to be a surprise, even though some of these contamination issues seem to have gone on for years," she relates.

Coleman believes a major strength of the U.S. food chain is the scrutiny of its meat and poultry, both raw and processed. "USDA has done a fantastic job of driving continued improvement in the reduction of *Listeria* in processed meats," she says. "They have also developed increasingly more data driven micro baseline levels for the raw meat plants, holding plants accountable for the contamination levels of their products over the past 20 years."

The USDA Food Safety and Inspection Service collects samples of meat and poultry products to estimate the national prevalence and levels of bacteria of public health concern. Each report is a compilation of data obtained for a particular species or type of animal.

"Having a known baseline level is step one to improvement in any process," Coleman points out. "Now the challenge is clear and industry is responding with ways to reduce levels over time."

Environmental Monitoring

When environmental monitoring came in vogue, it was viewed as a tool to help reduce the prevalent risks that are an issue in nearly every type of food plant, Coleman mentions. "But after years of running these programs, there is a tendency to react less and less to a few isolated positive results," she says. "So while many companies have embraced environmental monitoring over

the past 15 years or so, as an industry we need to figure out better ways to extract actionable information from the sporadic positives that many plants experience."

Progressive solutions, such as EnviroMap, raise environmental monitoring to the next level and help to track and map specific organisms, Coleman relates.

"It will take a proactive approach on the part of all food industry stakeholders to be more effective with bacterial monitoring, expansion of routine testing, and control," she asserts.

FSMA Impacts

With the FSMA rules regarding preventive controls for human food and preventive controls for animal food finalized on Aug. 31, 2015, and with the rules for produce safety, the foreign supplier verification program, and third-party accreditation expected to be finalized by Oct. 31, 2015, food companies of all sizes are wondering how to deal with these new rules and what they have to do to comply, says Robert Buchanan, PhD, director of the Center for Food Safety and Security Systems at the University of Maryland in College Park, Md.

"Clearly, we will have a whole new regulatory scheme unfolding in this country over the next three to five years," Dr. Buchanan says. "And the impact does not stop at the U.S. border since now, with FSMA, all the countries and companies that export to the U.S. will have to meet the requirements of the regulations."

Dr. Buchanan considers the U.S. taking the lead on new regulations a positive thing. "The regulations derived from FSMA seem to be paying a great deal of attention to ensuring that a level playing field does not favor certain segments of the food industry, such as small versus larger manufacturers, or domestic versus foreign manufacturers," he says. "And fortunately, the drafters of the regulations also appear to be very careful about not hampering innovation. If we tamper with this ability, we reduce the potential for continuing improvement in our food supply."

A great characteristic that is unique to the U.S. food system, Dr. Buchanan says, is that a single person can have tremendous positive impact, especially with regards to regulations. "If you have the scientific knowledge and the ability to communicate this effectively to the policy makers in the U.S., you can make a huge difference," he emphasizes.

"We have an open process in the U.S. that allows citizens to provide their input into new or changing regulations, something that is not common in many parts of the world," Dr. Buchanan says. "If you take advantage of the way regulations are developed, then you have the potential for influencing how we are governed. This is where the members of the academic community can play an increasing and important role in explaining the science underlying continuous improvement in food safety." ■

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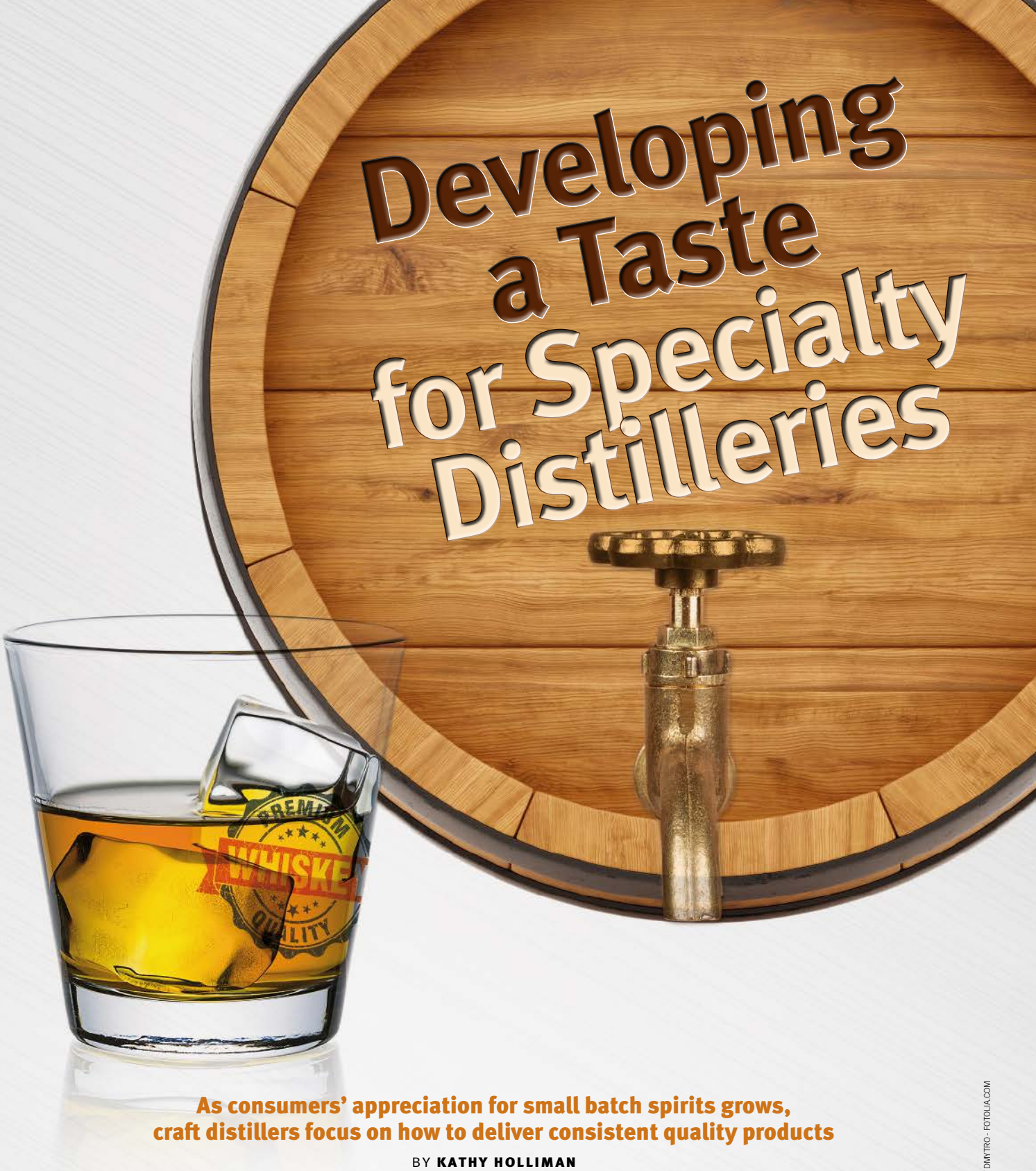
For bonus content, go to October/November 2015 issue on www.foodqualityandsafety.com and click on "Food Safety in North America."

Developing a Taste for Specialty Distilleries



As consumers' appreciation for small batch spirits grows, craft distillers focus on how to deliver consistent quality products

BY **KATHY HOLLIMAN**

Fifteen years ago, the number of craft distilleries in the U.S. barely topped 20. By 2010, there were 90, and today that number is edging toward 1,000.[1] The craft spirits industry is riding the wave of public enthusiasm for distilled spirits and locally sourced foods and beverages.

Overall revenue in the distilled spirits market—including the industrial-sized brand-name distilleries—has increased significantly in the past 15 years, reaching an all-time high of $4.2 billion in 2014, according to the Distilled Spirits Council. The craft distillery share of that revenue was $400 to $500 million, representing about 1.7 percent share of the spirits market by volume.[1]

Nicole Austin, master blender at King's County Distillery, Brooklyn, N.Y., says there has been a significant shift in market trends since the late 1990s. "In the '80s and '90s, during the height of the appletini cosmo drink, people weren't caring or asking questions about how things were made or where they came from or even

©PRIVATEER RUM

Maggie Campbell, head distiller and vice president, Privateer Rum, Ipswich, Mass.

CORSAIR

Distiller Colton Weinstein at Corsair Distillery in Nashville.

distinguished what was good or what was bad. It was just, 'I want the purple drink or the green one.'"

Now, things are different, agrees Ralph Erenzo, co-founder of Tuthilltown Spirits Farm Distillery, Gardiner, N.Y.

"The general market itself began to be inclined toward handmade goods, to know where they are coming from, to know what they are made of, and to know the people who are making them. And they were insisting on higher quality," says Erenzo, whose distillery was the first in New York State when it started operation in 2005. "Suddenly, vodka started falling off and there was a new generation of drinkers who were exploring whisky and aged spirits again. We never anticipated the kind of success we have had."

This change in general tastes has benefitted the distilling industry, which has undergone extraordinary development in a very short period of time, he says.

Pouring Quality into Craft Spirits

Quality in craft spirits is rightly measured by taste. "With every batch, what is most important to us is whether it meets our flavor profile and deciding whether we would want to drink this and whether it is a quality product," says Andrew Tice, head distiller at House Spirits Distillery, Portland, Ore. "A lot of our best tools for that are our experience and tasting the product every day."

Maggie Campbell, head distiller and vice president at Privateer Rum, Ipswich, Mass., says that craft distillers have a unique relationship with their customers. "People understand that we are a small handmade product and that, if we want to make it better, we will make it better. But with that comes the commitment that if it is not better, we have to be willing to throw it away."

Coaxing out the desired flavors requires aging spirits in barrels from different places in the warehouse and then blending spirits from different barrels to get "this large spectrum of character," Campbell explains.

"When the spirit is fresh off the still, we call that the primary flavor. At that stage it will taste like a fresh cut green apple." Secondary flavor development happens when both the flavors from the wood and the spirit can be tasted. "And eventually when it has enough age to it, that fresh cut apple will begin to taste like dried apple peel and that oak flavor will begin to taste like caramel and vanilla and lavender. We call that tertiary flavor development. It is like imagining a fresh fruit becoming a dried fruit. That's how we know that the flavor has actually matured," Campbell says.

For Austin, skillful blending is key. "The number one thing I focus on for quality control is determining, after the barrels have matured, which ones are ready to come out and which barrels are going to be blended together to create the product. Blending is a lot about nosing and tasting, knowing what you are aiming for, setting rules and parameters for yourself, being committed to not taking a shortcut and just dumping barrels in a tank because you have got to bottle," she says.

The art of spirit making is the nosing and tasting rather than a scientific analysis. "There is no scientific test for delicious. So much of that process is the brain making sense about what it is smelling, putting together vanilla, cinnamon, and fruit smells, and interpreting that to mean apple pie. That's where the artistry comes in," Austin says.

Flavor Begins in Ingredients, Oak Barrels

Selecting high quality ingredients is the first step in quality and consistency. Craft distilleries are known for being willing to experiment with a variety of ingredients to build in unique flavor. Corsair Distillery in Nashville, for example, uses quinoa in a whiskey and has started its own malting facility so that it can establish specifications for malting, according to distiller Colton Weinstein. Corsair buys barley but is hoping to start growing its own in the future to have even more control over the quality of the raw ingredient.

Achieving consistency of ingredients is a concern, Erenzo says, given that each batch of raw material is different. A distiller may start with one crop of rye and the next season have a different crop, grown during a different weather cycle. "That's where the blending comes in to get your desired flavor profile," he says.

Distilling begins with selecting ingredients, of course, but it's in the charred oak barrels where the spirits are aged that the flavor notes develop. Getting enough of those barrels can be a challenge, however. The rapid growth in craft distilleries began at about the same time as the housing slowdown, a slowdown that trickled down to the wood harvesting business and led to a shortage of dried oak for coopers, who could not keep up with the increasing demand for aged barrels.

(Continued on p. 22)

Ralph Erenzo and Brian Lee, founders of Tuthilltown Spirits Farm Distillery, Gardiner, N.Y.

TUTHILLTOWN

Erenzo says that when Tuthilltown started distilling spirit, it was one of only about 10 in the country, and getting barrels wasn't much of a problem. Now, with between 700 and 800 distilleries operating in the U.S., cooperages are working around the clock to keep up with the demand, and some have an 8-month waiting list.

The wood in the barrel comes with its own history—whether it grew slowly or quickly, its age when cut, whether it was air dried or kiln dried, how long it sat in the cooper's yard protected or unprotected, or how it was charred. Barrel making is an art, distillers say, and a good barrel isn't made in a day.

"You can't get around the fact that it is a natural product, and you can't get around the fact that when you fill it in September or in November, the weather will be slightly different, even if all the barrels are kept in the same room together," Austin explains. But those differences are desirable because the finished product should not have just one note. "You build that complexity by bringing those barrels together."

Temperature interacts with the wood barrels during the aging process. If whisky is placed in a barrel in October, it will take longer to age than if it is placed in the barrel in May because the temperature will drop during the first months of aging, according to Erenzo. Tuthilltown has no climate control in the building where its barrels are aging, so "whatever happens outside is what is happening inside, which is absolutely necessary," he says.

A barrel is charred so that the sugars in the wood are caramelized. When the barrel is filled with a spirit, the barrel warms up, the wood expands and sucks the liquid spirit, a solvent, into the wood. The solvent then dissolves the sugars and tannins and colors that are in the oak. When the barrel cools off, the wood contracts and pushes the liquid back out into the barrel. "So that hot-cold cycle is very important because that is what causes the exchange between the liquid and the wood," Erenzo says.

Tuthilltown now ships some freshly emptied barrels used to age one of its whiskeys to a maple syrup producer in Canada. After the maple syrup has been aged in the barrels for 4 to 5 months, those barrels are shipped back to Tuthilltown where they are refilled with rye whiskey. Both the maple syrup and the whiskey benefit from this exchange of flavors, Erenzo says.

