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Volume 21 Number 4
AUGUST/SEPTEMBER 2014

Food Quality & Safety

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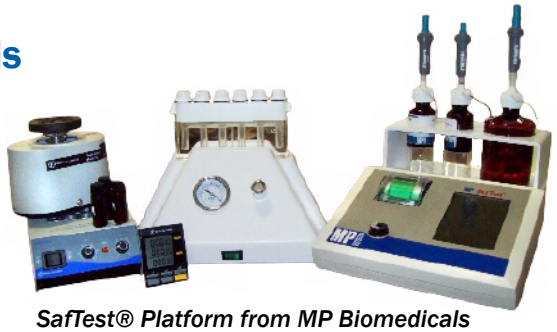

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Exclusive Online Content

To read these articles, go to the August/September issue on www.foodqualityandsafety.com:

- A Six Pack of Safety and Quality Questions for Beverage Manufacturers
- Maintaining Quality for Soy-Based Functional Beverages
- Ozone Helps Water Bottlers Deliver Quality to Consumers
- Adopting GFSI-Approved Schemes to Strengthen Food Safety Initiatives

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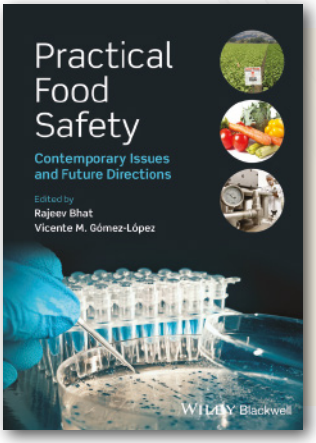

Practical Food Safety: Contemporary Issues and Future Directions

Rajeev Bhat, Vicente M. Gomez-Lopez

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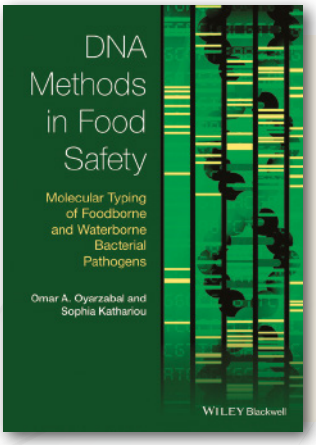

DNA Methods in Food Safety: Molecular Typing of Foodborne and Waterborne Bacterial Pathogens

Omar A. Oyarzabal, Sophia Kathariou

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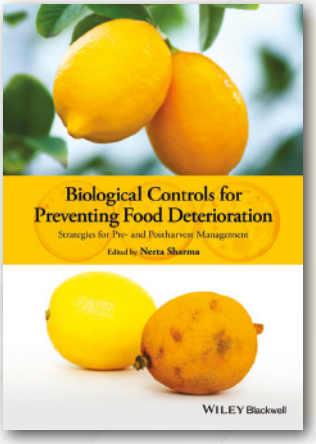

Biological Controls for Preventing Food Deterioration: Strategies for Pre- and Postharvest Management

Neeta Sharma

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From The Editor

The USDA has been busy this summer in working to improve the meat and poultry industry.

It started when USDA's FSIS announced it will start double testing on ground beef samples: Every time it tests for STEC in a sample, it will also test for *Salmonella*. Once FSIS collects enough data about *Salmonella* prevalence in ground beef, it'll create a new standard to encourage ground beef processors to strengthen their own *Salmonella* controls.

The USDA then issued a proposed recordkeeping rule for all makers of raw ground beef products that would require them to keep detailed information on all their meat sources. Retail outlets frequently mix cuts of beef from various sources to make their ground beef, creating difficulty in tracking ground beef back to its source during a recall. If finalized, this rule would require retail supermarkets and other ground beef makers to keep a log containing such detailed info as supplier lot numbers and product dates, names of supplied materials, amount of beef component used in each lot, date and time each lot of ground beef product is produced, and date and time when equipment are cleaned and sanitized.

And most recently, a final regulation was issued on food safety inspection in poultry processing plants along with an optional New Poultry Inspection System (NPIS) that would prevent up to an estimated 5,000 foodborne illnesses each year. Improving upon an inspection model that dates back to 1957, FSIS will now require all poultry companies to take measures to prevent contamination, rather than addressing it after it occurs. All poultry facilities will have to perform their own microbiological testing at two points in their production process. These requirements are in addition to FSIS' own testing, which will continue. The NPIS involves poultry companies sorting their own product for quality defects before presenting it to FSIS inspectors, allowing inspectors to focus less on routine quality assurance tasks and instead focus more on food safety. As a result, more inspectors will be available to more frequently remove birds from evisceration lines for close safety exams, take samples for testing, check plant sanitation, verify safety compliance plans, observe live birds for signs of disease or mistreatment, and ensure plants are meeting regulations.

With USDA's efforts in addressing issues like testing, recordkeeping, and inspections, hopefully bacteria can be kept at bay so the American public can better enjoy future summer barbeques!

Marian Zboraj
Editor

Food Quality & Safety
FARM TO FORK SAFETY

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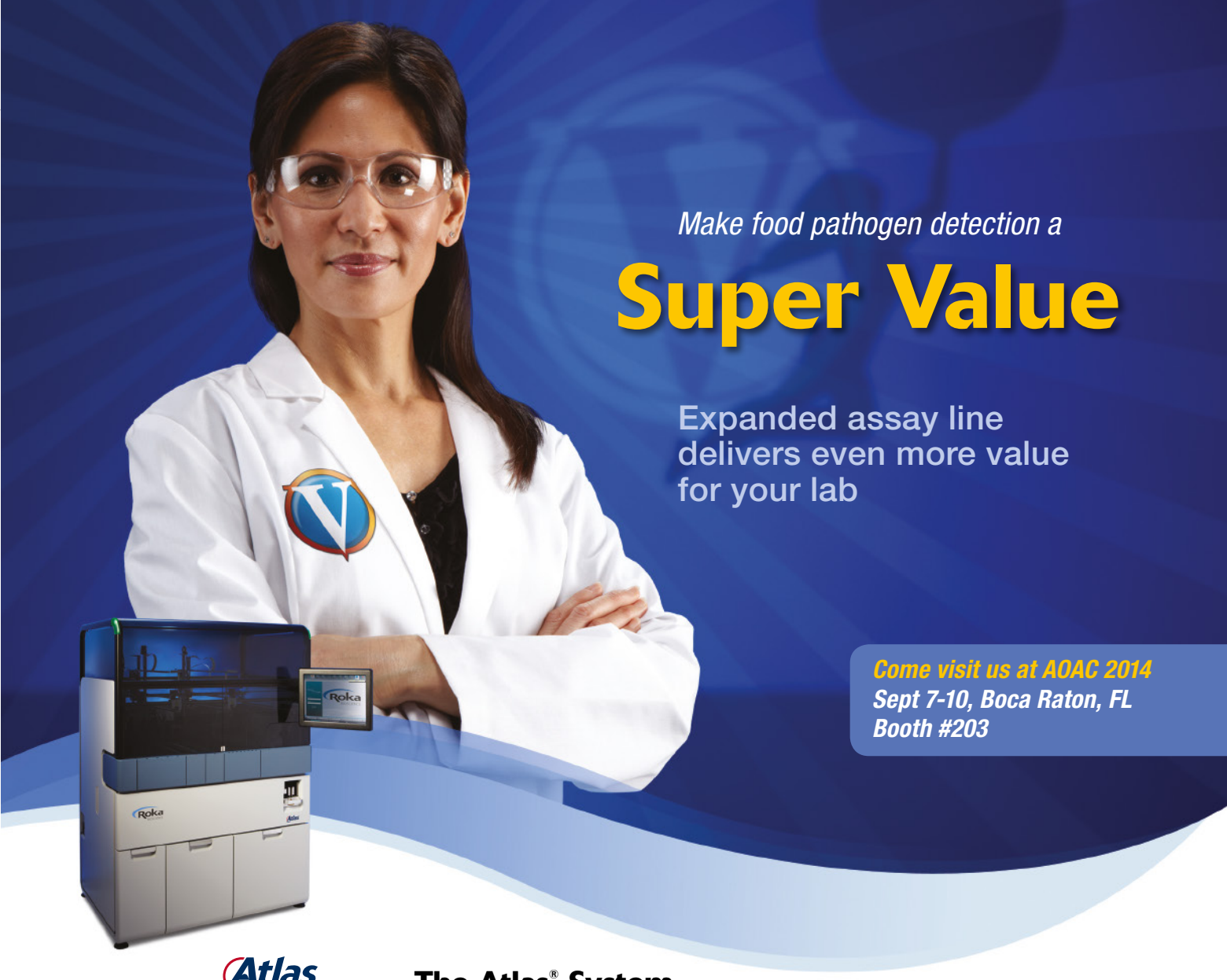

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NEWS & NOTES

Food Safety & Traceability Report: FSMA Perceptions

Many industry stakeholders are still confused about the proposed FSMA, according to a study from PMMI. The "Food Safety & Traceability 2014" report, based on 64 interviews with manufacturing professionals, includes details about the impact of FSMA and how equipment manufacturers can best prepare for the upcoming regulations. It identifies the industries most affected by the anticipated rules. Fresh produce manufacturers are expected to see the greatest impact. The report also expands on ways that manufacturers affected by FSMA can make strides towards compliance. These steps include reducing liability with greater traceability capabilities, evaluating equipment design for improved sanitary construction and easy cleaning, and training operators thoroughly and often.