Thomas Mooney, CEO and co-founder of House Spirits and president of the American Craft Spirits Association, says that, unlike craft brewers who must control temperature to ensure the quality of their products, craft distillers want that variation. "Whiskey matures at a better rate and gets to a better place if you have temperature variation. What a craft brewer tries to avoid is what we actually look for."

According to Weinstein, temperature control is also not an issue in storage and shipping. Keeping a distilled spirit out of direct sunlight is a good idea, but temperature ranges will not affect the quality of the spirit even after it is bottled.

Ensuring Safety

Although the alcohol content of distilled spirit is a sanitizer on its own, safety concerns are considered paramount within the industry. Campbell, who has an extensive background in Hazard Analysis and Critical Control Points, or HACCP, understands the various ways that contamination can be introduced into the product. Every barrel must be visually inspected and smelled for the presence of sulfur, taint, and even a dead animal; any bag of ingredients with even a small tear should be thrown out.

(Continued on p. 24)

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(Continued from p. 22)

Andrew Tice, head distiller at House Spirits, Portland, Oreg.

Staff must be trained about safety protocols for using ladders and chemical cleaners. No sparks or flames can be allowed in the building, and welding repair must be done outside the building. Every hose pump should be rinsed with reverse osmosis water; all of the fittings must be cleaned after every use and then stored; every bottle must be inspected before filling.

"People who are around stills and high-proof alcohol tend to be pretty aware of the danger. But it's the little things that many people don't think about, such as ladders, chemical cleaners, and cleaning materials," Campbell says.

Most craft distilleries have not yet caught the attention of OSHA, but the potential for an inspection is always present. Monthly training at Privateer Rum focuses on preventing accidents, and the company has compiled a safety notebook that includes the "near misses" that could potentially have been serious accidents.

Challenges of Small Volumes

There are advantages and disadvantages to operating a distillery on a small scale. A certain number of employees are needed to make distilled spirits, but there can be a point at which a company becomes staff-heavy without the sales to cover those costs. Purchasing of grain and other essential ingredients and barrels is more expensive when a distiller can only buy in small volumes. Without enough storage space, bottles and other supplies cannot be purchased in large quantities, driving up costs.

According to Mooney, there is a lot of overhead associated with running the distillery and compliance with federal, state, and local regulations. "We know we will never have the cost structure of a large brand, which is why you rarely see our brands at comparable prices."

Austin says there are many inefficiencies of labor because of the size of craft distilleries. "A distillery 100 times the size of us may have only 20 percent to 30 percent more staff." Big distilleries are also in a stronger negotiating position with distributors because they operate on a bigger scale, she says.

Disposing of waste is a huge operational and safety issue and an expensive one for smaller operations, comments Erenzo. "Almost no distiller that gets into the business thinks about waste, but it's one of our biggest and most expensive problems," he says.

Meanwhile, getting rid of thousands of gallons of spent mash requires trucking it somewhere because it cannot be spread on the ground or dumped into the municipal waste system. An expected revision of a Food Safety Modernization Act, or FSMA, proposal that spent grain intended for animal feed must first be inspected and then packaged will be welcomed by the industry, he says. For large distilleries with huge quantities of spent grain, selling it is another form of revenue; for craft distillers disposing of it is only an expense.

There are advantages to operating a small distillery that offset the disadvantages, one of the best being that these operations can be "very agile," according to Campbell. "If I want to change something or tweak something, it's very easy, whereas in a large distillery we wouldn't be able to do that. We get to question what we do and try out new things."

"Our advantage is that we can be more nimble," Mooney says. "We can create products and test them out here, and there are no layers of bureaucracy to go through. We look for all the ways that being small is an advantage and that allow us to make things with greater care." ■

HOUSESPIRITS

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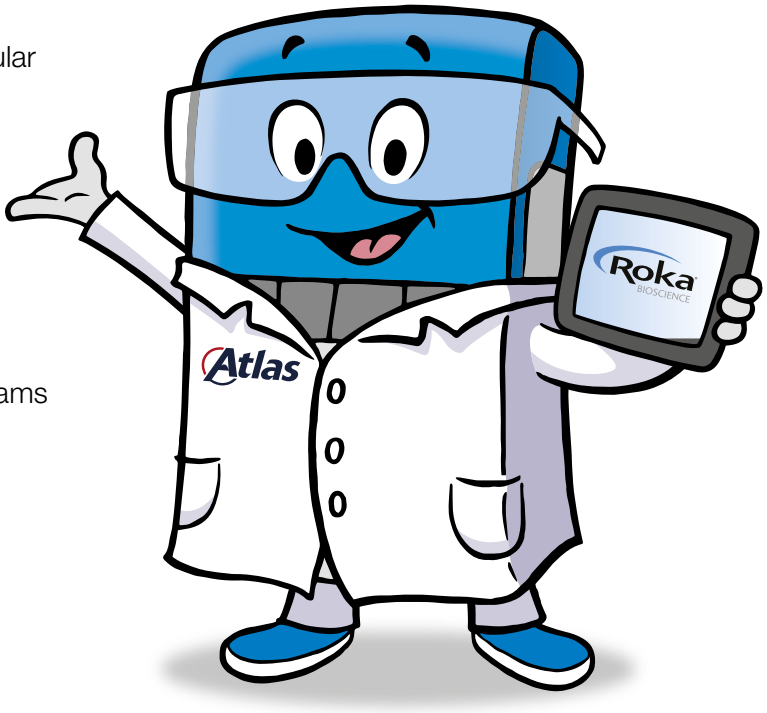

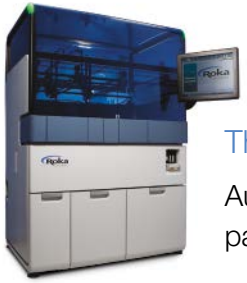

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US Foods' Road to Success

Company receives the 14th annual Food Quality & Safety Award for its commitment to becoming an innovator in the food safety realm | BY **LORI VALIGRA**

Change has been the one constant in assuring food quality and safety at US Foods Inc., says Jorge Hernandez, senior vice president of food safety and quality assurance (FSQA) at the Rosemont, Ill., food and distribution company. Over the years, it has grown by acquiring a number of different companies, which in turn necessitated culling the best practices from all of them while reducing overlap.

"This is a continuous improvement process," explains Hernandez. "It has a lot to do with the culture we established from the beginning."

When Hernandez started the FSQA department at US Foods 10 years ago, there was no single food quality program across all the different companies.

"My first job was to integrate the program into one function that would be across all the different businesses and distribution centers," he explains. "So from the beginning the challenge was to take the best of all of those programs and put them into one that was not only able to meet regulations, but that would have a sense of innovation with more effective processes and solutions."

He adds, "We saw the world of safety, quality, and compliance was starting to change and speed up, and we needed a program that could adapt with those changes and make continuous improvements so it would be easier to move forward with new regulations, new findings from investigations, and new technology."

For its corporate-wide integration and focus on quality and safety, US Foods was recently named the winner of the 14th annual Food Quality & Safety Award. The Award presentation was held during the International Association for Food Protection (IAFP) conference, Portland, Ore., on July 26.

The company has a challenging task, with 350,000 products, including 20,000 high-quality exclusive brands, distributed through 63 nationwide locations on more than 6,000 refrigerated trucks. It also has 12 beef processing facilities, four culinary equipment and supplies distribution centers and six Cash & Carry retail stores.

Despite those huge numbers, it has managed to require that all of its 1,200 private-label co-packers—as well as its own distribution centers—obtain Global Food Safety Initiative (GFSI) certification. It initiated a web-based complaint system that has made it easier to report, investigate, and catch problems earlier. The results: a 24 percent reduction of product foreign material complaints and an 11 percent reduction in quality complaints in 2014 compared to the previous year.

In addition, US Foods has added new technologies such as a system to control meat package leakage. The company also developed and required food safety training for every job function in its distribution centers. And, it is the first broadline distributor to use DNA testing to verify seafood species and prevent mislabeling or detect fraud.

"The need for the application of food safety science has never been greater than it is today," Gale Prince, CFS, founder and president of SAGE Food Safety Consultants LLC of Cincinnati, Ohio, said in giving his keynote address during the Award ceremony.

US FOODS

"You must be proactive with futuristic thinking in preventing food safety issues."

US Foods has been a strong proponent of partnerships across the industry at GLOBALG.A.P., GFSI, the International Food Protection Institute, the Center for Produce Safety, Produce Marketing Association, Association of Food & Drug Officials, IFS, and the American National Standards Institute. The company has also been an advocate of sharing best practices among food companies throughout the country.

Accepting the Award at the July ceremony were Hernandez and his colleagues Jeff Semanchek, director, supplier food safety and quality; Frank Ferko, director of distribution-FSQA; Stephen B. Posey, manager distribution FSQA–Central/Southwest Regions; and Roberto Bellavia, director of FSQA Stock Yards National.

Past winners of the annual Food Quality & Safety Award include Backyard Farms, Hans Kissle, Mastronardi Produce, Fieldale Farms, West Liberty Foods, and Hormel Foods.

US FOODS

Most of the company's distribution centers have state-of-the-art kitchens used by US Foods Fanatic Chefs not only to work with their local customers in the latest culinary techniques, but also to teach proper "hands on" food safety practices that can be used in restaurants.

GFSI: A Central Strategy

While US Foods has continued to upgrade its technology, staff training, key performance indicators, and other FSQA systems and procedures over the past year, Hernandez says that GFSI certification of its different businesses was central to its strategy.

"The reason is that certification provided a vehicle for us to get the food safety directive into each business unit's leadership while instilling the discipline to measure, track, and review the food safety and quality key performance indicators on a regular basis as part of the business review," he says. "That combination allowed us to drive food safety and food safety performance into the business."

That being said, he emphasizes that each food safety and quality project and action is important since they each provide value to the company and its business.

Staff training is also important. Every staff member has specific food safety and quality training aspects to their job. For example, he says a delivery driver's training focuses on time and temperature risks, as well as controls and his/her role in keeping the food safe in transit and during delivery. The same training is also taken by his/her supervisor, with the added tasks of how and when to check and document a drivers' non-compliance.

US FOODS

Proper storage and appropriate rotation are critical to ensure the safety and quality of the foods in US Foods' warehouses.

"All these are checked by internal and third-party audits several times a year," he says. "This allows us to embed the food safety and quality actions into the day-to-day delivery operations." The same strategy is followed with all other positions.

Hernandez explains that while everyone who handles food at US Foods has a food safety and quality responsibility, his team is formed by 40 corporate FSQA staff with direct line responsibilities and more than 300 associates in the distribution centers who have FSQA functions embedded in their jobs with dotted line responsibilities. For example, every distribution center has several recall coordinators, a couple of produce inspectors, and a Hazard Analysis and Critical Control Points (HACCP) coordinator.

"So there are a number of different folks who do those things in a distribution center, but who do not report directly to FSQA," Hernandez says. All corporate workers are HACCP-certified, as are two to three staffers at each distribution center.

"HACCP is one of our basic building blocks. It's expensive and time-consuming, but it goes to the approach you take on how you embed food safety within the business," he says. "When you make food safety and quality a requirement of the business, it's just another thing that you have to do. But when you make it a value to the business, it becomes a lot easier to explain the disruptions, changes, and expenses you're making to the business."

He adds, "From the beginning, we've been able to provide information on how that investment pays back the business. When we're able to win more customers because we have better documentation than others with more certifications, and you make that more well known, it becomes a value rather than a cost."

US Foods has also invested in a number of new technologies aimed at improving the quality of its food products. Its online complaint system streamlines the complaint process, making it easier to catch and solve problems earlier.

Technology improvements extend to other parts of the company. For example, Stock Yards Chicago implemented a leaker reduction program earlier this year that involves both meat film wrappers and technologies to reduce leakage rates by about 1 percent so far this year. And its Las Vegas Stock Yard conducted a Lean Six Sigma project to reduce waste from the Roll Stock packaging

(Continued on p. 28)

(Continued from p. 27)

The US Foods team members at Award ceremony, from left to right, Jeff Semanchek, director, supplier food safety and quality; Frank Ferko, director, distribution-FSQA; Jorge Hernandez, SVP FSQA; Stephen B. Posey, manager distribution FSQA – Central/Southwest Regions; and Roberto Bellavia, director, FSQA Stock Yards National.

CHRIS RYAN PHOTOGRAPHY

line. One form of waste was leakers created by bone-in products that pierced the Cryovac film. The company added a bone guard to the product to remedy the situation, which the company says saves it $72,464 annually.

"From the beginning we developed a program that met the most stringent food quality and safety compliance," Hernandez says. "As we looked at new findings from the industry and new technology, we tried to obtain it year to year rather than waiting for the regulators to react. When it comes to regulations there's been a lot of changes but we, for the most part, have been ahead of them, whether it's an approach to product sourcing or stronger management systems."

Keeping Score

The company also is using a scorecard-tracking system to document, track, and trend its facilities' food safety and quality key performance indicators. The same program provides customized charts for each of US Foods' private-label suppliers and compares their scores against "best in class" and "worst in class" in their specific food category.

"This type of communication has made an impact and improved the suppliers' performance significantly," comments Hernandez, in some cases as much as 20 to 30 percent over previous period scores.

US Foods also has a customer education blog on food safety and quality topics to help customers learn about better, safer food handling and get the most from their food delivery. Recent topics include how to read code dates, improve food rotation in storage, maximize shelf life, and the best and safest food temperatures.

In addition, US Foods has developed a Supplier Expectations Manual (SEM) outlining its food safety, quality, packaging, and regulatory compliance requirements for all private-label products and for all facilities producing US Foods-branded products.

"This is a living document and is reviewed regularly and updated as often as necessary to focus on the criteria that are important from a regulatory or food safety and quality perspective," says Hernandez. Revisions and updates occur every two to three years to reflect emerging risks, changing regulations, and suppliers' performance.