Retailers to Track Sources of Ground Meats

The USDA's FSIS is proposing to require that all makers of raw ground beef products keep records in order to further protect consumers by ensuring retailers can trace sources of ground meats. Retail outlets regularly make ground beef by mixing cuts of beef from various sources. This proposal, if finalized, will require them to keep clear records identifying the source, supplier, and names of all materials used in the preparation of raw ground beef products. When foodborne illness outbreaks occur, traceback investigations can be hindered when retail outlets fail to keep clear records that would allow investigators to determine which supplier produced the unsafe product.

GFSI's Food Fraud Position Paper

The GFSI Guidance Document Working Group and the Food Fraud Think Tank have released a paper on the position of the GFSI on food fraud mitigation. Companies are urged to perform a food fraud vulnerability assessment and to have a food fraud vulnerability control plan in place to mitigate the identified vulnerabilities. In order to ensure transparency, the GFSI Board believes that the mitigation of food fraud is an integral part of a company's food safety management system, and has therefore decided to include new requirements specific to food fraud mitigation in the next full revision of the GFSI Guidance Document 7th Edition, which will be released in early 2016.

Wholesaler-Distributor Operations Benchmarking Report

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United Fresh's "Wholesaler-Distributor Operations Benchmarking Report" is designed specifically to help produce wholesalers and distributors evaluate the effectiveness of their operations. Prepared by research firm Industry Insights, the report allows produce companies to compare their labor practices, sales practices, procurement and inventory management, warehouse metrics and outbound transportation by ownership type (family or private), primary customer business segment, produce sales and case volume, number of full-time employees, and warehouse square footage.

'Top Ten' List of Foodborne Parasites

A report issued by the UN's FAO and WHO details the dangers of foodborne parasites in various parts of the world. It highlighted the top 10 parasites: *Taenia solium* (pork tapeworm), *Echinococcus granulosus* (hydatid worm or dog tapeworm found in produce), *Echinococcus multilocularis* (a type of tapeworm in produce), *Toxoplasma gondii* (protozoa in red meat), *Cryptosporidium spp.* (protozoa in produce, juice, and milk), *Entamoeba histolytica* (protozoa in produce), *Trichinella spiralis* (pork worm), *Opisthorchiidae* (family of flatworms in freshwater fish), *Ascaris spp.* (roundworms in produce), and *Trypanosoma cruzi* (protozoa in fruit juices). The Codex Committee on Food Hygiene is now developing a set of guidelines to help tackle these parasites with a new set of standards.

Antibiotic Resistance

The CDC's new report details the progress and problems of antibiotic-resistant foodborne microorganisms. It shows that multi-drug resistant *Salmonella* decreased during the past 10 years and resistance to two important groups of drugs—cephalosporins and fluoroquinolones—remained low in 2012. However, in *Salmonella typhi*, the germ that causes typhoid fever, resistance to quinolone drugs increased to 68 percent in 2012, raising concerns that one of the common treatments for typhoid fever may not work in many cases. Meanwhile, *Campylobacter* resistance to ciprofloxacin remained at 25 percent, despite FDA's 2005 withdrawal of its approval for the use of enrofloxacin in poultry.

HACCP Online Course

AIB International's new 60-day HACCP online course is a hands-on instruction intended for food professionals to learn the history and formation of HACCP. Participants learn the seven HACCP principles; how to recognize biological, chemical, and physical hazards; and how to develop a HACCP plan. The course will prepare individuals on how to contribute to a HACCP team and meet their requirements for audits. A certificate of completion as well as Continuing Education Units will be provided.

Retail Grocery Initiative

A new Retail Grocery Initiative facilitated by GS1 US aims to address industry challenges with broad adoption and implementation of GS1 Standards. Uniting suppliers, manufacturers, distributors, wholesalers, retailers, solution providers, and industry associations, the GS1 US Retail Grocery Initiative gathered industry stakeholders for its inaugural meeting on June 10 during the GS1 Connect 2014 conference. During the initial meeting, more than 150 stakeholders gathered and identified high priority topics impacting their businesses that could be addressed by the Initiative, including alignment on product information for business and consumer use, and standardized usage of images and adherence to regulations from FSMA.

Business Briefs

Cherney Microbiological Services plans to open a new testing facility in Clovis, N.M. in August.

Mérieux NutriSciences acquires **Total Quality Food Consultants** to expand its global offer for regulatory, scientific, and marketing services to the food and non-food industries.

Quality Certification Services is now an approved and accredited certification body to the GLOBALG.A.P. scheme.

FSNS C&A adds SQF capabilities to its body of auditing work.

The new IFS Food United Fresh Produce Program provides a method of certifying fruit and vegetable packing companies using the Harmonized Standard from **United Fresh** during an **IFS** Food audit.

NSF International earns IFS Logistics Standard Accreditation.

Helping Small Businesses Comply with Gluten-Free Labeling

The FDA's "Small Entity Compliance Guide" helps small businesses comply with gluten-free labeling requirements. It provides a plain-language question and answer overview of the regulatory requirements for using the words "gluten-free" on labels for food products subject to the rule; the definitions of the terms "gluten" and "gluten-free"; and when FDA considers a food labeled "gluten-free" to be misbranded. Beginning August 5, all food distributors hoping to use that word must comply with FDA restrictions. The rule is designed to assist those with Celiac's disease, a severe sensitivity to gluten, in choosing products that are safe to eat.

Washington Report

The Countdown: Enacting FSMA through FITs and FOTs

Time is running out as FDA sets up teams to plan how to implement final food safety rules starting next year | BY **TED AGRES**

Facing court-imposed deadlines to finalize seven major food safety regulations within the next two years, FDA will adopt a carrot-and-stick strategy to obtain industry compliance with the Food Safety Modernization Act (FSMA). For example, FDA will create "incentives" for companies to comply with FSMA's preventive control rules for food and feed facilities by reducing inspections of firms having a record of "good behavior" and targeting high-risk firms with "enhanced" surveillance and inspections, according to the agency's latest strategic plan for implementing FSMA.

When preventive control problems do arise, FDA will first seek voluntary corrections at the facility level. If that fails, the agency will next use its enhanced administrative powers, such as detention and mandatory recalls, and only afterwards seek court-ordered injunctions, seizures, or criminal prosecutions. Overall, FDA hopes to encourage industry compliance through education and technical assistance by partnering with other federal, state, and local agencies. For instance, FDA will partner with USDA and private auditors when it comes to on-farm inspections related to produce safety standards. Internationally, FDA will partner with foreign governments and accredited third-party auditors to assess imported food.

In May, FDA published its "Operational Strategy for Implementing the FDA FSMA." As mandated by a federal court-ordered consent decree, FDA must finalize and publish rules for preventive controls for human and animal foods by Aug. 30, 2015 and publish final rules for produce safety, the Foreign Supplier Verification Program, and accreditation of third-part auditors by Oct. 31, 2015. The sanitary transport of food and feed rule must be finalized by March 31, 2016 and the intentional adulteration final rule by May 31, 2016.

These rules "intersect and cover an incredibly diverse spectrum of people and companies located all over the world," says Roberta F. Wagner and Joanne Givens, co-chairs of the FSMA Operations Team Steering Committee and, respectively, deputy director for regulatory affairs at FDA's Center for Food Safety and Applied Nutrition and an acting regional food and drug director in FDA's Office of Regulatory Affairs. "Our team is talking with those most affected by the proposed rules—including farmers, importers, industry representatives, and state officials—for their feedback on the most reasonable and practical ways to carry out our preventive and enforcement activities," Wagner and Givens state in a May 8, 2014 FDA blog posting. State regulatory partners will play an increasingly active role in industry oversight once the agency moves into post-final rule implementation in late 2015 and early 2016, Wagner adds.

This state-level collaboration will be critical, "especially when it comes to the new and unique challenge of implementing the produce safety rule," explains Michael R. Taylor, deputy FDA commissioner for foods and veterinary medicine. "We aspire to rely heavily on state agriculture departments and other state and tribal departments with on-farm food safety responsibility, taking advantage of their food safety commitment, their knowledge of local conditions and practices, and their local presence to deliver training, technical assistance, and compliance oversight," Taylor writes in a May 2, 2014 FDA blog posting coauthored by Howard Sklamberg, deputy FDA commissioner for global regulatory operations and policy. "But we have to work closely with our state partners to convert this aspiration to reality. That work includes finding the funding they will need to play an expanded role on produce safety and other areas of FSMA implementation."

Funding Problems

"Good luck with getting more funding for the states; that's probably not going to happen," says David Acheson, MD, CEO, The Acheson Group and a former FDA associate commissioner for foods. "States are already doing inspections on behalf

of FDA and any expansion of this will depend on more resources. The states are in at least as much budget trouble if not more so than FDA in that regard," Dr. Acheson tells *Food Quality & Safety* magazine.

Illustrating this point, the National Environmental Health Association released an analysis in May of the capacity of local and state governments to investigate and respond to foodborne illness outbreaks. The survey of environmental health and regulatory food safety managers at local, tribal, and state agencies found that budget cuts and other financial strains have resulted in high employee turnover, less experienced staff, and decreased capacity to respond to foodborne outbreaks. Not unexpectedly, small municipalities and local agencies have been hardest hit.

"What you really want is for everybody to be at a high standard of food production and growing with regard to produce," Dr. Acheson says. Many food companies are already at that level or beyond it, but many others are not. "Small- and medium-sized businesses are still fairly clueless about what it all means and what they need to do," Dr. Acheson says, adding that the FDA needs to find better mechanisms for getting information to these firms. "So there's a big messaging and education component that has to happen. How do you get these firms to understand the importance of environmental and process controls? FDA's strategic plan doesn't get into that level of detail, and that's the challenge," he says.

FDA organized groups of interdepartmental teams to review and recommend how the thousands of pages of proposed FSMA rules and regulations should be put into practice. FSMA Implementation Teams (FITs) are developing regulations and guidance documents, inspection and compliance strategies, and administrative enforcement tool protocols. Concurrently, FSMA Operational Teams (FOTs) are creating plans to make the rules, programs, and policies operational while developing specific strategies to prepare for implementation. Transparency will remain a priority throughout the process. "We are engaging with external public/private sector and internal stakeholders to elicit input to inform the development of post-final rule implementation strategies and determine reasonable and practical ways to implement the standards," Wagner says.

Preventive Controls

Based on its strategic plan, FDA will tailor implementation of each FSMA rule according to the nature and degree of risk posed by specific commodities, sectors, and facilities; by the availability of interventions to reduce risk; and by the availability of resources and tools to provide oversight, among other factors. When it comes to implementing the preventive control rules for food and feed facilities, for example, FDA will significantly expand its inspection and surveillance tools to include a wider range of inspections, testing, and data collection activities conducted through its own field force and through collaboration with partner agencies and the food industry. The types and purposes of inspection and surveillance will include:

- Providing incentives for compliance through reduced scrutiny of firms having records of good performance;
- Assessing the compliance of individual companies through a range of inspection and sampling techniques;
- Making in-depth assessments of individual firms when needed to increase incentives for compliance and to determine the need for compliance or enforcement actions; and
- Collecting data on sector-wide hazards and practices and on compliance rates.

Produce Safety

FDA acknowledges that "there is no reasonable expectation" that it has the resources and expertise to conduct routine on-farm inspections when it comes to implementing the produce safety rules. Rather, FDA notes congressional mandates to coordinate education and enforcement with state and local officials and for USDA to provide technical assistance grants for implementation, especially to small growers. As a result, the FDA will focus on :

- Deploying a cadre of produce safety experts in headquarters and the field to educate and foster compliance;
- Supporting education, technical assistance, and audits and accountability functions through collaborations with public and private parties; and
- Conducting targeted on-farm surveys, inspections, and environmental assessments to understand current practices and to identify gaps.

Imported Foods

FSMA requires imported foods be produced using preventive measures that achieve the same level of food safety as domestic foods. Key features of implementing the Foreign Supplier Verification Program and Third-Party Accreditation rules include:

- Reconfiguring current import field exam activities to complement oversight of foreign supplier verification;
- Implementing the Voluntary Qualified Importer Program and other measures to expedite entries for good performers; and
- Developing the skills and processes to audit accrediting bodies and accredited third-party certifiers.

Despite the effort spent in planning, drafting legislation, and writing the food safety regulations, some experts don't believe the results will be worth it. "I don't object to FSMA, I just don't expect a lot from it," says Douglas Powell, a former professor of food safety at the University of Guelph, Ontario, Canada and of diagnostic medicine at Kansas State University and now publisher of www.barfblog.com.

"Food safety becomes very important when there's an outbreak. The challenge is how you make it important in the absence of an outbreak," Powell tells *Food Quality & Safety*. "The FDA sets minimum standards for the food service industry, restaurants, and others to follow. But the best companies go above and beyond those standards and should brag about doing so. Companies should hold themselves to higher standards because if they don't, they will get sued."

Dr. Acheson is concerned that FDA inspectors may know less about the rules than food manufacturers and growers. While FDA plans to focus on education, "many of its inspectors are not wired to be educators; they are regulators and don't have the personality or skill set to be educators," he says. He foresees situations where an inspector says something needs to be done a certain way but the company disagrees. "We will end up with potentially awkward situations where the food company says it knows it's doing things the right way and the regulator disagrees, but is wrong. It's going to get a little tricky." ■

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

FSMA Update

The risks of ignoring even one sign of a pest infestation are higher than any company can afford.

Pesty Food Management

Start the FSMA compliance process by first dealing with bothersome pest problems—incorporate a rigorous management plan into overall operating procedures

BY **JIM FREDERICKS, PHD,** AND **MISSY HENRIKSEN**

Proper pest management plays an important role in ensuring the safety of the nation's food supply, especially inside food processing and storage facilities. In fact, several recent cases of food contamination have been traced back to facilities with pest problems. Although FDA regulations allow for a trace amount of insect parts in processed food, active pest infestations in facilities can easily result in contamination of food products.

One of the largest and most expensive food recalls in the U.S. occurred in 2009, when FDA officials discovered that the Peanut Corporation of America (PCA) had been distributing shipments of peanut-based products that were contaminated with *Salmonella* bacteria.

Inspections of the PCA plant revealed clear violations of basic Good Manufacturing Practices, or GMPs, including damage to the roof, which allowed rainwater to leak into the production area; mold growing on the ceilings; large gaps throughout the structure, allowing rodents easy access to the plant; and cockroaches throughout the facility.

During their investigation, federal officers also unearthed emails between PCA executives, which showed they had knowledge of the conditions in this plant and were also aware that the products had tested positive for *Salmonella* over a two-year period. Because of PCA's lack of pest prevention and action in resolving infestations, the contaminated products led to a major national outbreak of *Salmonella* poisoning, affecting 700 people in 46 states. Nine of those cases were fatal.

PCA filed for bankruptcy and closed its doors amid a series of lawsuits. However, the case continues, as former PCA executives are scheduled to go on trial for a 76-count indictment by the U.S. Department of Justice.

In PCA's case, structural issues and extreme pest infestations led to both serious harm of customers and the eventual shutdown of the company. Under the Food Safety Modernization Act (FSMA), the FDA has the authority to shut down facilities in which they find these types of safety violations. For this reason, proper and specific documentation of periodic pest inspections and proper sanitation practices will become increasingly important in determining compliance with the facility's food defense plan.

Implementing a Plan

Applying a pest management plan into a standard operating procedure is the only way to make sure that facilities will consistently pass inspections and continue to manufacture safe products for consumers.