"The SEM is an important document in the training of all FSQA staff and contains general requirements for all commodities and category-specific expectations," he adds. "The manual is provided to all prospective vendors and they are bound, by contract, to comply with it." He says his staff or its representatives conduct regular onsite audits of facilities to verify SEM compliance.

Staying Nimble

This past summer, US Foods had to rethink how it will move forward in the wake of a failed takeover bid by rival distributor Sysco Corp., which terminated the potential merger in June after a U.S. District Court judge granted a Federal Trade Commission (FTC) request for a preliminary injunction. The reason: it feared the combination of the country's two largest food service distributors would increase prices at food establishments nationwide and significantly reduce competition in the industry.

Hernandez explains that before the deal fell through, US Foods and Sysco were preparing for the merger for 18 months by putting together a "Best of Both" FSQA program.

"While we were disappointed by the FTC ruling, our goal at US Foods has always been to serve our customers by never forgetting what we're about: delivering great, safe, quality food, cultivating talented food people, and making it easy for them to work with us. This internal belief now makes it easier to go back with renewed focus and unwavering dedication to take the company to the next level," he says.

In relaunching as a single company, US Foods will focus on accelerating the progress it has already made, says Hernandez, with innovation, a long-time company strength, at the center of its relaunch strategy, entitled "Just Taking Off."

The company states that it is in a strong financial position and is well-prepared for growth. Over the last 18 months, it invested millions of dollars into new technology and fleet and building improvements, including the construction of new LEED-certified facilities that service the Boston, Mass. and Jackson, Miss. markets.

"Our customers can expect to see more of the innovative and exclusive food items that empower them to explore on-trend dishes and freshen up menus," comments Hernandez. "New technology enhancements and intuitive business solutions will increase their business success and make working with US Foods even easier. The company will continue to revolutionize the way the industry experiences food and business consultation with its Food Fanatics program."

He adds that food safety is part of the campaign, making sure US Foods has the best-in-class programs that ensure the safety and quality of the foods it delivers.

According to Hernandez, "That makes it easier for our customers...so they don't have to take that worry into their business." ■

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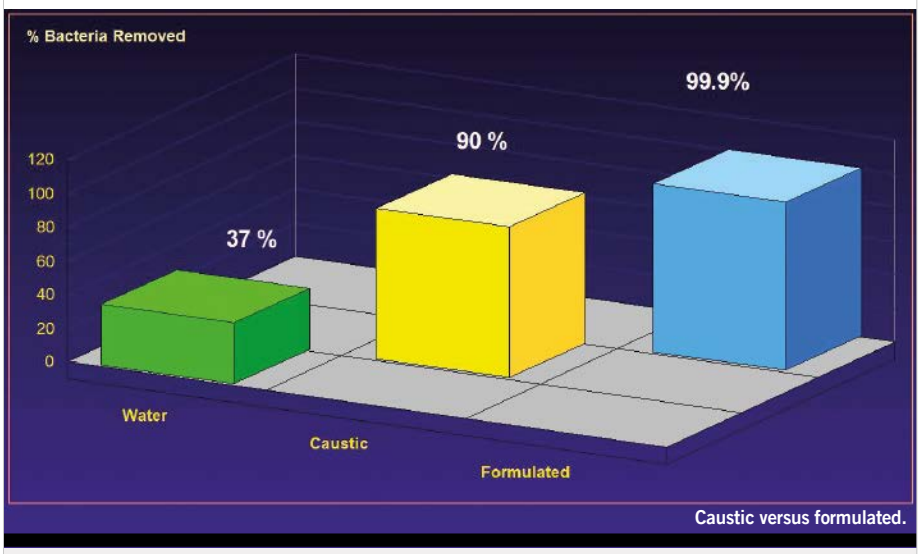

Caustic versus formulated.

What's So Special About Specialty Sanitation Chemistries?

Today's sanitation suppliers are meeting the growing need to clean smarter using more efficient chemistries in demanding processing scenarios | BY **CHARLES J. GIAMBRONE, MS**

The rudiments of the cleaning chemistries are applicable from environmental and kitchen sanitation in the home up to the mega food processing plant. In order to appreciate how specialty sanitation cleaners, clean in place (CIP) or clean out of place (COP) and open plant systems, create value and innovation, a brief review of the principles of cleaning systems/formulas is instructive.

Sanitation Parameters

The acronym "SS TARTEC" stands for eight sanitation parameters.

1. Soil: organics verses inorganic types.

2. Surface type: mixed metal or plastic, or combination surface that is to be cleaned.

3. Time to clean.

4. Action: CIP flow rate, fluid psi of fluid, or mechanical action.

5. Rinsability: water, volume, and pressure used.

6. Temperature parameters.

7. Energy: kinetic, thermal, and mechanical.

8. Cost: what the current seven parameter procedures established in the sanitation standard operating procedure (SSOP) cost in terms of labor, energy, time, and chemicals.

How you currently conduct the operation and execution of the cleaning parameters (SS TARTEC) is going to let you know what improvements in procedures, equipment, and "specialty" chemistries are required or desired.

Caustic vs. Formulated

The figure at left highlights that straight caustic does not remove as much soil as a formulated cleaner. The example used is a dairy soil with inoculated *Lactobacillus spp.* typically found in CIP sanitation applications.

Caustic alone leaves 10 percent soil plus microbes, which is too high of an organic load/ bioburden for the sanitizer to overcome. A "formulated" cleaner is like an orchestra with all the components to give a well-rounded sound or cleaning approach. Caustic is your foundation while the chelating agents prevent redeposition of organic-inorganic complexes onto surfaces. The surfactants reduce the surface tension so that you create more efficient cleaner to soil contact. The sequestrants will type up inorganic ions like calcium, magnesium, etc. and work hand in hand with the chelants and the surfactants. If it's a chlorinated caustic formulation, the hypochlorite is there to attack the protein soil fraction, forming the removal of the proteins in a colloidal suspension. Acid cleaners are also formulated with comparable components to promote enhanced acid cleaning, including enhanced inorganic scale and biofilm removals.

How Much

Bottom line to the sanitation performance in the plant is: How much chemical, energy, water, and time will your product cost me? Or, how much will it save me? The approach you take with the "specialty" chemistry you trial and employ for a specific sanitation application will only be valid and successful if it saves the end user's bottom line. Included in the bottom are chemical costs, energy (BTUs), water, and labor/time consumption to create a ROI by providing less chemistry usages, less water, less BTUs, and giving the plant more processing time by shrinking the sanitation time. This has to be all achieved while being as efficient, or more efficient, than older cleaning SSOPs to satisfy food

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safety regulatory requirements without compromising food quality parameters like organoleptics, while also increasing product shelf life. As you can see, there is a huge balancing act to maintain.

With all these increased demands and requirements, this is why the classic formulated cleaners have had to evolve into more and more specialized or specialty cleaning technologies. Often it's not the cost of the actual cleaning chemistry that's the issue, it's the other costs of sanitation that are out of line in a program, primarily labor, followed by utilities (energy, water, BTUs), with chemical costs a distant third in the equation.

The "costs" of sanitation must be reduced under increasing processing run demand with new or modified soils created by these new processing systems. These tougher, problematic soils need to be efficiently removed in a variety of complicated equipment processing modes. For example, a fruit or vegetable flume that is cleaned nightly will have significantly less biofilm and scale buildup than one who is on a seasonal intense extended production run that won't be properly cleaned for four or five days. The same can be said for the same produce-processing mode in the blancher where these typical seasonal extended runs result in a level of organic load and scale that can imperil both food safety as well as quality. Another example is that of a fry operation. In some production scenarios, the fryers are not cleaned for over two weeks. Obviously, the same product being fried is going to have significantly less carbonized soil if the fryer is cleaned nightly versus weekly versus every two weeks.

Challenges

While the chemistries used for a fryer, a freezer/cooling tunnel, or a flume have in each instance the same soils, temperatures, and processes, the processing time between cleanups create a multitude of soil scale factors that will demand novel or specialty cleaning chemistries to be employed.

Ovens, fryers, and smokehouses/cookers and brewery equipment all pose significant cleaning challenges for the sanitation program especially during extended runs. The high temperatures of cooking and kill process coupled with the high carbohydrate, high protein, or combination soils being carbonized create the sanitation challenges. While conventional chemistries could deal with these after a short production run, these same chemistries provide incomplete cleaning for extended runs.

The demands for new creative chemistries or procedures to deal with these heavily carbonized protein-lipid-carbohydrate complexes have compelled the industry to become creative to effectively remove these problematic soils without wreaking havoc on a plant's wastewater treatment system. An approach to reduce levels of caustic cleaners and cleaning these carbonized soils more effectively involve the utilization of a low concentration of an acidic peroxide additive (e.g. Rochester Midland Corp.'s Enhance O2) that creates a unique oxidative, the perhydroxyl anion. The formation of the perhydroxyl anion markedly reduces concentrations of the caustic cleaner by up to 50 percent and reduces the time by roughly 50 percent. This regimen is done in concert with cleaning coils, vents, and other ancillary areas with a gel caustic product to loosen the most problematic carbonized soils. Non to low hydrogenated oils (e.g. canola or sunflower oils) are becoming the standard for fried foods. Non-hydrogenated oils (NHOs) have created cleaning challenges so specialty gel caustic cleaners (e.g. Rochester Midland's Powergel NHO) have had to be developed to deal with the unique soils these NHOs create. Also, in brew house applications involving mash, lauter tuns, and wort kettles, the carbonized soils are very difficult to clean.

Some case study examples utilizing the acidic peroxide additive include the following.

- A deep fat tortilla-corn chip fryer had issues with polymerized cottonseed oil creating a laborious six-hour SSOP. By utilizing the acidic peroxide additive with a powdered caustic, the total cleaning process was reduced down to two hours (one hour boilout and one hour clean). This reduction in cleaning resulted in a $500 per month savings on this fryer alone.
- Potato fry plant had high levels of transition metals in its water supply, which resulted in huge scale buildups in the fryers' energy recovery systems (ERS). For years the BTU efficiencies of the ERS had plummeted to very wasteful levels. Recirculation of the acidic peroxide enabled the complete removal of the scale buildups and returned the ERS to its original optimal BTU efficiencies.
- A major pasta processor had serious issues in removing scale from cookers and blanchers used in the process. Besides using a copious amount of caustic cleaner, an acidic CIP cleaner

(Continued on p. 32)

(Continued from p. 32)

At left, wort kettle before Rochester Midland Enhance O2 and, at right, the wort kettle after Ehance O2.

step was required weekly to remove the scale. Utilizing the acidic peroxide additive resulted in a 50 percent reduction in caustic usage, and elimination of the weekly acidic wash step. This resulted in an $11,000 reduction of labor costs annually coupled with a $1,000 reduction in water usage for $12,000 savings annually. This same plant was provided with cleaning equipment, which further resulted in $7,000 in joint process improvements.

- A snack food plant with fryers had high annual sanitation chemical costs of $125,000 annually with its previous supplier. Utilization of the acidic peroxide additive in the fryer boilouts coupled with increased chemical delivery efficiencies resulted in total sanitation, labor, and utilities costs of $50,000 annually, a $75,000 annualized savings.

Cooling or freezing tunnels and spirals also have unique challenges. These equipment units, used either in post kill or par-fry operations, can become major reservoirs of post-lethality cross-contamination due to the older units' poor hygienic designs. Even the newer cooling or freezer tunnels or spirals can be major cross-contamination vectors if proper adherence to the SSOP is not maintained, especially in the cooling unit's fans, fins, and coils. The hygienic challenge with these unit fans, fins, and coils is partially due to the huge surface areas inherent in the unit design coupled with the soft metals, particularly aluminum, that inhibits usage of robust chlorinated caustic cleaning systems. This is also the same issue in the environmental sanitation of HVAC units in holding coolers throughout plants.

Utilization of specialty aluminum safe (ALS) products both as foam cleaners and gel cleaners permit the inclusion of a chlorinated chemistry due to the inhibitors inherent in the formulation in concert with the surfactants and chelants that provide the deep cleaning without damaging the base soft metals. For example, gel type ALS cleaners have enabled sanitation chemical provider to obtain excellent soil penetration with a high degree of contact time and minimal damage to the base aluminum metal or galvanized steel surfaces common in these cooler or freezer fins and coils.

The gel type ALS cleaner employed was found to have a loss rate of 3.76 mils per year (mpy) with over 20 mpy loss being considered corrosive for aluminum. In a frying operation cooling tunnel, the above mentioned non-hydrogenated oils left a high level lipid residue in the cooling tunnels' fans, coils, and fins. The ALS gel cleaner (e.g. Rochester Midland's Powergel ALS) enabled the operator to obtain a complete clean, with no damage to the unit's base soft metal coupled with a 30 percent reduction in labor, water usage, and time.

Environmental Sanitation

Strong caustic cleaners for floorings, drains, etc. can result in huge fines. The employment of enzyme cleaners, foams, or powders on both food processing equipment or on environmental surfaces can appreciably reduce the level of strong alkaline or acidic cleaners that create waste treatment issues.

One example of this is the utilization of enzymatic floor tile and grout cleaners to safely and efficiently remove soils and biofilms from problematic quarry tile surfaces found in many older processing plants. These enzymatic tile and grout cleaners (e.g. Rochester Midland's Enviroguard Floor and Grout) permit the environmental sanitation program to forgo using strong acid and alkaline cleaning products that will create severe treatment pressures on a plant's wastewater effluent and its down flow treatment system.

The same principle in bacterial enzyme utilization is being actively employed with drain cleaners. No longer are most processing plants utilizing strong alkaline chemistries to unclog drains. They now relay on these bacterial enzyme systems to efficiently remove biofilm clogs from a plant's drain field without damage to the piping or to the wastewater and the environment.