An effective pest management plan will vary by company and by facility, due to factors such as the type of food stored and manufactured, building structure, surrounding environment, and weather conditions.

To best comply with new regulations under FSMA, facility managers in decision-making positions should begin by consulting with their pest control

company of record. If a specialized plan is already in place, the discussion can involve possible updates to the existing plan, as well as improved procedures for implementation, reporting, and recordkeeping.

If a preventative pest management plan is not already in place, facility managers are encouraged to work together with their pest control company to identify potential threats and how to best address them. The main elements of a good pest management plan are prevention, compliance, and response. By working through these steps, plant managers can be sure they are protecting their products and abiding by FDA regulations.

Prevention involves regular inspections and reporting of potential threats at a facility, implementing preventative treatments designed for the facility in question, and creating a set of procedures to maintain proper cleaning and sanitation of production areas. By scheduling, at minimum, monthly inspections, operators and their pest control partners will be able to quickly recognize and treat any potential pest problems.

Since FSMA gives the FDA the authority to perform surprise inspections in addition to a set schedule, as well as increased access to records that indicate whether or not safety measures have been implemented, and high-quality food testing by third-party laboratories, ongoing compliance will be one of the most important aspects of the new regulations. These measures are designed to make food companies more accountable for enacting and recording the measures they take to ensure food safety. Keeping updated and accurate records is essential to properly complying with new regulations. These records should include pest control procedures, the schedule of inspections, the status of employee training, and improvements in sanitation.

The final piece of an effective pest management plan is the development and implementation of an action plan should a facility face an infestation. In the majority of cases, this will involve partnering with a pest management company to quickly and completely eradicate an infestation. Signs of a pest infestation are not always obvious to the untrained eye, but can easily be uncovered by professionals who are trained to look for such evidence. In an ideal world, facilities would never have to implement these response measures, but due to the risks pests pose to both public health and companies' reputations, being prepared for the worst-case scenario is the best option.

The Bottom Line

The negative media coverage and loss of faith from consumers as a result of a Class I recall due to contamination can cause irreparable damage to a company's reputation, as well as the food industry's reputation at large.

As the U.S. food industry has a direct role in ensuring the safety of the country's food supply, companies that fail to comply with FSMA will pay a heavier price than ever before. Between the potential shutdown of facilities, fines levied by the FDA, costs of a recall, and loss of future business, the risks of ignoring even one sign of a pest infestation are higher than any company can afford. Developing a preventative plan is far easier and more beneficial to all involved than relying on a crisis management plan after the problem arises.

Deadlines

Although the final implementation of FSMA was scheduled for June 2015, a recent agreement between the FDA, the Center for Food Safety, and the Center for Environmental Health set a staggered schedule for the following four regulations:

- Preventative controls for human and animal food: August 30, 2015
- Imported food and foreign suppliers and produce safety: October 31, 2015
- Food and fee transportation: March 31, 2016
- Intentional adulteration of food: May 31, 2016

By implementing proper pest management programs, companies are protecting the public from the harmful effects of pests as well as protecting the interests of their business. When prevention becomes the norm, the negative attention that is often directed at the issue of food safety failures will subside, allowing public confidence in the food industry to continue to grow. For these reasons, pest management, now more than ever, is a necessity within the food industry. ■

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THE ART BEHIND QUALITY CRAFT BEER

Quality brewing experts discuss what goes into crafting their increasingly popular products

BY **TIM DONALD**

THE CRAFT BREWING INDUSTRY IN THE U.S. IS BOOMING. The number of U.S. craft breweries increased 15.3 percent in a single year, up from 2,401 in 2012 to 2,768 in 2013, according to the Denver-based Brewers Association. Sales of craft beer (measured in barrels, or bbl) increased by 17.2 percent in 2013, despite a decrease of 1.9 percent in the overall national beer market.

Craft brewers, defined by the Brewers Association as brewers that produce 6 million barrels of beer or less annually, are a relatively small part of a large market. In 2013, craft brewing held a 7.8 percent market share of the $100 billion overall U.S. beer market. Craft beer sales were $14.3 billion in 2013, representing a 20 percent growth in dollar sales over the previous year, according to the Brewers Association.

Ask craft brewers what role quality plays in the maintenance and growth of this rapidly expanding niche market, and they will tell you that quality is an essential ingredient, as important as the hops, malt, and yeast that are responsible for the character of their beer.

"Our goal is first quality," says Rich Michaels, quality and innovation manager for F.X. Matt Brewing Co. in Utica, N.Y, creator of the Saranac line of beers. "Our goal is that when you purchase a beer out in the trade, it tastes just as fresh as it tastes here at the brewery."

Consumers pay a premium for beer brewed in relatively small batches compared with those produced by the large breweries—those that produce more than 6 million bbl annually, such as MillerCoors of Chicago or Anheuser-Busch of St. Louis. In return, they expect consistency and quality, and this can be a matter of life and death for small startups venturing into the craft beer realm.

"If you allow inconsistencies, it's really going to hurt you in the marketplace," Michaels says. "As craft becomes a bigger part of the beer segment, quality is going to be the difference between being in business five years from now and not."

What constitutes quality and consistency in craft beer production? The issues are the same as for many other segments of the food and beverage industry: careful production, exacting sanitation, reliable distribution, and appropriate equipment, according to the craft beer quality experts interviewed for this article. The ways these elements are applied and come together in the form of delicate and delicious beverages are explored below.

No Difference in Issues

In its 2013 annual report, Anheuser-Busch reported global production of more than 360 million bbl of beer in 2013. With total U.S. craft beer production at 15.6 million bbl in 2013, that means "it takes Anheuser-Busch about two weeks to produce what U.S. craft does in a year," notes Bart Watson, PhD, chief economist for the Brewers Association.

Nonetheless, the quality issues for giants like Anheuser-Busch and MillerCoors are the same as those for craft brewers, quality managers say.

"From a quality perspective, all the concerns are the same," says Jim Kuhr, director of brewery operations and brewmaster for F.X. Matt. "Whether it's a light American lager or a big heavy craft beer, the same issues affect it."

"Budweiser is just a different flavor profile, and, believe me, I worked with Anheuser-Busch for 15 years, and they make high-quality beer," says Rob Fraser, quality manager for Sierra Nevada's brewery in Chico, Calif. "It's just different."

In fact, while the large brewers have some advantages over smaller companies because of their greater resources, they face challenges that many craft brewers do not.

"The challenge [is] that American light lager is one of the most difficult beer styles to execute well. It's very delicate, really nothing to hide behind, so if you make a mistake it will be much more readily apparent to the consumer," says Jaime Schier, director of quality at Harpoon Brewery, based in Boston. "In craft brewing, we have a lot of alcohol, hops, and malt flavor that can cover up some of the minor sins you can commit as a brewer."

In addition, the major brewers have multiple production sites throughout the country—MillerCoors has nine, Anheuser-Busch a dozen—so there are challenges with flavor matching from one facility to another, with different water sources and different equipment.

"But in total, the things that affect light lagers affect craft beers as well," Kuhr says.

Keeping it Fresh

Perhaps the most important factor for maintaining quality in craft brewing is making sure the product in the field is consumed when it is fresh. One difficulty in this respect is that control over freshness decreases as length of the supply chain increases, from brewer to distributor to retailer.

"Beer is better fresh, almost universally," Kuhr says. "As a brewer hands over control of their product when it hits the distribution channel, that's one of the challenging aspects of trying to deliver that product to your consumer, that flavor you're looking for. All brewers struggle with that, big and small."

Working with a reliable distributor is essential for monitoring the quality of the product as much as possible. "We do everything we can to work with distributors who know how to take care of beer," Kuhr continues. "You want to work with a distributor that's successful in their whole portfolio of brands."

Harpoon, which sells more than half its product in Massachusetts but distributes as far as Texas, uses a combination of distributors and employees to monitor its stock.

"We select distributors who are diligent about keeping appropriate stock levels, having their reps visit the retail locations far more often than we can visit them, having appropriate stock levels in a given location, and pulling stock when it's getting long in the tooth," Schier says. "In every area where we distribute, we have a brewery representative, a Harpoon employee who liaises with the distributor and does brand-building and promotional work, visiting retail accounts. Those guys do as much as they can to keep an eye [on] the freshness of the beer."

Sierra Nevada has field sales quality managers who help to ensure that products are cold and there is good rotation, Fraser says.

"We have national and international distribution, so our number one problem is making sure our beer is kept cold," he says. "We don't want our bottles or cans to be stored at any greater than 49 degrees Fahrenheit, and we prefer it be stored between 33 and 49 degrees Fahrenheit. Our draft should be between 33 and 40 degrees Fahrenheit. All the distributors have been told that we want our beers to be kept cold."

Beyond the distributor, at the retail level, "that's one part of the beer culture where we haven't made much progress yet in the U.S.," says Schier. "If it was up to the retailer they would never pull anything from their shelf."

The industry has taken steps to try to educate retailers about caring for craft beer products, for example with the *Draft Beer Quality Manual* available from the Brewers Association.

In retail stores, beer can be kept warm or even hot on the floor, frustrating the efforts of quality managers.

"Our rule of thumb is that every increase of 18 degrees Fahrenheit doubles the rate of staling of the beer, so if it's stored at

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68 degrees Fahrenheit the shelf life will be roughly cut in half," says Sierra Nevada's Fraser. "It's nearly impossible to address [the variations at the retail level], so we focus on producing a beer with as long a flavor stability and product stability as we can get. We focus here on making sure our flavor profiles are consistent and stable over that shelf life."

The Harpoon Brewery in Boston, Mass.

HARPOON BREWERY

Making the Yeast Happy

Quality beer starts with quality brewing, which proceeds through stages including malting, mashing, lautering, fermenting, conditioning, and filtering. Like any kind of cooking process, careful attention is required at each stage to ensure consistency and quality in the finished product.

The fermenting stage is one of the most important components, and, according to brewing quality consultant Alastair Pringle, of Pringle-Scott LLC in St. Louis, one that is often underemphasized.

"Some people don't understand that yeast is a living organism that you need to treat right, just like you need to treat your tomato plant right if you expect it to grow," he says.

The brewer must ensure that the wort—the liquid extracted from malt in the mashing process—has the nutritional qualities that the yeast wants, and that it has "the right balance of fermentable and nonfermentable carbohydrates to produce the right balance between alcohol and sweetness from unfermentable sugars," Pringle explains. "Focus on the components of the wort, and then making sure that you treat the yeast right, that you pitch it at the right amount into the wort, and that you get the right amount of oxygen in there for growth. The single most important thing is to get the right amount of oxygen."

When these elements are combined in the right quantities, he says, "the fermentation becomes predictable, and so does the quality of the beer, in that it tastes the same and analytically it's the same."

Once this stage is past, where oxygen is essential to yeast reproduction, further oxygen intake must be minimized.

"Zero would be the goal," Harpoon's Schier says. "Any exposure to oxygen after the beer has fermented will shorten its shelf life and remove the gustatory enjoyment of the beer, make it smell sweet and flat and flabby. Brewers work really hard to keep their oxygen exposure down, and a dissolved oxygen meter is an incredibly valuable piece of equipment to help with that."

Keeping the living yeast healthy is vital for flavor production, Schier notes, as the yeast imparts a large percentage of the aroma and flavor present in the finished product. Producing the high-alcohol-content beers common in craft brewing can be stressful for yeast.

"In addition to ethanol, which is a form of alcohol, and carbon dioxide, which is the fizz in beer, yeast also produces a wide range of secondary metabolites, and they give to beer a big part of its flavor. Healthy yeast will produce those secondary metabolites in consistent and pleasant ratios. Yeast that is stressed out or unhappy will produce those metabolites in ratios that are inconsistent so that you don't get the same beer time after time, or unpleasant combinations that just don't work that well," Schier says.

Sanitation is Key

The craft beer industry is fortunate, from a safety standpoint, that no pathogens can survive in beer with normal alcohol content, bitterness, carbonation, and pH. From a quality standpoint, however, brewers must be constantly on the lookout for what Kuhr, of F.X. Matt, calls spoilage organisms, "which would make beer not taste good but would not make it harmful. It doesn't take much of a lapse of process to allow those sorts of bacteria to get a foothold, and then they will quickly have a negative impact on flavor."

So essential is sanitation, he says, that "most brewers spend their first several months of their career just learning to clean, before they are ever trusted with brewing."

Fraser concurs: "Craft brewers take sanitation and microbiology very seriously. There's a lot of manual cleaning on the craft side, whereas the bigger breweries are more automated."

Used kegs are washed when returned to the brewery, and are cleaned internally with a caustic, an acid, and steam before being rinsed and refilled with beer, Fraser says. Sierra Nevada also uses a keg line monitor system (Rotech, Swindon, England) to validate the cleaning process, and occasionally opens kegs to make sure they are being cleaned properly, he says.

Education

As the craft brew industry is growing, so are the educational opportunities for those in or entering the field. The Master Brewers Association of the Americas (MBAA) has identified 32 colleges and universities in the U.S. and Canada that plan to start, or have recently started, certificate or 2- or 4-year degree programs in brewing.

"We are working to assist these institutions in formulating their curricula so that what they teach and the credentials they offer are recognized by the brewing industry," says Karl Ockert, technical director for the MBAA. These programs are in addition to a number of existing brewing schools and organizations.

People enter the craft brewing industry with a range of educational backgrounds, Schier says.

"We look for people to work in our quality department who have chemistry, microbiology, or food science degrees. To work in the brewery they are better off with a mechanical, electrical, or chemical engineering background. But at a brewery like ours, there are also plenty of ways to get into the industry as a novice trainee," he says.

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Specialty Coffee Adds Layers of Complexity to Obtaining Quality

Another field that has developed a large specialty niche in a parallel timeframe with the rise of craft beer is the coffee industry. Half the U.S. population drinks some type of specialty coffee beverage—cappuccinos, lattes, macchiatos, iced coffees—and 30 million Americans consume these types of drinks daily, according to E-Imports of Vancouver, Wash. Specialty coffee sales account for nearly 8 percent of the total U.S. coffee market—similar to the craft beer segment of the total U.S. beer market—and sales are growing by 20 percent per year.

And as with the craft beer industry, quality is paramount in providing the experience customers are looking for in specialty coffees.

"Throughout the farm-to-cup supply chain there is a lot of quality control that takes place through the normal transactional process, by exporters, importers, roasters, private label brands, and retailers," says Spencer Turer, vice president of coffee operations for Coffee Analysts. His firm, based in Burlington, Vt., provides independent analysis of coffee and coffee products for all of the above stakeholders.

(A word about terminology: The Specialty Coffee Association of America defines "specialty coffee" in a specific way, referring to the quality of the beans and their preparation. For the purposes of this brief discussion, "specialty coffee" means espresso-based beverages such as lattes and cappuccinos.)

"Coffee is an exotic item," Turer says, with green coffee coming predominantly from outside the U.S. "We talk about a global industry, but it's not one industry. Definitions for terminology may be different from country to country, from one producing origin to another. Understanding the language of green coffee allows buyers and sellers to communicate more effectively, without ambiguity."

Canned coffee in the grocery store is usually a blend of coffees designed to produce a specific flavor profile of taste and aroma. The quality emphasis for manufacturers is to make sure the coffee looks, smells, and tastes the same way every time, Turer says.

While the quality of the beans and their production is important, water quality is also a high priority. The standards for quality of brewed coffee established by the Coffee Brewing Institute in 1952 by Dr. E.E. Lockart, Food Science professor at MIT, still holds true today, Turer says.

"When you're brewing coffee, you want to extract 18 to 22 percent of the materials from the ground coffee during the process. The final beverage should have 1.15 to 1.35 percent brew solids. The rest is water. So with such a high percentage of water in the beverage, it is important for the water to be the right vehicle," he says. It is essential to establish a system that can maintain the level of dissolved solids, neutral pH, remove any impurities or aromas, and eliminate components such as sodium that can be harmful to the extraction process and affect the flavor of the final product.

Another level of complexity is added with espresso-based drinks, he says. "A single espresso has a much higher ratio of brew solids to water than a drip coffee. The process happens so quickly, with such small amounts of coffee and water, that any variation in any of the attributes of the grind-dose-tamp-extraction process get magnified dramatically in the beverage." Add to this the varia-

Methods in Aroma Recovery for Enhanced Coffee Extract Quality

BY **DR. STEPHEN MASTERS** AND **ULRICH NIESSE**

In the production of instant (soluble) coffee powder, aroma recovery and off-flavor removal have significant impact on the quality of the end product. This discussion describes the processing steps required to produce premium aroma-rich instant coffee with reduced off-flavors without compromising on extraction yield.