Another exciting area of more sustainable chemistries includes the growing usage of "dry" conveyor belt lubricants in packaging halls that reduce water usages. One brief example of an environmental benefit is of a beverage plant that employed a dry lube reduced its water usage by over 1 million gallons ($7,000 annual savings) with an $18,000 in overall line lube savings.

There clearly is a growing need to clean smarter using more efficient chemistries in more demanding processing scenarios while reducing time, utility, and labor costs. This all has to be achieved utilizing more sustainable, environmentally friendlier chemistries. The challenges are being confronted and met by the sanitation suppliers and will evolve as the regulatory, financial, and food safety programs continue to evolve as well. ■

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How to Fit Training Into Your Production Schedule: Part 5

Comprehensive training addresses the fear of change by building a human sensibility into the learning program

BY **JENNIFER MCCREARY** AND **MARIE LEFAIVE**

Editor's Note: *This is the fifth in a five-part series of articles that will explore each concept behind the five moments of need in training.*

"Nothing is so painful to the human mind as a great and sudden change," so said Mary Shelley in her famous novel *Frankenstein*. This would be wise to remember when dealing with the fifth and last moment of training need.

In our industry, the moments of change are many: new science requires a change in risk validation; new formulas require a change in process; new regulations require a change in reporting and documentation; new equipment requires a change in process; and new product lines require a change in Hazard Analysis and Critical Control Points, or HACCP, plans.

And yet, according to Conrad Gottfredson, PhD, and Bob Mosher, authors of *The Five Moments of Learning Need*, "This moment...has been the least attended to, and yet it is the most challenging. And since we don't attend to it very well, it is often the most costly to organizations."

When training for change, the first step is to understand its impact on your workforce and tailor your interventions accordingly.

Some change initiatives are simple. They are modifications or improvements to existing processes and patterns that do not demand too much of the learner. For instance, one trainer told the story of watching day shift employees arrive for work at a client's facility. "Either you've changed your process flow, or you've hired a bunch of ballerinas," she commented to her host. The host was stumped. "Well," she continued, "I've just watched at least eight people walk to that door over there, pirouette, and go in the opposite direction."

The change in traffic patterns did not require a formal training program, though a well-placed reminder at key entrance points was a key requirement. The true challenge was not in crafting a kick-ass video job aid or micro-training moment; it was in having enough patience to allow the new learning to take effect. It takes on average three weeks to break a habit. Provide reinforcement and encouragement, and let the change grow organically.

Complex change is a different matter. It breaks the pattern and moves into brand new territory. And this is where training becomes more challenging. Humans like consistency. We like to be in control. We like feeling confident. We do not like to appear foolish.

A good training program addresses this fear by building a human sensibility into the program with these three steps:

1. When the learner grieves for the old pattern, emphasize the benefits of the new learning;

2. When the learner feels uncomfortable and not in control, provide a safe environment for practice and experimentation; and

3. When the learner works hard to build the new skills, offer guidance and reinforcement until the skill is mastered.

1. Emphasize the Benefits

We've talked of Station WIIFM before. It's the one all the cool workers listen to: What's In It For Me. You will never succeed in convincing employees to adopt change unless you are on their wavelength. When the change is externally mandated, this task can be relatively easy: "We must adopt this new process because the regulators will shut us down if we do not" is a pretty compelling reason.

Internally directed change can be more challenging. You may think the new process improvement will increase efficiency tremendously, but it's highly likely that not everyone will feel the same. Moving from paper to electronic record-keeping is a case in point. This requires training not only in new documentation practices, but quite likely computer training as well. Depending on the computer literacy of your workforce, this can be a daunting task.

Implementing the following actions can help.

Involve everyone. Make a formal case for change and allow opinions to be voiced. You can then address any concerns in your training. If people are afraid that their workload will increase, show them how electronic record access and management can actually simplify their tasks. Explain the benefits of data mining that can

(Continued on p. 34)

(Continued from p. 33)

happen when records are available in a format that allows you to easily analyze data and plot trends.

Create ownership. When workers feel involved, they become invested in the success of a project. Include a representative sample of your workforce in the pilot course. Incorporate their feedback into the project. You will then have a solid group of ambassadors who will promote training's message.

Communicate. Nothing stalls an initiative quicker than a wall of silence. Let people know that the change is coming. Tell them how the training will help them quickly embrace the new requirements.

Speak to them as individuals. Change affects people and work units differently. Your training must take this into account. It may be possible to have a general introductory course that provides a broad overview of the new system, but be mindful that you may also have to provide targeted sessions for different work units. In our documentation example, the QA department will need a specialized course on data management, while operators need in-depth training on data input procedures.

2. Provide a Safe Environment for Practice and Experimentation

Change asks people to abandon the old way and embrace the new in a complicated dance of unlearning and learning. They need time to practice the steps. If they feel uncomfortable, they will resist. Create a learning room—be it factual or virtual—that celebrates best efforts and salutes fabulous failures. Share stories of your own awkward learning attempts. Remind them that an expert is nothing more than someone who has made all the mistakes that can be made in that field. In short, make the training fun. It is one of the best ways to build excitement for the change and enthusiasm for the learning process.

3. Offer Guidance and Reinforcement

At some point in the training, things may stall. Learners will become disheartened, especially if they've tried—and failed—over and over and over again. Sometimes though, the only solution is more practice. This is where you assume the role of wise cheerleader (and no, that is not an oxymoron). Offer guidance and suggestions, but know when to step back and let the learner figure it out. At some point, those training wheels have to come off.

There is no single foolproof method to train for change. The adopted approach will depend in part on the type and scope of the change, the number of people affected, the implementation timeline, and the business impact of the change itself. Whether you decide on a series of lunch-n-learns, a full training rollout, or a series of video tutorials accessible from everyone's phone and tablet, the key ingredient must always be unwavering support. Remember that you need this change, and for it to be a success, others must embrace your vision. By providing training that addresses not only the technical intricacies of the conversion, but the emotional impact as well, you will be well on your way to making this vision a reality. ■

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Animal Feed Safety Management—Are You Ready For The Future?

An overview for animal feed manufacturers on how to design and implement competent FSMA compliant feed safety control systems

BY **VICTOR MULIYIL**

The majority of major retailers and manufacturers worldwide now require their suppliers to implement competent food and animal feed safety management systems all the way through the supply chain. The trickle-down effect of this mandate, as well as the introduction of the Food Safety Modernization Act in the U.S., has brought animal feed safety control to the forefront of industry discussion over the past two years.

The implementation and certification of animal feed safety systems is not a recent development in some international circles. The "GMP Plus" program based in the Netherlands was one of the first that required ingredients exported to that country for use in animal feed to be independently certified against standardized Good Manufacturing Practices. In 1997, the Animal Nutrition Association of Canada sponsored the development of a third-party trained and audited feed safety control program, FeedAssure. This program has been adopted by the majority of leading animal feed manufacturers in Canada for over 15 years. The program has become so popular that the Canadian Food Inspection Agency has now reviewed the industry driven program and found it to be competent in controlling significant feed safety hazards, backed up with rigorous, annual third-party verification.

To compete in the new world of supply chain food safety, animal feed manufacturers across the U.S. are going to have to design, implement, and ideally undergo independent certification of their feed safety control systems. In this article, we will summarize some of the key implementation steps and areas of focus you must include to implement an effective safety control system within your animal feed manufacturing company.

The Plan

First, a "top-down" focus is essential, with defined roles for management and a clearly defined feed safety policy tracked through measurable objectives and regular management review. This is followed by setting up a multi-departmental feed safety team and structured communication channels, both external, with consumers, customers, service providers, suppliers, associations, and regulators, as well as internal, involving company departments, the feed safety team, and senior management. Competent training of the team and company staff is essential prior to designing a feed safety control system. The training should preferably be done by experienced trainers with practical system audit experience and a proven track record specific to the animal feed industry. Truly feed-focused training will increase staff buy-in, resulting in a more robust feed safety control system.

Once the infrastructure is established, you must define the scope and specifics of the hazards to be controlled within your feed safety system. This starts with defining the types of products, where they will be sold, any applicable regulatory or customer requirements, and details of any claims or sensitivities that could affect animal health or, through transmission, human health. Ingredients used in the feed manufacturing process, as well as process steps, equipment, and aids, must be detailed and verified. This is

(Continued on p. 36)

(Continued from p. 35)

followed by intensive research into hazards associated with each ingredient or process step, as well as hazards from the process and storage environment, equipment, pests, or intentional sabotage of products or process. This research must also include details on how suppliers control hazards at their level and whether or not details of this control are verifiable through specification sheets, certificates of analysis, or review of supplier audit or certification reports.

The Hazard Analysis and Risk-Based Preventive Controls approach is an effective tool to structure identification and assessment, or risk rating, of significant hazards. It also serves to establish effective, sustainable, and demonstrable controls over these hazards. This approach enhances focus on "prerequisite programs" (PRPs) in controlling significant hazards, since these control the majority of feed safety hazards. These programs are broad-based controls such as cleaning, training, supplier monitoring/approval, pest control, equipment maintenance, and calibration, inspection, and premises controls. The use of "critical control points" (CCPs) and intermediate level controls, sometimes known as "operational prerequisite programs" (OPRPs) or "significant PRP control points" (SPCPs) assist in clearly defining control tasks and responsibilities to maximize consistent control over feed safety hazards. These can include controls over prohibited, ruminant source material, medications, and sensitive nutrients or additives. CCPs, OPRPs, or SPCPs are written into targeted feed safety control plans, including a control or critical limit, frequency, method and responsibility for the task, corrective actions to be taken if limits are not met, verification of the task, and required records. Once hazards and controls have been clearly identified, internal and supplier monitoring procedures must be reviewed and upgraded as required to ensure ongoing control of these hazards.

It is very important to discuss the specifics of hazard control tasks with the operators and supervisors responsible for performing and reviewing these tasks in order to gauge the level of understanding and identify areas for improvement or clarification. This will prevent future misinterpretation and bring out aspects of the task that may be difficult or impractical to implement consistently. An important component to be clearly established is corrective action, which must be immediately triggered whenever a process deviation is identified. This will include immediate action to bring the process back under control, together with identification and segregation of any affected product or ingredient. This is followed by root cause analysis to determine why the deviation occurred and prevent recurrence. Qualified evaluation of the process data and affected product is then done to determine effective disposition options. All of this must be clearly documented and verified to be effective. The handling of customer complaints must also be linked to effective corrective actions to minimize the risk that these complaints will be retriggered.

An additional component of the feed safety control system is the design and implementation of an effective traceability program that can track key ingredients such as medications from suppliers through to customers. This program should be tested every year at minimum to evaluate how well it works in practice. In the event of a hazardous product or ingredient defect, an effective traceability program can minimize the spread of hazards through the supply chain and help control the extent of product withdrawals or recalls. A comprehensive recall program with updated contact lists and steps to determine the need for customer or regulatory agency communication must also be established.

Once your feed safety system is implemented, its overall effectiveness must be verified at least annually. This involves a thorough internal audit of the entire feed safety management system by a trained internal audit team, with prompt follow up to correct and re-verify any deficiencies identified. To provide experienced, demonstrably independent verification of the effectiveness of your feed safety system, a third-party audit can be a cost-effective option. If this external audit is done by an audit company with specific experience in animal feed safety auditing, it will provide valuable insight and feedback on the effectiveness of your system and allow you to better demonstrate this third-party verified system to customers and regulatory agencies such as the FDA.

Finally, all of the information from audits, inspections, customer feedback, regulatory visit records, product/ingredient testing, supplier monitoring, and industry contacts must be discussed amongst the feed safety team and senior management during structured management review meetings at least annually. These meetings are used to identify changes, system status, and needs for updates, resources, or improvements. Regular system updating will ensure your feed safety control system remains effective and keeps your company at the leading edge of the animal feed industry. ■

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Judging the 'Freshness' of Bread

Applying custom enzyme, emulsifier, and softener solutions in baked goods can help provide longer-lasting softness, consistent crumb structure, and improved resilience

BY **DEFNE SARAL**

Softness is a key parameter used to judge the freshness and, consequently, the quality of bread. Bakers are therefore interested in maintaining the softness of their bread for as long as possible. Any loss of bread crumb softness is often referred to simply as staling. Staling is defined as any change other than microbial spoilage that occurs after baking, making bread less acceptable to the consumer.

Physical or sensory changes associated with staling include: loss of crumb softness, flexibility, and strength; increase in crumb resilience; tendency to become crumbly; loss of flavor; and change in mouthfeel.

Staling Mechanisms

Starch, which makes up approximately 70 percent of flour, is regarded as the main flour component involved in staling. After baking, the gelatinized starch in bread tends to re-associate or, to use another term, retrograde.

After cooling and during the first hours after baking, the initial crumb structure is set by amylose gelatinization, creating a network in which the gelatinized starch granules are embedded. Re-crystallization of amylopectin side chains leads to the increasing rigidity of the starch granules and an overall strengthening of the crumb structure, measured as an increase in crumb firmness. Other factors, however, also have an impact on bread firming, particularly the distribution of water between protein and starch, which undoubtedly, plays an important role.

Starch retrogradation, though, is the main factor with regard to time determined changes in crumb softness. Functional ingredients that limit retrogradation are instrumental in improving crumb softness.

Starch consists of two fractions: amylose and amylopectin in a ratio of approximately 1:3. Both macromolecules comprise glucose units, although with structural differences. Amylose is a relatively small (molecular weight is approximately 250,000), linear and water-soluble macromolecule, while amylopectin is a very large (molecular weight is approximately 205,000), bulky, branched, and water-insoluble molecule.

Figure 1 on page 38 shows the changes that occur from the dough stage to fresh bread and, finally, to old or stale bread. The restoration of bread freshness by heating (toasting) is also indicated. In the dough stage, unswollen starch granules contain crystalline amylopectin, amorphous amylose, and polar lipids. The granules are embedded in gluten, which forms the continuous phase. During baking, the starch granules absorb water and swell. The amylopectin crystals are gradually disrupted at temperatures above 140 degrees Fahrenheit, and gelatinization takes place. Some of the amylopectin molecules expand into the inter-granular space and, at a somewhat higher temperature—around 176 degrees Fahrenheit, some of the amylose that has not formed complexes with polar lipids leaks from the swollen granules. Within hours after baking, the amylose molecules develop a network, and a sliceable crumb structure is formed, giving the fresh bread its initial firmness. During aging, reformation of the amylopectin's double helical structure and reorganization into crystalline regions takes place. While the re-association of amylose occurs within hours, the retrogradation of amylopectin takes days.

How Enzymes Work

Enzymes have been applied in bread making for decades. Bakery enzymes such as amylases help modify starch during the baking process. Slowing starch retrograda-

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tion, they ensure bread stays soft for longer than bread made without enzymes.

The varying action patterns of the most important amylases are shown in Figure 2. One effect of the enzymes is to reduce starch retrogradation by modifying the starch.

There are two main types of amylase enzymes: endo-amylases, such as classic fungal and bacterial α-amylases, that primarily hydrolyze starch at random within the amylose and amylopectin molecules; and exo-amylases that primarily hydrolyze starch from the non-reducing ends of starch molecules, cutting off two or four glucose units.

In practice, starch granules only become susceptible to enzyme attack upon gelatinization, which means the baking amylases need to be heat stable in order to be efficient. The curve in Figure 3 shows a typical temperature pattern when baking a loaf of bread. The functionality of amylases is highly influenced by the temperature profile of the baking step. A standard fungal α-amylase only has a couple of minutes in which to act on the gelatinized starch, and consequently, has no anti-staling effect. The bacterial α-amylase is active even at elevated temperatures and may cause excessive starch degradation, as it primarily weakens the inter-granular amylose network. Therefore, a narrow window of optimal dosage exists. G4-amylase and maltogenic α-amylase are optimized to modify gelatinized starch in the temperature range of 60 to 90 degrees Celsius, which is considered important for obtaining a strong anti-staling effect.

The amylopectin fraction in starch granules is more complex than that shown in Figure 2. A more comprehensive structure is shown in Figure 4 on page 39, which illustrates that the amylopectin structure consists of amorphous and crystalline regions. Endo-amylases are most likely to attack in the amorphous regions. This gives the gel structure more freedom of movement and reduces crumb rigidity. Exo-enzyme attack reduces the possibility of a re-association of amylopectin side chains.

The action pattern of specific amylases effectively combines the shortening of amylopectin side chains with balanced amylose fragmentation. Enzymes preferentially attack starch from its non-reducing ends.

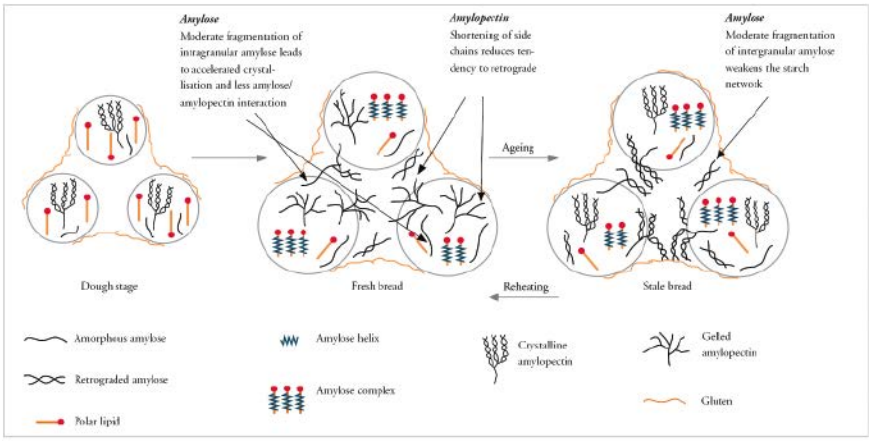

Figure 1: Changes in starch during baking, cooling and storage (modified after Zobel & Kulp, Baked Goods Freshness, eds. Hebeda & Zobel; Marcel Dekker, Inc., 1996).

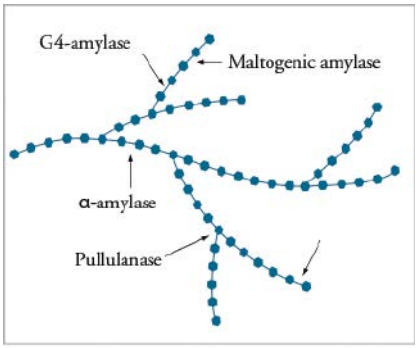

Figure 2: Action pattern of amylases.

In this way, they shorten the amylopectin side chains and reduce the amount of amylopectin available for retrogradation, slowing the actual rate of firming. This provides substantial crumb softening and improved resilience and elasticity without excessive weakening of the amylose network. In addition to superior softness and resilience, specific amylases can generate a moister, more flexible bread crumb.

Starch is not the only component acting in the staling process. Proteins and arabinoxylans also contribute to the firming of bread crumbs. For this reason, most enzyme products are optimized with additional enzyme activities specifically designed for individual applications.

Specific amylases, such as maltotetrahydrolases, are mainly responsible for the anti-staling effects; although phospholipase enzymes and bacterial xylanases can provide some additional softness. The amylases help products retain original production freshness by primarily modifying the amylopectin portion of the wheat starch, which greatly reduces recrystallization over time, resulting in softer product. The enzymes used for improving volume are usually selected from hexose oxidase, glucose oxidase, xylanase, and phospholipase, often in combination. There are several mechanisms involved in increasing volume. Phospholipases modify naturally occurring lipids in the wheat flour, producing emulsifiers that strengthen the protein structure. Xylanases specifically modify the arabinoxylan polysaccharides naturally present in flour. This releases water that can be absorbed by gluten to produce stronger networks and greater volume. Hexose oxidase and glucose oxidase oxidize small amounts of sugars in the product, resulting in production of very small amounts of hydrogen peroxide, which helps to cross-link gluten proteins also generating stronger networks and increased volume.

Enzymes used in baking help breads and bagels retain their original freshness for longer, thereby reducing food waste,

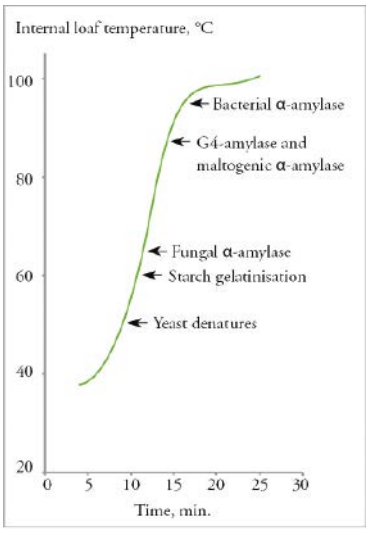

Figure 3: Temperature pattern during baking.

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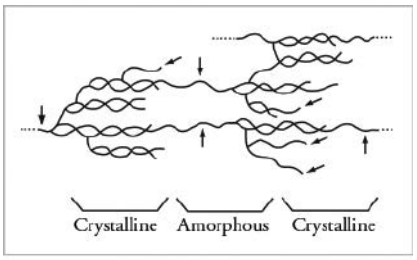

Figure 4: Amylopectin structure.

energy consumption, and their carbon footprint. Enzymes used in cakes and muffins enhance softness, moisture, and reduce crumbling, helping improve taste perception and convenience in the on-the-go market. Other baked goods that benefit in similar ways to bread would include buns and rolls, bagels, pretzels, English muffins, tortillas, etc.

Enzymes are of course present in flour, yeast, bacteria, and several other common raw materials used in bakery products, and therefore were used unknowingly for thousands of years before their discovery and the introduction of commercial enzymes. Commercial industrial enzymes were introduced as a way to better control the amount and type of enzyme activity in baked goods and to give bakers better control. Enzymes can play an important role in the vast majority of baked goods with only a few exceptions.

What Are Enzymes?

Enzymes used in food processes have the same properties as those found in nature. They are specialized proteins—but not living organisms. Enzymes are biodegradable proteins that act as catalysts helping the food manufacturing industry to reduce food production costs, increase yields, enhance quality, and provide tastier, healthier, and safer food. They are enabling various industries to help guarantee quality and stability of products with increased production efficiency.

Enzymes are processing aids, not ingredients. Current labeling legislation does not require enzymes to be listed on product labels when used as processing aids because they have already performed the action they were intended to perform. Enzymes often perform different tasks from emulsifiers, and in most cases actively work with additives to provide a given effect in the finished product. The confusion arises when enzymes are presented as being equal to, or in some cases alternatives to, additives—this leads to the misconception that enzymes are additives.

All enzymes are proteins. They are made up of small amino acids strung together in a linear polymer. Enzymes can be found in nature and extracted from plants, bacteria, fungi, and animal glands. Commercial industrial enzymes are more commonly produced by microorganisms under optimized and contained conditions, or to a minor extent extracted from plant material. Commercial industrial enzymes share the same properties as naturally existing enzymes, and only small quantities are needed to perform the function (for instance, bread would contain less than 0.002 percent enzyme protein).

In some industrial enzymes, a small number of amino acids are changed to improve enzyme performance, for example, at different temperatures, or enhanced pH stability or increased specificity of the catalyzed reaction. This technology is referred to as protein engineering. Fermentation, recovery, purification, and formulation processing steps are controlled from start to finish and the enzyme is separated from its production microorganism after fermentation. The microorganism is then destroyed before being disposed of in a controlled way. Enzymes are finally formulated in either solid or liquid form and sold commercially to food manufacturers.

Enzyme products are only introduced onto the market when their safety has been fully established according to internationally accepted assessments and regulatory procedures. This safety assessment evaluates all aspects and steps in the production chain—from the safety of the development of production organisms, through the production process, and to the final enzyme products in their intended uses.—*D.S.*

The products that tend to benefit the most are those that require fresh keeping, and in particular, those that also have a specific volume requirement. Most traditional pan breads are expected to be soft and light in texture and are now also expected to have shelf lives of up to three weeks. Anti-staling enzymes can help baked goods retain their original freshness for extended periods and can be used to improve volume and dough handling properties.

How to Evaluate Freshness

Expert sensory evaluation of bread is usually done three and 10 days after production, comparing the market standard to the new recipe. Parameters such as foldability, softness, moistness, crumbliness, and freshness are measured.

Some common tests to evaluate freshness over the course of several days are measuring firmness (units in HPa), also called crumb softness; and crumb resilience (units in %).

In Summary

By applying custom enzyme, emulsifier, and softener solutions, you can obtain optimal performance baked goods with enhanced consumer appeal, fewer returns, and improved consumer loyalty. Your potential product benefits include longer-lasting softness, fine homogeneous crumb structure, fresh mouthfeel, and improved resilience.

Aside from their specificity, enzymes often offer other benefits that stretch beyond the product itself. Enzymes can often replace substances or processes that may present safety or environmental issues, help reduce salt and sugar content of foods, and enhance nutritional value. Enzymes are very specific and will work under mild reaction conditions, allowing selective reactions in the presence of sensitive substances. Today enzymes are already used in a variety of foods from beer, dairy, oils and fats, meats, and of course, bakery products. However, innovative new applications and solutions are continuously being found together with food producers to help meet the needs of the growing population. ■

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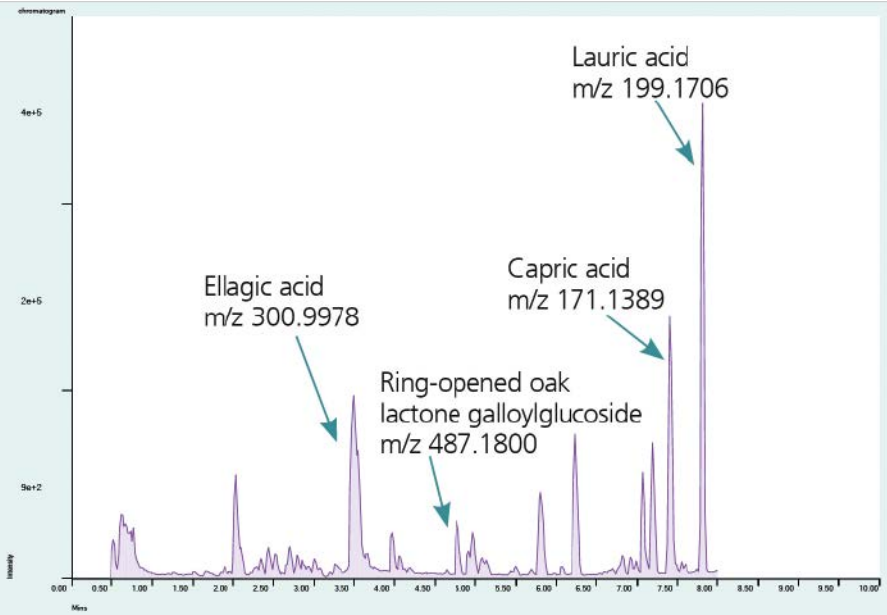

Figure 1: Example separation of the involatile components of whisky, trace shows compounds detected with negative mode ionization. Labeled peaks are assigned from the accurate mass of the major component.

Identifying Whiskey Counterfeits

Novel application of molecular spectroscopic techniques to ensure authenticity of whiskies

BY **NICOLA VOSLOO, PHD**

The problem of food and drink fraud is not new; with the increasing complexity in our supply chains it is a very real and modern problem that continues to be an issue globally. Counterfeiting of spirit brands are a major concern posing a serious health risk by providing inferior or even toxic products. Furthermore, these practices damage not only the spirits industry but also government revenues, with an estimated cost to the industry of more than $1 billion a year. According to spiritsEUROPE, it's estimated that a quarter of products sold in China as imported spirits are actually fakes.