After handling of the green coffee beans, the initial stage in producing coffee extract is roasting and grinding the coffee beans to the optimized particle size distribution for extraction. The size of the Roast and Ground (R&G) particles is the first consideration to achieve efficient aroma recovery. More finely ground R&G particles maximizes aroma extraction and yield, while specially designed percolators are required in order to handle the fine particles without having an unacceptable high pressure drop across the percolators and a high risk of filter blockage. To manage this process challenge, new percolators, such as from SPX, are wider and shorter than conventional percolator designs so that finer particles can be used while limiting the pressure drop. Specially designed top and bottom filters on SPX percolators further enable extended running times and minimize the risk of filter blockage.

To achieve the best extract quality from the extraction process, methods have to be used which can gather and preserve the premium aromas. Therefore prior to commencement of the extraction process, steam stripping of aromas from the roast and ground coffee recovers the most volatile and desirable aromas. The resulting aroma-rich steam is condensed and stored under chilled conditions to be added back into the extract prior to coffee extract standardization.

Once the most volatile aromas have been stripped using the steam, the coffee extract quality is further enhanced by using low-temperature, lenient extraction conditions. The primary, aroma-rich extract this produces is stored with the aromas recovered from the steam stripping.

A second high-temperature extraction stage takes place to obtain high yield, hydrolyzed extract. This stage of aroma extraction forms undesirable off-flavors which, are removed to maintain premium extract quality. The undesirable off-flavors are removed by flash separation in a vacuum vessel. The secondary hydrolyzed extract is then cleaned in a centri-

tions introduced by the use of steamed or warmed milk and other ingredients, and "the amount of quality control for baristas making espresso drinks is much more detailed than with drip coffee," Turer says. "It takes one skill set to be able to do it well, and another skill set to be able to do it consistently."

Turer likens the barista to "a coffee chef or a highly skilled bartender." The skills of baristas are part science and part art, and employee development is essential for the retailer. Many of the functions on the scientific side can be supplied by automation, however, and some retailers with multiple outlets lean in that direction.

"The fully automated machine grinds, doses, tamps, and extracts all by itself. All the science is taken care of by microprocessors. So now you're spending more on equipment and less on employee training," Turer says. "The issue is, when you automate, you eliminate the poor quality beverage, but you also lose the ability to control the production of grind-dose-tamp-extraction to create a truly specialty quality beverage, a high-quality drink." That capability still depends on the barista's art.—***T.D.***

fuge to remove sediments and subsequently concentrated in an evaporator.

Steam stripping of aromas followed by the low-temperature and then high-temperature extraction conditions (known as dual-dual extraction) helps to ensure the primary aromas are preserved while still maintaining high extraction yield. Once the hydrolyzed extract has been concentrated, the premium aromas are added in-line to the concentrated extract to obtain the desired aroma quality in the extract. Due to the high viscosity of the concentrated coffee extract, using an in-line mixer at this stage can achieve good homogeneous mixing compared to mixing within the tank.

Dr. Masters is regional sales manager at SPX Flow Technology, Food and Beverage Division (coffee). **Niesse** is sales director at SPX Flow Technology, Food and Beverage Division (coffee), and can be reached at ulrich.niesse@spx.com.

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"Having a science background helps a lot with brewing because there's a lot of biochemistry in mashing and microbiology in the actual fermentation," says Pringle, who is also an examiner for the Institute of Brewing and Distilling in England, which provides internationally recognized qualifications in the brewing industry.

Integration is taking place between the brewing industry and the more general food industry, says Kuhr, at least partially as a result of greater awareness of food safety issues among brewers.

"The FSMA has shined a light on the fact that we share some of the same risks, and the brewing industry needs to integrate a lot of those practices," he says. "I don't know if this had been on the radar of a lot of brewers, especially startups who don't have a food background. I have seen interest going both ways, with brewers recruiting people from the food industry, but also people with food safety experience seeking out opportunities in craft."

Equipment

This year's Craft Brewers Conference, April 8 to 11, in Denver, drew 9,000 industry professionals, the largest attendance to date, according to the Brewers Association. A glance at the list of almost 500 exhibitors demonstrates that there is no lack of instrumentation available for the brewing industry.

One trend in the industry is toward miniaturization, automation, and making things simpler for brewers and equipment operators.

"For 30 years, every time you went to a meeting somebody had a bigger instrument that was more complicated and more expensive, and that's really not what the craft industry needs," says Pringle. "It needs simpler methods, smaller instruments. For instance, we used to measure haze in beer with a meter that cost $18,000. Now you can buy an LED turbidity meter for $600. This is the way the craft industry needs to go. Because these small brewers can't afford the highly specialized technical people that the large breweries have, but with the newer equipment they can do just about the same."

Kuhr agrees: "A lot of brewers are on brewhouse version two or three, stepping up from a fully manual operation to a pretty highly automated operation. The accuracy and robustness of a lot of the lab equipment has improved a great deal."

F.X. MATT

Nick Matt, CEO, (at left) and Rich Michaels, quality and innovation manager, (at right) weighing hops at F.X. Matt's annual Saranac Hop Harvest.

Still, small brewers need to maintain a balance between using automation to improve consistency and sticking with traditional methods, Sierra Nevada's Fraser says.

"Our big focus is to assure quality through process control, and you can achieve that through automation. We are a fairly large craft brewer, and some of the smaller brewers don't have as much automation, so maintaining a consistent flavorful product can be more challenging. But often craft brewers prefer to retain more manual processes, and we still have a lot of those processes here because it maintains the art of the beer." ■

Donald is a veteran journalist with extensive experience covering a variety of industries. Reach him at timdonald2020@gmail.com.

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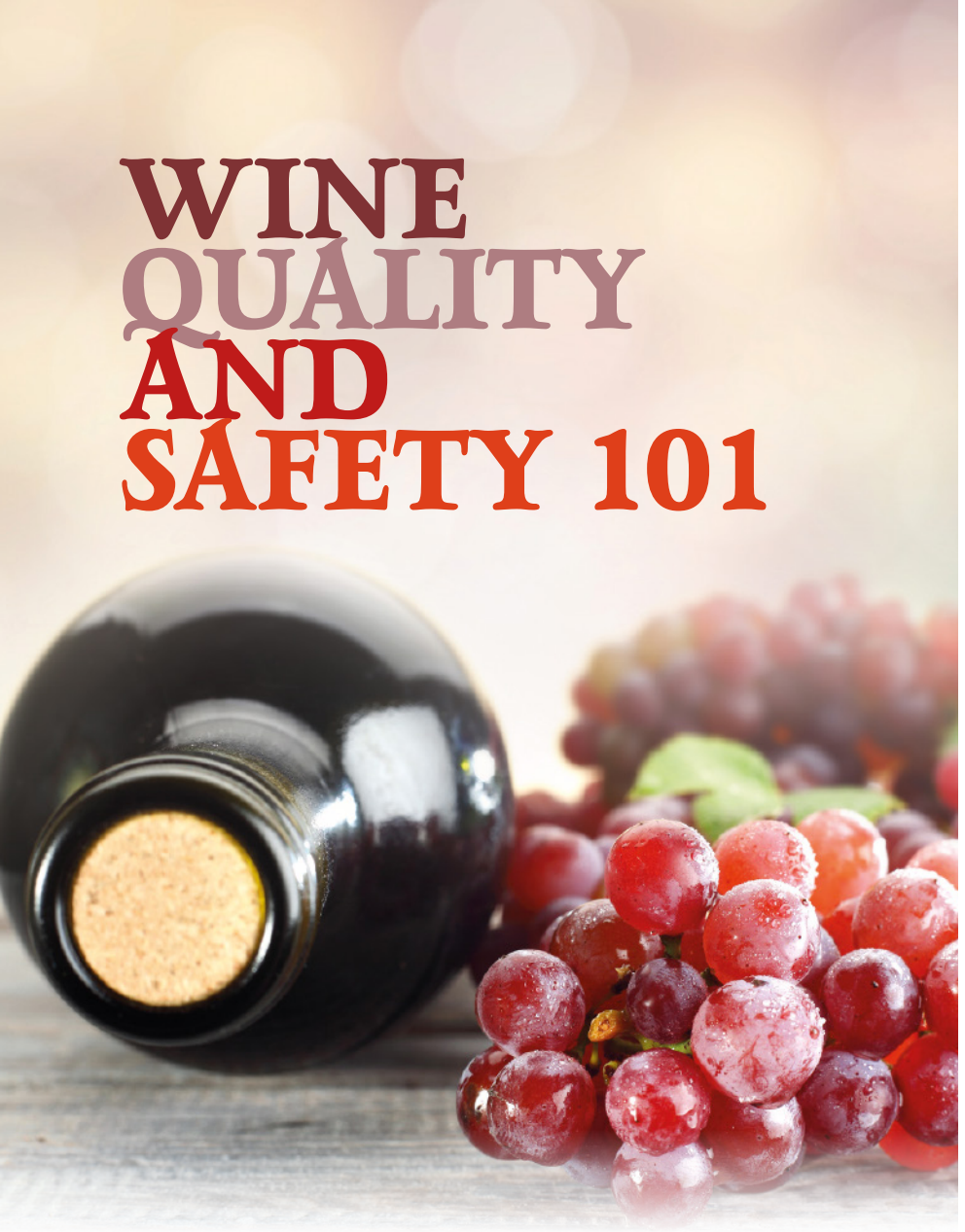
WINE QUALITY AND SAFETY 101