Analyzing Whisky with LC/MS

Adulteration is a major problem for the global drinks industry; whisky in particularly is prone to fraudulent activity with single malt Scotch whisky brands a continued target as they command a price premium. So how can suppliers within the food chain be assured of the authenticity of the products they are distributing and selling?

Establishing the geographical origin offers traceability and reassurance of product quality. Malt whiskies contain a large number of compounds, which vary according to the local ingredients used, fermentation, distillation, and maturation processes. This enables the ability to build profiles of different whiskies and in turn show correlation related to geographic origin, as indicated by marker compounds that strongly correlate to location. So monitoring these marker substances in products can be used in an effort to keep control of this problem and accurately identify adulteration when it occurs.

Whiskies from different geographical origins were analyzed by both accurate mass electrospray liquid chromatography/mass spectrometry (LC/MS) and by inductively coupled plasma mass spectrometry (ICP-MS), to create a detailed profile of involatile organic and inorganic components.

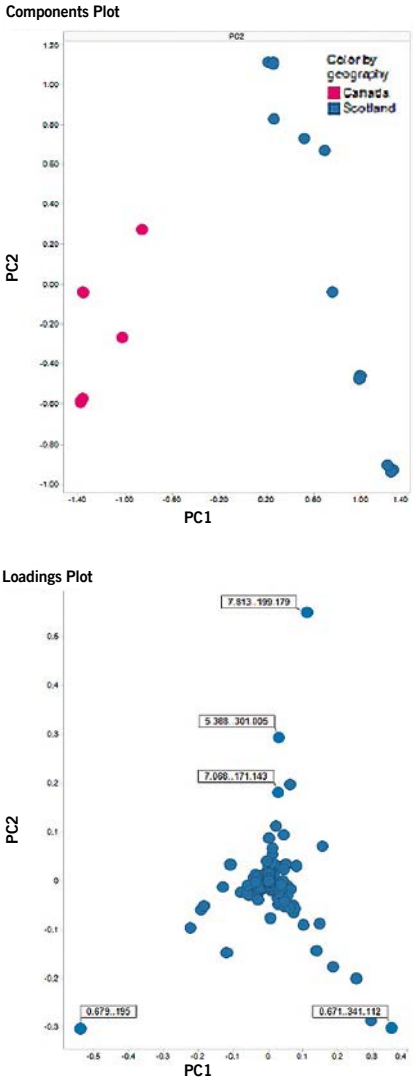

Figure 2: Negative mode Scores Plot of PC1 v PC2 shows grouping of the two Canadian (red) and four Scotch (blue) samples. Loadings plot displays the marker compounds that most strongly differentiate whiskies in negative mode.

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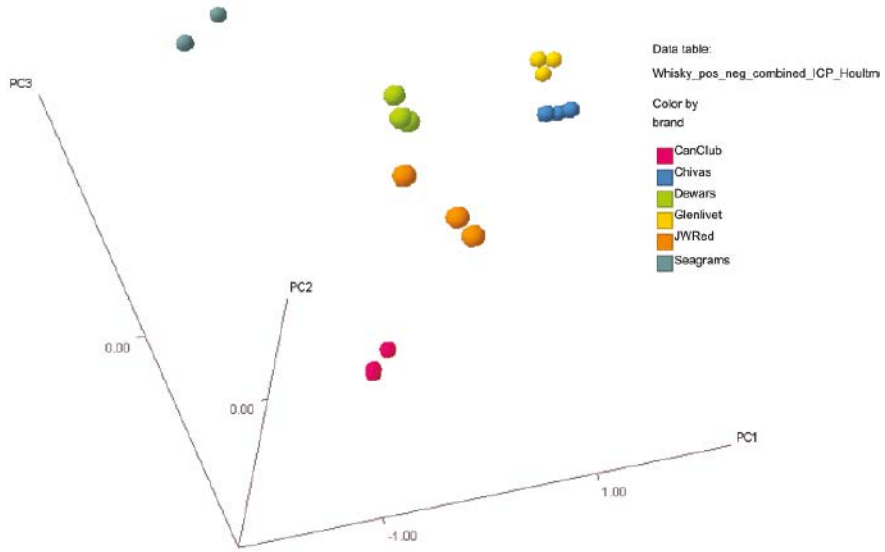

Figure 3: Data fused organic and inorganic markers results in a Scores plot of PC1 v PC2 v PC3, showing complete separation of all the groups of whisky samples.

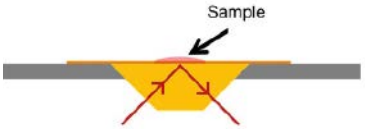

Figure 4: Attenuated total reflectance.

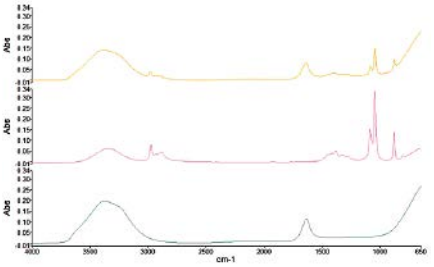

Figure 5: ATR spectra of whisky (top), ethanol (middle), and water (bottom).

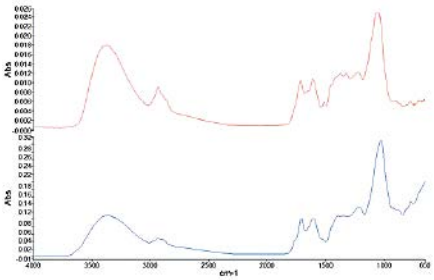

Figure 6: Spectra of whisky residue (top) and caramel sample (bottom).

Commercial Scotch and Canadian whiskies were purchased in plastic miniature bottles. The whiskies used were two Canadian blends, three Scotch blends, and one single malt Scotch. Samples were evaporated to dryness to remove ethanol and volatile components, dissolved in water, and analyzed by LC/MS to detect the low volatility compounds. Data was generated on a mass time-of-flight (TOF) instrument (PerkinElmer AxION 2 TOF and Flexar FX-15 UHPLC system) in both positive and negative modes.

Over 100 compounds were detected in total, although a few compounds were detected in both positive and negative modes; an example trace is illustrated in Figure 1 on page 40. Many known compounds could be assigned from the formulas; some were identified as phenolics and terpenes, originating from the oak barrels used to mature the whiskies and from the barley used in the fermentation mash.

For elemental analysis, each whisky was evaporated to dryness, re-dissolved in an acidic solution and analyzed in collision mode using a PerkinElmer NexION 300D ICP-MS instrument. Completed analytical work essentially generates a number of different raw datasets that can be reviewed via principle component analysis.

Analysis of the negative ion mode results (see Figure 2, p. 40) showed clearly resolved sample groups, with the Canadian whiskies separated from the Scotch whiskies. The loadings plot revealed significant markers with significantly different intensities between the sample groups.

Strong differentiators between the whiskies in negative ion mode identified include capric and lauric acids. These acids derive from barley lipids and remain in the whisky after alembic distillation from copper pots. They are detected at higher levels in Scotch whiskies. Another strong differentiator for Canadian whisky was identified as containing sulfur (by mass and isotopic pattern), which may relate to the caramel that is legally added to these blends. Another clear marker, ellagic acid, is the end product of the degradation of barley tannins and also present in oak wood; and is detected at high levels in certain Scotch whiskies. So a number of markers has clearly been detected and identified for the various whiskies tested using negative ion mode LC/MS, however complete separation of all samples studied was not able to be obtained.

Data Fusion

Review of the same parameters for positive ion mode LC/MS also revealed markers that helped to distinguish between the Canadian blends and Scotch whiskies. But like the LC/MS results in negative mode, it failed to distinguish between two Scotch blend samples. How can this issue be resolved and allow for an unambiguous result to help confirm authenticity? By fusing data from orthogonal analytical techniques, LC/MS and ICP-MS, there's an opportunity to develop truly unique product profiles. By fusing together the inorganic and organic markers into one table enabled a complete separation of all of the whisky groups, see Figure 3.

The LC/MS and ICP-MS analyses detected chemicals and elements related to the wood, maturation, and distillation methods used in whisky production. It's only when using data fusion (combining results from independent analyses on the same samples) that a more complete differentiation of blends was produced. This output reveals characteristic markers that aid determination of the origin of different whiskies. And similar analysis could be used to assign the geographical origins of

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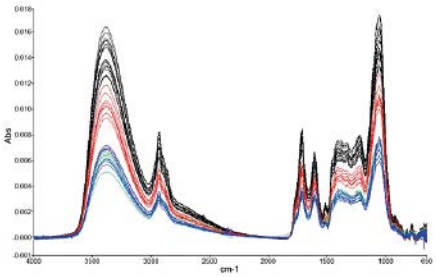

Figure 7: Black - Blend A. Red - Blend B. Green - Blend C. Blue - Blend D.

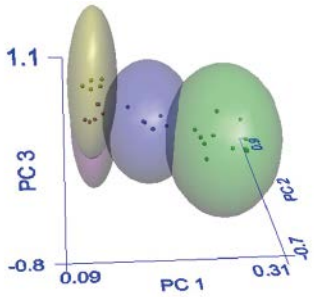

Figure 8: SIMCA plot showing separation of the whisky blend samples.

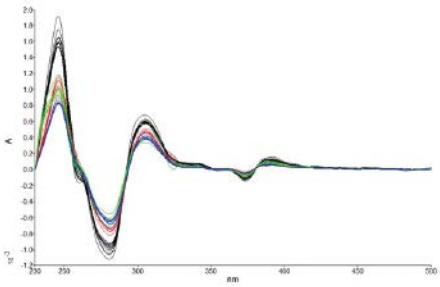

Figure 9: Second derivative spectra of Blends A (black), B (red), C (green), D (blue).

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unknown whiskies and to highlight adulterated and fraudulent samples.

Rapid Screening Methodologies

It's been shown how sophisticated analytical techniques can be employed to generate unique profiles that can be used as markers for origin and authenticity. Whilst providing very insightful data and analysis, such methodologies do not lend themselves to swift screening. Molecular spectroscopic-based technologies are particularly well suited to rapid screening testing. They are relatively inexpensive, easy to operate, and give a fast answer.

Using IR Spectroscopy

Whisky samples have been studied by both mid- and near-infrared (IR) spectroscopy. There are also a number of different sampling techniques that can be employed when collecting IR measurements. One of the fastest and certainly most convenient for real-time analysis of whisky samples is by attenuated total reflectance (ATR) (see Figure 4, p. 41).

In ATR, the sample is placed on top of a suitable crystal material. The IR beam passes through the crystal, which then penetrates a small distance into the sample before it is reflected back in to the crystal and to the IR detector, generating an IR spectrum. Due to the strong absorptions present in mid-IR, ATR can be applied successfully.

Figure 5 on page 41 shows the ATR spectra for a whisky sample, ethanol, and water. Since water and ethanol are the major ingredients in whisky, it is dominated by their spectral features. The mid-IR region of the spectrum is obscured by the very strongly absorbing bands for water (in the approximate regions of 1,640 cm^{-1} and 3,400 cm^{-1}). The weaker bands in the near-IR region of the spectrum are much more suitable for the analysis of such aqueous based samples; in this region, it is possible to observe the combination bands for water (at 5,167 cm^{-1}) and ethanol (in the region 4,420 cm^{-1} to 4,300 cm^{-1}).

The mid-IR region is the best spectral region for identification of materials. Since this region is greatly obscured in whisky by water, it is difficult to use for determination of other ingredients. It is possible to decrease the intensity of the water bands (by working in the near-IR region), but this would also sacrifice the intensity from the other ingredients. So how can accurate identification compounds within predominately aqueous liquids be achieved?

Using a heated ATR accessory (heated to 65 degrees Celsius) allows for the evaporation of the water and ethanol to leave behind a residue of the other ingredients within the whisky. This residue can then be analyzed without the strong inferences afforded by the present of water and ethanol. The residue spectrum obtained appears very similar to the spectrum of the caramel ingredient used in these whiskies as shown in Figure 6 on page 41.

The addition of E150a caramel is permitted within Whisky legislation to achieve consistency of color within whiskies. The ATR technique should be capable of identifying the type of caramel additive used.

Study of Whisky Blends

As IR sampling and measurements are easy and fast, the technique lends itself to rapid screening testing. The ATR spectra of a series of commercially available blends were measured to determine if it would be possible to differentiate the blends using their spectra, Figure 7.

As seen in Figure 7, the spectral shapes are similar, but the overall intensities differ among blends. This suggests different amounts of caramel and/or other dissolved non-volatiles are present in the different blends. Blends A and B differ only by alcohol content. Blend C and Blend D appear the most similar. Applying chemometrics to the spectral data would allow for qualitative identification of the blends. A soft independent modeling by class analogy (SIMCA) algorithm has been applied to this blend data and shows that the different blends separate out into different classes of materials within the model, see Figure 8.

Measuring the different blends by UV-visible spectroscopy (UV-vis) showed very similar results to those generated by IR; with different absorbance intensities recorded, see Figure 9, which also translated into separate groups when the SIMCA plot was applied. UV-vis could offer a potentially faster route to results, but its real advantage over IR is in the measurement and quantification of sample color. Color is often added to counterfeit spirits and the ability for UV-vis to differentiate between real and fake products provides a valuable tool in the arsenal to fight fraud.