Attention to detail ensures a safe, desirable, compliant product

BY **LINDA L. LEAKE, MS**

It's ancient news that wine is a global phenomenon.

Wine has flowed across many seas since it was first produced 8,000 years ago. Archaeological evidence suggests that the earliest known production of wine, made by fermenting grapes, occurred about 6,000 BC in the area now known as the country Georgia.

Cut to the present. Total 2012 wine production worldwide was a whopping 6.56 billion gallons, according to the Demeter Group's *State of the Wine Industry 2013*.

The U.S. ranks fourth in wine production, behind France, Italy, and Spain. All 50 states have operating wineries. WinesVinesDATA identified 7,498 wineries in the U.S. in 2012. Twelve states have more than 100 wineries, with California (3,542 wineries), Washington (670), Oregon (544), New York (306), and Virginia (222) topping that list.

Total U.S. wine production reached 752.4 million gallons in 2012. California bottles more than 88 percent of the nation's wine, 662.8 million gallons in 2012, says the Wine Institute. Moreover, U.S. wineries shipped 48.4 million cases of wine to foreign markets in 2013.

In 2012, U.S. wine consumption was 2.7 gallons per person, and total U.S. consumption was 856 million gallons, a record high, reports the Wine Institute. The bottom line is that 8,000 years since its humble beginnings, wine is a deliriously popular and economically significant component of the global and U.S. food chain.

Without question, wine is a sensitive consumable and many factors affect and contribute to its quality and safety.

Winery HACCP

While not currently required to have a Hazard Analysis and Critical Control Points (HACCP) plan, wineries have been implementing HACCP with increasing regularity, says Randy Worobo, PhD, an associate professor in the Cornell University Department of Food Science.

"Even under the Food Safety Modernization Act (FSMA), wineries likely won't be required to have a HACCP plan, but they will have to have a documented program in place to control biological, chemical, and physical hazards," Dr. Worobo points out.

There aren't really any microbiological hazards associated with wine, Dr. Worobo says, since the alcohol protects it from foodborne pathogens.

That said, wine's primary potential hazards are chemical and physical.

Glass is the key potential physical hazard and control of this hazard may be listed as a CCP in a winery HACCP plan or controlled by their prerequisite programs. "It's absolutely essential that every winery have a glass control policy complete with a handling and breakage management program," Dr. Worobo emphasizes.

Wine's noteworthy chemical hazard is sulfur dioxide (SO_2), and it might be advisable to include labeling for this hazard as a CCP, Dr. Worobo says. SO_2 serves as an antimicrobial agent to inhibit yeast and bacteria, and also as an antioxidant to safeguard wine's fruit integrity and protect it against browning.

"Virtually all commercial wines have sulfites and a wine HACCP program should definitely have a sulfite management program," Dr. Worobo advises. "To safeguard consumers who may be allergic to sulfites, 350 ppm [parts per million] is the maximum total allowed in the US 27 CFR 4.22(b)(1) for finished product."

Normally, allergens in wine are controlled under a sanitation standard operating procedure (SSOP). Mycotoxins, particularly ochratoxin A, can be an issue

in winemaking, depending on climatic conditions. "Thus, wineries may want to identify mycotoxins as a chemical hazard," Dr. Worobo says. "If the risk for this hazard is great, a CCP to sort the grapes to remove any moldy grapes is advisable."

Another chemical hazard a winery might want to address is lysozyme, an enzyme extracted from egg white, which is an allergen and sometimes used as a clarifying agent. "It's important that any wine containing lysozome be labeled as such," Dr. Worobo says.

In general, HACCP plans are about the same for any type of alcoholic wines, but winemakers must evaluate the hazards for every type of wine they are making. "If you are using a fruit other than grapes, you may have other unique hazards," Dr. Worobo explains. "Two examples are cherries and peaches whose pits contain cyanide. The pits will be filtered out during the winemaking process, but the cyanide will leach into the wine with the macerated fruit, which is then extracted as juice."

Wine Safety

Wine safety hinges on raw materials safety, packaged wine safety, and wine safety documentation, according to Glenn O'Dell, director of quality improvement for Constellation Brands, U.S., Inc., which operates 14 wineries in the U.S., plus others in Canada, Italy, and New Zealand.

"Raw materials safety starts with grape grower documentation of compliance with pesticide regulations," O'Dell begins. "For the very limited other ingredients used in our winemaking processes, a manufacturer's certificate of analysis is required for fining agents and additives, including sulfites and allergens such as casein, albumin, and also enzymes."

Relative to packaged wine safety, Constellation employs HACCP programs to keep glass fragments from bottles.

"Control comes from rinsing bottles to remove foreign materials just prior to filling, handling all broken glass encountered during bottling, following detailed and documented procedures, and performing random quality checks to assure glass conformance to purchasing requirements," O'Dell explains.

Wine Quality

"Understanding threats to wine quality, having strategies to control those threats, and maintaining systems to verify the threats are under control are key to any winery's success," O'Dell continues.

The five primary threats to wine quality are light, microbial spoilage, temperature fluctuations, unintended oxygen exposure, and time.

"Exposure to light can trigger undesirable chemical reaction in some wines," O'Dell says.

Tetrapak, bag-in-box, and kegs provide positive light barriers, he points out. "Glass bottles rely on colors for light protection. Flint (clear) provides minimal protection. Various shades of green are better, depending on the color used. Amber is best, though it is not widely used.

"Microbial activity is required to make wine, wine without the action of microbes is juice," O'Dell continues. "Some bacteria strains are intentionally encouraged or added to reduce acidity and add complexity. It can be said that wineries are stews of microbial activity. So these beneficial organisms, and a few other non-pathogens, become potential sources of spoilage later in the process."

Constellation controls microbial spoilage by several means, including, but not limited to, inoculating with pure cultures; using non-chlorine gas sanitizing agents on tanks, grape and wine processing equipment, pipelines, and fittings; appropriate use of SO_2; hot water/steam sanitation of packaging lines following chemical cleaning in place; and membrane filtration inline to packaging.

"To scrutinize microbial control, we monitor CCPs, especially by evaluating sanitized surfaces using ATP [adenosine triphosphate]-sensitive swabs," O'Dell mentions. "We also conduct sanitation audits of cellars and packaging facilities, and we plate for viable organisms in finished goods."

While some oxygen exposure is a necessary part of wine development, too much oxygen exposure limits shelf life, O'Dell says. Closures, including various types of corks and screw caps, all offer benefits and downsides to maintaining seals on bottles, which impact oxygen exposure.

The optimum temperature for wine storage is generally 40 degrees to 60 degrees Fahrenheit. "Wine does develop with age," O'Dell elaborates. "At lower temperatures it develops more slowly. At extremely low temperatures it can freeze. At higher, but moderate temperatures, it ages more quickly. At very high temperatures, 90 degrees to 100 degrees Fahrenheit-plus, wine can cook quickly."