As seen in this article, it is possible to distinguish between different blends of Scotch whisky with simple ATR IR measurements. Utilizing the same methodology, it's also possible to differentiate between French, Scotch, and Spanish whiskies, and whisky from other non-Scotch spirits. Accordingly, it's feasible to distinguish samples that have been diluted with water and or ethanol, offering a robust solution for the authentication of whisky. ■

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Detecting Contaminants in Mineral Water: An Application Note

Performance testing on waterborne microorganisms using fluorescence-based technology

BY **ADRIEN VENCHIARUTTI**
AND **NATHALIE VALTON EL KHOURY**

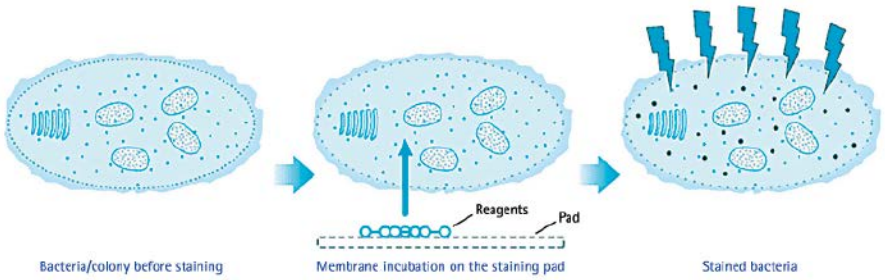

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Image 1: Fluorescence detection is a non-destructive method that enables microorganisms to continue to grow after they have been stained in order to identify them using standard ID technology.

Mineral water manufacturing processes are susceptible to yeast, mold, and bacterial contamination. A rapid microbiology system that can detect potential contamination three times faster than traditional monitoring methods would result in significant cost savings and consistent, timely release of products to market.

Fluorescence-based technology offers rapid, quantitative detection of microorganisms over a broad range of filterable matrices. These easy-to-use systems employ industry-standard membrane filtration techniques to detect viable and culturable microorganisms down to 1 colony forming unit (CFU) per sample. Test results are comparable to current microbial test results, which facilitate the validation of these rapid systems in any laboratory. The non-destructiveness of these methods also enables the identification of microorganisms detected during the initial fluorescent count using current ID methods.

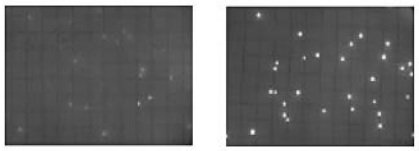

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Image 2: Image on right shows a sufficient fluorescent signal intensity translating into an appropriate incubation time; image on left shows that an accurate count isn't possible if intensity of fluorescence is too low due to an insufficient incubation time.

Principle of Detection

The principle of the fluorescence detection is based on an enzymatic reaction. The fluorogenic substrate used is a non-fluorescent viability marker that is cleaved by non-specific ubiquitous intracellular enzymes, resulting in a fluorescent product. Natural amplification of fluorescence by intracellular accumulation is an indicator of microbial metabolism. The dye is diluted in a staining buffer enhancing cell-membrane permeability and thus facilitating the introduction of dye into cells (see Image 1).

Protocol for Rapid Detection

The following is a standard protocol to find waterborne microorganisms in samples of interest with fluorescence detection.

1. A filtration unit is installed onto the filtration system.

2. The appropriate volume of sample is poured into the filtration unit.

3. After filtration, the membrane is disconnected from the device and aseptically transferred onto media and incubated.

4. After incubation, the membrane is stained with the fluorogenic reagent for 30 minutes at 32.5 degrees Celsius +/-2.5 degrees Celsius.

5. The fluorescent micro colonies are counted using the fluorescence reader.

6. After detection, the stained membrane can be re-incubated on fresh media for traditional plate count and identification if required.

Rapid Incubation Time Definition

An appropriate incubation time is defined as the minimum time necessary to achieve a recovery rate higher than 70 percent compared to the traditional method. The calculation is based on both formulas:

- The fluorescence recovery is the fluorescent count compared to the traditional method count. Fluorescence recovery (percentage) = (average of fluorescence counts/average of traditional method count) x 100.
- The viability recovery is the colony count on stained membranes after re-incubation compared to the traditional method count. Viability recovery (percentage) = (average of CFU counts after re-incubation/average of traditional method counts) x 100.

An optimal incubation time should allow a sufficient fluorescent signal intensity, fluorescence, and viability recoveries above 70 percent (see Image 2).

Summary of Performances

Table 1 provides an overview of the different time savings observed for rapid microbial detection using EMD Millipore fluorescence-based technology compared to traditional microbial filtration. Depending on the matrix challenged, the nutritive medium used, and the microorganism growth kinetics, the rapid detection fluorescence based technology can reduce the time to result by a factor of two to four compared to the compendial microbiological method.

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Table 1: Summary of EMD Millipore fluorescence-based technology performances using environmental strains or naturally contaminated mineral waters.

Microorganism	Medium	Incubation temperature	Rapid Incubation time	Traditional time
Naturally contaminated water, direct well	Yeast extract agar	22°C	24 hours	72 hours
Naturally contaminated water, storage tank	Yeast extract agar	22°C	48 hours	72 hours
Coliforms that ferment lactose after 24 hours	Lactose TTC with Tergitol 7	37°C	16 hours	24 hours
Coliforms which ferment lactose after 48 hours	Lactose TTC with Tergitol 7	37°C	14 hours	24 hours
Enterococcus faecalis	Slanetz Bartley agar	37°C	20 hours	48 hours
Blue/green *Pseudomonas aeruginosa*	Cetrimide agar	37°C	18 hours	48 hours
Fluorescent *Pseudomonas aeruginosa*	Cetrimide agar	37°C	18 hours	48 hours
Pseudomonas sp.	Cetrimide with nalidixic acid agar	37°C	16 hours	48 hours
Zygosaccharomyces bailii	Sabouraud dextrose agar	28°C	40 hours	5 days
Aspergillus brasiliensis	Sabouraud dextrose agar	28°C	30 hours	5 days
Candida intermedia	Sabouraud dextrose agar	28°C	48 hours	5 days

Conclusion

Using fluorescence technology as a microbiology quality control tool dramatically reduces the time needed to detect yeast, mold, and bacterial contaminations in mineral water. As an example, this article demonstrates that the EMD Millipore fluorescence-based technology can easily replace the compendial microbiological method with a two to four fold faster time to result and compatibility with the standard culture media traditionally used for the detection of spoilage microorganisms in mineral water. Moreover, as the method is non-destructive, each fluorescent micro colony detected will continue to grow to yield visible colonies, allowing the identification of contaminants using conventional identification methods.

The faster release of product not only brings logistical advantages for a manufacturer, but in addition there is the financial benefit associated with bringing product to the market faster. A rapid method that enables the release of product faster results in a reduction in the amount of stock held in the warehouse and therefore a positive improvement in the company cash flow. ■

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For bonus content, including a complete list of materials and methods as well as detailed results, go to October/November 2015 issue at www.foodqualityandsafety.com and click on "Detecting Contaminants in Mineral Water."

EMD MILLIPORE

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Avoiding Costly Recalls with Inspection Technologies

The threat of product recalls is as much a concern for food manufacturers now as it was a few years ago, but advances in technology have helped to minimize the risk to brand owners

BY **SIMON KING**

In 2009, there were 56 separate food safety incidents recorded in the U.K. caused by contamination from foreign bodies, such as glass or metal shards, stones or bones, or fragments of plastics or rubber. This has since risen to 118 in 2013, with plastic, metal, and glass contamination in 19, 12, and 10 incidents respectively. Interestingly, of the 118 recorded incidents, 62 originated from the U.K., 35 from the European Union (EU), and 11 were imported. In the U.S., there were 10 recorded incidents of extraneous material contamination in 2013, with 331,732 pounds of food recalled. According to USDA's Food Safety Inspection Service, the number of incidents significantly increased from five in 2009, however the amount of food recalled reduced from over 1 million pounds. These, combined with a number of other high-profile food scares, have had consumers in both Europe and North America increasingly worried about the safety of the products at supermarkets.

For any brand involved in a safety incident, a product recall can be costly, especially when you factor in the time and effort spent initiating the recall, communicating it to customers and consumers, then working to rebuild their reputation in the eyes of both retailers and the general public. In addition, there are damages that have to be paid to customers left out of pocket, as well as the expense of lost and wasted product. It is no surprise then that manufacturers are keen to do all they can to avoid an incident.

To continually protect consumers against substandard products, food safety legislation and standards in both the U.S. and the EU have evolved. The International Featured Standards in France, Germany, and other European economies, the British Retail Consortium (BRC) Global Standards in the U.K., and the Food Safety Modernization Act (FSMA) in the U.S. are all more stringent than ever before to combat food safety hazards, safeguard consumer well-being, and reclaim public trust in the food supply chain. They are now becoming the blueprints for similar regulations in emerging markets, such as China, both to improve safety for local consumers and to facilitate exports to Europe and North America.

As a result of these stricter rules around the globe, food manufacturers have had to evolve their product inspection processes to ensure compliance with regulations and minimize the risk of a costly product recall. At the same time, increasing worldwide demand for food products and growing globalization of the market has meant that they have had to maintain high levels of quality control while boosting their manufacturing output and productivity.

Product inspection manufacturers have had to develop their technologies, such as X-ray inspection systems, innovating to meet these requirements from customers with ever greater sensitivity and features to balance product safety and productivity. Incorporating fully integrated automatic rejection systems, for example, into X-ray technology has enabled manufacturers to significantly increase throughput rates on their line without compromising contaminant detection. The development and inclusion of advanced data management systems in product inspection machines has also resulted in more accurate analysis and monitoring, enabling food manufacturers to not only demonstrate due diligence in the event of an incident, but to identify potential sources of contamination to minimize the risk of it happening again in the future.

Where We Stand Today

Even with the developments in legislation, food product recalls remain a significant issue for manufacturers today. The number of recalls in the U.K. and U.S., due to physical contamination has increased over the last few years. However, this is due in large part to increased awareness of food safety among consumers and re-

(Continued on p. 46)

(Continued from p. 45)

tailers, as well as stricter regulations—including audits—raising the bar for food manufacturers.

The globalization of the food market has led to much longer supply chains, with raw ingredients sourced in one country, processed, and packaged in another, ready for selling in a third or even a fourth nation. This means that brand owners have to ensure that their products and their manufacturing processes comply with the regulations in place in each of the markets they are operating in. For example, if food is sourced in the U.S., processed in the U.K. and sold in France, then the manufacturer will have to meet the requirements of FSMA, the BRC Global Standards, and the IFS.

As a result, in order to comply with so many food safety standards, manufacturers have to ensure that their production lines meet more than just high hygiene standards. They also need to have in place precision product inspection processes to identify any and all instances of physical contamination on the line to minimize the risk of sub-standard packs reaching consumers. Product inspection equipment, such as advanced X-ray systems has been a real help here to manufacturers, enabling them to automate their quality control procedures to inspect all of their packs for foreign bodies. The use of high-performance X-ray technology can help manufacturers safeguard against physical contamination and reduce the risk of food safety recalls, protecting their brand reputation.

A New Generation of Technologies to Avoid Recall Threat

The new more stringent regulations in place worldwide are pressuring manufacturers to achieve ever higher standards of food safety. The industry is now turning to equipment suppliers to provide them with technologies that uphold the highest levels of product quality, while maintaining optimum line speed and efficiency.

Installing product inspection technologies on production lines in accordance with the principles of Hazard Analysis and Critical Control Points (HACCP) is a key first step in minimizing the risk of contamination. Under this protocol, rather than just inspecting products at the end of the manufacturing process, advanced inspection systems must be installed at every location on the line identified as vulnerable to contamination, known as Critical Control Points, or CCPs. Doing this can ensure that even minuscule foreign bodies are identified as early as possible, maximizing detection rates and preventing contaminants from fragmenting during processing to affect a greater number of products.

However, to keep up with burgeoning competition on the international stage, food manufacturers need to strike the right balance between product safety and line productivity, which increasingly means boosting line speeds. High throughput rates through the product inspection process can be easily achieved though by installing advanced X-ray inspection machines capable of precision contaminant detection at high speeds, as well as by automating the rejection process. Fully-integrated automatic rejection systems can ensure that all non-conforming packs can be removed without the need to stop or slow the production line, maximizing production uptime while keeping the risk of a contamination incident to a minimum.

While the inclusion of inspection systems that follow HACCP principles has helped to significantly decrease the likelihood of contamination reaching consumers, it is imperative that manufacturers are prepared for a potential food safety incident involving their product. If a recall were to occur, they need to be able to manage both the recovery of non-conforming packs from retailers and consumers, as well as any investigation by the authorities, providing proof of their due diligence.

In such an event, being fully informed about the performance of the production line and the product inspection systems is vital to maintain continuous operation and to mitigate the negative impact on brand reputation. Modern X-ray systems feature data management systems fully incorporated into the machine, capable of recording and storing data about both conforming and non-conforming products on the line. This information can allow manufacturers to demonstrate that they have taken every feasible measure to prevent contamination to investigators, and to enable them to trace the source of safety issues. Advanced systems can also be connected to a larger network, enabling manufacturers to access data from multiple inspection machines, and at the same time, further facilitating their analysis of contamination trends. All of this can help manufacturers to keep up to speed with how their production processes are operating and help to demonstrate due diligence, should the worst happen.

Evolving with the Food Safety Landscape

The international food market has undergone an immense transformation since 2009, with increased globalization of the supply chain and the introduction of a raft of rigorous safety regulations worldwide. To continue to comply with legislation and retain access to lucrative overseas markets while remaining competitive on the world stage, food manufacturers need to ensure that they have the most up-to-date product inspection systems installed on their lines to optimize contaminant detection without compromising on productivity.

Product inspection system specialists are constantly developing their technologies to stay ahead of changes in the food safety landscape and to meet customer requirements. Working with such specialists, food manufacturers can ensure that their product inspection processes are capable of evolving with the food market, maximizing safety, and helping them to avoid a costly recall. ■

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Hand Hygiene's Critical Role

Practicing appropriate hygiene can help remove microorganisms from food workers' hands, thereby eliminating common foodborne illness triggers

BY **DAVE SHUMAKER**

When we talk about food safety, numerous factors that impact the overall safety of our food come to mind. For some, it could be making sure the food is prepared to and served at the right temperature, and for others it is ensuring that produce is washed properly. Yet, how many of us think about the importance of hand hygiene?

Practicing Good Hand Hygiene

The practice of good hand hygiene—washing with soap and water or using an alcohol-based hand sanitizer—is the first step that needs to be taken to ensure the safety of food. Whether it takes place on the farm where the food is being grown or in the kitchen (at home or in a restaurant), hand hygiene is vital to preventing food from becoming contaminated.

Bugs of Concern

According to research conducted by Charles P. Gerba, PhD, from the University of Arizona, more than 80 percent of illnesses can be transmitted by the hands. This includes potentially harmful bacteria such as *E. coli, Salmonella, Listeria, Shigella, Campylobacter*, and viruses like norovirus, which all pose a serious threat to public health.

Oftentimes, restaurant workers do not realize the germs from items such as raw meat can be on the gloves they are wearing. They then unknowingly contaminate their hands when they remove the gloves and the microorganisms are then transferred to the food that is about to be served to restaurant patrons. The best way to remove the bacteria from a food worker's hands is through practicing good hand hygiene.

How Hand Hygiene Products Work

When people think about hand hygiene, they typically think about handwashing with soap and water. Anti-bacterial soaps, which are common in the food service industry, contain ingredients designed to kill germs on the skin, adding an extra level of protection from microbial contamination.

While handwashing with soap and water is a common practice among restaurant workers, alcohol-based hand sanitizers also provide food handlers with convenient hygiene when soap and water are not readily available. Alcohol-based hand sanitizers can also be used as part of an overall hand hygiene regimen following handwashing. In fact, a study showed that using a hand hygiene regimen, which included handwashing followed by hand sanitizer, was more effective at reducing transient microorganisms on hands soiled with chicken broth and ground beef than handwashing alone. Alcohol-based hand sanitizers are effective antimicrobials that reduce the spread of foodborne disease-causing microorganisms on the skin.

Soap and hand sanitizer dispensers also play a key role in reducing the spread of illness-causing germs. For example, touch-free dispensers allow for portion-controlled dispensing and easy access to hand hygiene products. Another reason to move towards touch-free dispensers is that the use of these dispensers

(Continued on p. 48)

(Continued from p. 47)

has been shown to improve compliance rates over manual dispensers because these touch-free dispensers are typically used more often than manual dispensers. However, there is one system to avoid: an open, refillable bulk soap dispenser.

Open, refillable bulk soap dispensers are refilled by pouring soap into an open, partially filled reservoir. Three published studies mentioned below revealed potential human health risks for those who wash their hands with these dispensers. The studies found that these types of dispensers are rarely cleaned, leading to exposure to fecal contamination.

- A study published in the March 2011 *Journal of Environmental Health* finds 25 percent of open, refillable bulk soap dispensers in the public are contaminated with unsafe levels of bacteria.
- A follow-up study published in the May 2011 issue of *Applied and Environmental Microbiology* reports washing with soap from refillable bulk dispensers can leave hands with 25 times more bacteria after washing.
- According to a study published in the January 2012 issue of *Biofouling*, biofilms grow in open, refillable bulk soap dispensers, causing recontamination of the soap even after the dispensers are cleaned with bleach.

Continuing to use these types of dispensers actually works against efforts to create a healthy environment. One way to overcome this challenge is to switch to sealed soap systems, which provide the solution to reducing contamination risks. The soap inside of these systems is protected from contamination because it is factory sealed and includes a fresh nozzle with each refill. Having the right kind of product and dispenser in place is only the start. It's also important to understand there are factors and variables that impact efficacy of hygiene products used in the food service industry.

Variables that Influence Efficacy

There are numerous variables that influence efficacy. These include the following.

Product volume. Generally, people don't use enough of a product—soap and hand sanitizer—to get an efficacious dose. There are dispensing systems available that have optimized the right product output for hand hygiene effectiveness.

Contact time. Guidelines recommend for handwashing to be at least 20 seconds long and hand sanitizing 15 seconds.

Formulation. Hand hygiene products need formulations that are effective, deliver good skin performance (not damaging to the skin), and provide a good sensory experience, i.e. it is likeable to use.

Compliance. Have the right hand hygiene products in place as workers will not use products they do not like.

No difference between foam and liquid soap. Both can be effective as long as they are properly formulated.

Hand Hygiene Compliance

Some studies have indicated that 0 to 61 percent of restaurant workers, 6 to 73 percent of workers in institutional settings, and 2 to 82 percent of workers in deli operations properly follow recommended handwashing procedures.

There are many factors driving these low compliance rates. These include a lack of understanding about the importance of hand hygiene, insufficient training, access and promotion of hand hygiene, and lack of management support. So is there a way to increase compliance rates and get workers to practice good hygiene on the job?

A Risk-Based Approach

Current recommendations are to wash hands whenever hands may have become contaminated. However, might it make sense for the food industry to move towards a more risk-based approach?

According to *Food Protection Trends*' "Rethinking Hand Hygiene in the Retail and Food Service Industries: Are Recommended Procedures Based on the Best Science and Practical Under Real-World Conditions?," criteria for rethinking hand hygiene include the following.

- Verify which actions in the food preparation environment pose the greatest risk for pathogen contamination via hand and human contact. Consider basic food microbiological principles, along with conducting observational studies of food handler behavior and production of quantitative risk models, which could help identify hand hygiene "critical control points." Such findings could be used to prioritize hand hygiene actions based on potential public health risks.
- Engage in studies to understand motivations associated to the lack of food handler compliance with hand hygiene recommendations, perhaps capitalizing on lessons learned from the healthcare sector. A multi-model strategy to improve food handler compliance with hygiene practices should be developed, tested, validated, and implemented at a larger scale.
- Study the efficacy and overall risk-benefit of the use of alternative hand antiseptics. Alcohol-based hand sanitizers especially should be studied as a replacement for rigorous handwashing when hands are not soiled or likely to be contaminated with parasites or bacterial spores in cases where a worker has engaged in less risky practices before contacting ready-to-eat foods and before or between gloving.
- Revise education and training material to reflect changes in recommended hand hygiene procedures based on sound science and risk.

All in all, hand hygiene plays a critical role in food safety. The right products, an understanding of the barriers to compliance, and a sound plan to strengthen hand hygiene compliance will help decrease the occurrences of foodborne illnesses. ■

Shumaker is a microbiologist at GOJO Industries. Reach him at ShumakeD@gojo.com.

Why Hand Drying Shouldn't Be Hung Out to Dry

Proper drying protocols should not be overlooked, as they are just as critical to the protection of safe food as handwashing

BY **THIERRY TRUDEL**

As much focus as there is on the general issue of hand hygiene, why is it that the discussion around hand drying in particular seemed to have, ironically, dried up?

Decades of research from hygiene authorities suggest that wet hands transfer bacteria much more readily than dry ones, as the residual moisture left on hands after leaving the wash station allows bacteria and viruses to transfer to food and solid surfaces by touch. Despite this clear research, it seems that a majority of discussion is focused almost exclusively on the importance of soap and water, washing long and vigorously.

Drying, on the other hand, has been given little attention. A recent search through research portal Lexis-Nexis for hand hygiene-related news stories over the past five years suggests that references to "handwashing" practices occurred over 250 times, whereas "hand drying" was only discussed twice.

The risks of touch-contact-associated bacterial transfer can be particularly dangerous and pervasive for food service workers, so it's essential to place a spotlight on the "total picture" of hand hygiene. In fact, a study that observed restaurant workers showed food service employees wash hands only one-third of the time as required by the Food Code.

Although the Food Code doesn't specifically prescribe the kind or configuration of hand drying devices (paper towels, heated air dryers, air-knife systems) to be used, it does require that adequate provisions be provided to prevent food workers from drying their hands on their clothing or other unclean materials. It also notes that for environments in which employees are expected to wash and dry their forearms, air-knife systems—automatic hand dryers that provide separate drying areas for each hand—do not accommodate sufficient arm drying, and the establishment is expected to provide an alternate means of drying.

Hand Drying Methods

Not all hand-drying methods are equally effective in reducing chances of cross-contamination.

Multiple studies have looked at the effectiveness of air dryers versus hand towels and results strongly favor paper towels. For example, one study published by the University of Leeds in 2014 found that levels of airborne germs collected and counted near warm air dryers to be 27 times more than those near paper towel dispensers. Another paper, published in 2012 by the *Mayo Clinic Proceedings*, which observed research from a dozen investigations, stated that "from a hygiene standpoint, paper towels are superior to electric air dryers" and "should be recommended in locations where hygiene is paramount."

These findings, and others like them, reinforce the World Health Organization's stance that proper hand hygiene involves drying "preferably with a paper towel."

Compensating for Bad Habits

People are their own worst enemies when it comes to hygiene. Even with proper training, signage, and hygiene tools, people rarely lather, rub, rinse, and dry long or thorough enough.

Technologies that compensate for people's hygienic imperfections—killing bacteria and preventing transmission without adding extra steps—can be valuable to the food industry. For example, Cascades Tissue Group developed the Antibacterial Paper Towel, which third-party labs have shown kills over 99.99 percent of bacteria on hands without requiring any change in habit. The dry paper towel is "impregnated" with a safe antimicrobial agent, benzalkonium chloride, commonly used in products ranging from mouthwash to contact lens solution. Benzalkonium chloride is released when the paper towel is in contact with wet hands.

In addition, the use of touch-free paper towel dispensers is increasing, which helps reduce the spread of bacteria. But organizations sometimes have a tough time finding space to install these bulky automatic dispensers, so it may be necessary to "think small." For instance, Cascades Tissue Group's no touch hand towel dispenser, Tandem+ Nano, is designed to fit into smaller spaces.

Setting the Trend

While proper handwashing protocols and techniques will always be critical to a healthy restaurant environment, proper hand and forearm drying is equally important and shouldn't be overlooked. The impact that food service and hospitality can play in creating more awareness and adoption of this practice is enormous. It's not uncommon for innovations applied in away-from-home spaces to seep into our daily life, so hand drying improvements made at the back of the restaurant can migrate its way to patron restrooms, spurring cleaner hands and more awareness about the value of drying. Similar to how the trend toward sustainable residential homes sprung out of LEED-certification in commercial buildings, healthy practices can eventually travel into consumers' homes to permeate society on all levels. ■

Trudel is VP of marketing and communications for Cascades Tissue Group. Reach him at thierry_trudel@cascades.com.

NEW PRODUCTS

Digital Sorting Platform

The VERYX digital sorting platform consists of belt-fed and chute-fed sorters that share a common user interface. With full object surface coverage, multi-sensor data fusion, and high-resolution cameras and laser sensors, VERYX can detect and discriminate foreign material and product defects. Auto-learn, self-adjusting capabilities, and recipe-driven operation offer an intuitive user experience. Every sorter is configured around the product characteristics, application requirements, and process objectives of each customer. Available in a range of product inspection widths, VERYX can satisfy small to very large production capacity requirements. **Key Technology, Inc., 509-529-2161, www.key.net.**

Instantly Soluble Sterile Media

Insterprep (Instant Sterile Preparation) granulated media bags and sachets are intended to speed up and simplify sample preparation for microbiological analysis of food samples, with preparation times as low as 1 minute or less. The Insterprep media bag range comes with the correct amount of granular media sealed in a Stomacher bag ready for instant use. The user simply selects the Insterprep media bag required, adds sterile water and sample before placing directly into a Stomacher laboratory blender for immediate blending. No waiting is needed for the media granules to dissolve prior to blending. **Seward Ltd., www.seward.co.uk.**

Vacuum Cooling Systems

ULVAC is offering vacuum cooling systems for use in large-scale farms to extend product shelf life. The systems are mainly used for fresh agricultural products, including green leafy vegetables and other types of vegetables, fruits, and mushrooms. Vacuum cooling equipment can also be used for meats and prepared foods, such as airplane meals. Vacuum cooling is usually applied shortly after the harvesting of crops or cutting mushrooms to preserve and extend the freshness of these products. Four models are available that can cool from two to six pallets of agricultural products per batch. **ULVAC Technologies, Inc., 978-686-7550, www.ulvac.com.**

Non-GMO Certification

NSF Non-GMO True North certification, available through NSF International's Consumer Values Verified Program, provides manufacturers an additional certification for sourcing and production claims on packaging and in marketing materials. It utilizes elements of global and domestic GMO labeling regulations, including EU and Vermont GMO labeling requirements. The certification gives credit for food safety and quality system best practices, including segregation, traceability, and supplier approval and monitoring programs. To ensure consumer confidence and transparency, certification requires risk assessment-based unannounced audits, unannounced chain of custody sampling, and independent testing. It also requires manufacturers to perform routine testing. **NSF International, 734-769-8010, www.nsf.org.**

FRP Wall and Ceiling System

The FRP CleanSeam insulated metal panel wall creates a virtually seamless wall and ceiling by combining fiberglass reinforced plastic (FRP) panel faces with a flush surface and hard joints that do not have voids and are mold, mildew, and impact resistant. The panel joints are permanently sealed with a

two-part caulking compound that bonds the adjacent FRP surfaces together. System eliminates the constant maintenance associated with silicone and butyl caulked joints that deteriorate from frequent and aggressive wash-down regimens. Panels are corrosion free and are USDA and FSIS compliant. **MetlSpan, 877-585-9969, www.metlspan.com.**

In Other Product News

AOAC-RI approves a method extension for DuPont BAX System real-time PCR assay for *Salmonella* to include enrichment protocols using Actero *Salmonella* Enrichment Media from FoodChek Systems.

Bioo Scientific receives USDA approval for using its MaxSignal Ractopamine ELISA Test Kit for the verification testing requirements for screening of meat in the QSVP, Never Fed Beta-Agonists Marketing Program.

Sensaphone introduces a cellular version of its Sentinel system that provides 24/7 monitoring of unattended freezers and coolers where Internet or Ethernet connectivity is unavailable.

3M Food Safety's Molecular Detection Assay 2—*Listeria monocytogenes* has been approved by AOAC Performance Tested Methods program, which certifies kit is now equivalent or better than standard reference methods.

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