Contrary to popular belief, all wines do not get better with age, O'Dell points out. "Old vintages are always rarer, but not always better," he says. "Some wines do improve with age, for a while. Eventually, the combination of oxygen, temperature and time will limit the useful life of virtually all wine. The best we can do is monitor wine quality, assign an estimated shelf life to all lots, and begin monitoring when lots in inventory are at risk of approaching their expected shelf life."

Wine Regulations

Wine is regulated by the Alcohol and Tobacco Tax and Trade Bureau (TTB), under the U.S. Department of the Treasury.

"The goals of the TTB are to collect taxes and protect consumers," says Brent Trela, PhD, an enology specialist who operates Alert Aesthetics, a private consulting firm that serves the international wine industry.

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Specifically, TTB's existing authority under the Federal Alcohol Administration Act's [27 U.S.C. § 201 et seq.] Section 205 (e) is "to provide the consumer with adequate information as to the identity and quality of the products."

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To that end, TTB regulates labels, additives, processing methods, etc. (It is interesting to note, Dr. Trela says that while TTB regulates the labeling of alcohol beverages, it is FDA's responsibility to evaluate the safety of ingredients added to alcohol beverages, but the TTB still regulates what ingredients are permitted to be added.)

"States can make more restrictive wine regulations," Dr. Trela relates. "For example, California does not allow chaptalization, which is the process of adding sugar to unfermented 'grape must' [i.e. young wine] in order to increase the alcohol content after fermentation. The TTB does allow chaptalization under specific conditions."

TTB also works to level the playing field to facilitate U.S. export, import, and domestic trade in alcohol, Dr. Trela adds. "Overseas, TTB serves the U.S. as a liaison among foreign governments, industry, and the public in support of worldwide trade."

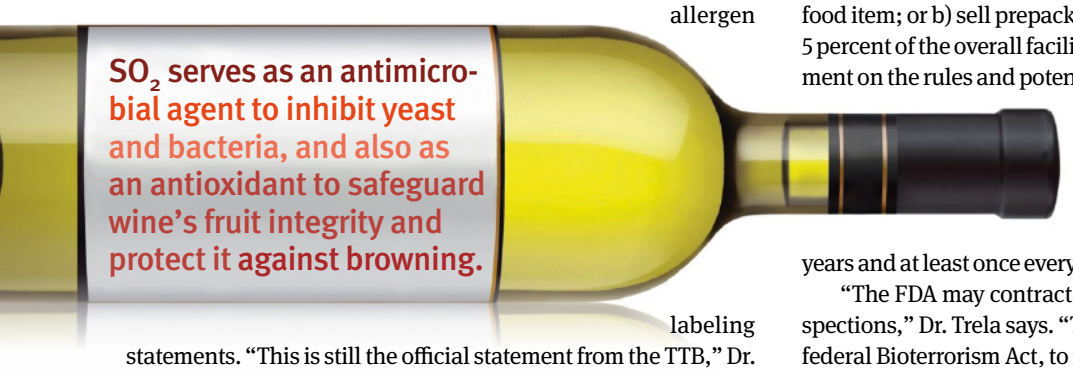
Aside from TTB, the U.S. participates in the World Wine Trade Group (WWTG), an informal grouping of industry representatives from wine-producing countries around the world.

The WWTG's vision is "a successful, competitive and growing global wine industry, characterized by social responsibility, sustainability and focus on consumer interests, operating in a climate free of trade-distorting factors."

As of now, FDA nutrition labeling is not mandatory for wine, and neither is allergen labeling.

"Even though beverage alcohol is not within the jurisdiction of the FDA, TTB, in cooperation with the FDA, issues its own allergen labeling requirements," Dr. Trela says. "The voluntary interim rules require specific information and wording to be included if a producer, bottler, or importer of any alcoholic beverage discloses information. Any allergen declaration must state 'Contains' followed by the common name for the major food allergen."

The TTB published an interim rule, T.D. TTB-53, 71 FR 42260, effective on July 26, 2006, which sets forth standards for optional allergen labeling statements. "This is still the official statement from the TTB," Dr. Trela points out. "There has been no date offered for implementation, other than indications that ultimately there will be mandatory allergen disclosure requirements in the U.S. for all alcoholic beverages."



FSMA will affect wine production, Dr. Trela notes. Actually, it already has. During fiscal years 2009-2012, about 393 FSMA winery inspections were conducted nationwide.

"While the FDA has always had inspection authority over wineries, many of the 2011 FSMA provisions do not apply to wineries," Dr. Trela says. "However, there are instances where they may be invoked and compliance with the entire Act is required through Section 116: a) distribute an unpackaged or repackaged (e.g. potentially exposed to direct human contact), non-alcohol food item; or b) sell prepackaged food in an amount greater than 5 percent of the overall facility sales. The FDA sought public comment on the rules and potential impacts of the FSMA on wineries that concluded in November 2013. Further regulations or changes to the regulations are expected to follow."

FSMA states that all food facilities must be inspected within seven years and at least once every five years after that.

"The FDA may contract state agencies to conduct winery inspections," Dr. Trela says. "The FSMA directs the FDA, under the federal Bioterrorism Act, to inspect every registered food facility, including wineries, in the U.S. by 2018. Due to the recognized relatively low food safety risk of wines, the FDA may scrutinize wineries less than most other food facilities. Subsequent inspection frequency may likely be based on risk assessments and facility compliance history."■

Wine Labeling: Alcohol and Tobacco Tax and Trade Bureau Requirements

According to 27 CFR 4.62, the mandatory information for wine labels includes:

- Front Label: Brand name, class and/or type, alcohol statement (as a % by Vol., or wineries can use "Table Wine" or "Light Wine" if alcohol content is 7% to 14%); appellation of origin, as required in various cases (appellation is mandatory if type, vintage date, or the term 'estate' is used).
- Anywhere on the bottle must be the government warning, sulfites statement, bottling statement (name and address of the bottling winery, preceded by certain words such as bottled by, vinted, cellared, etc.), and net contents.
- Class: "grape," "table," "light," "white," "red," "pink," "amber," "rose," or "dessert" followed by the word "wine" may be used.
- Type: 75% grape variety, such as "merlot." (Or various generic, semi-generic, or non-generic information of geographic significance).
- Multiple varietals can be a type designation, but require listing on the label in order of highest to lowest corresponding concentrations, and the total must equal 100%.
- Formula wines are wines that require formula approval, such as agricultural wine (rhubarb), other than standard wine (mixing wine from different classes), flavored wine, non-beverage wine, and high fermentation wine.
- U.S. wine labels do not have to specify the variety. They can have fanciful names and be blends, such as "meritage." If the wine label has a fanciful name, then that name cannot appear on the same line as the class/type, etc.

For more information go to www.ttb.gov/labeling. —*L.L*

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Efficiency and Sustainability in Organic Processing

With the continued growth of the organic market, chemical companies and beverage processors are providing solutions that meet the strict regulations of aseptic packaging

BY **PAVEL KORZINEK**

Producing an abundant, nutritious, and appealing food supply is no small feat, but once produced, it must be kept safe. Food safety must be ensured by controlling a wide spectrum of microorganisms that could otherwise threaten consumer health. Food processors and beverage bottlers are challenged with controlling harmful microbes with applications that are safe to humans and minimally impactful to the environment. The growth of the organic food and beverage market necessitates the expansion of environmentally benign chemistries that can be used in food and beverage processing while meeting the strict organic processing standards.

Organic Food Market

According to the *Nutrition Business Journal*, "...the organic food and beverage market in the U.S. was valued at $29.2 billion in 2011, with growth projected at 9.4 percent, as compared to an anticipated growth in the low single digits for conventional food and beverages." As consumer demand for unique, organic products continues to grow, processors are challenged to meet this expanding need with affordable products that comply with safety standards mandated by the separate and distinct regulating agencies FDA and EPA.

Pathogen Control

The food and beverage industry has evolved into a highly regulated market to address foodborne disease outbreaks such as botulism. Regulation of the food processing establishment—including food processing, processed food, packaging, and equipment—is under the jurisdiction of the FDA. The EPA is the responsible agency for regulating antimicrobials used in the aseptic packaging process. The dual agency oversight highlights the technical rigor required to offer a regulated sterilant that meets the all-encompassing FDA performance guidelines as they relate to foodstuffs and packaging, as well as the environmental controls associated with the chemical products used as microbial control agents.

In spite of great strides in aseptic packaging safety, contaminants persist in the food systems. In the past, packaging of shelf-stable food and beverages has relied on a variety of technologies—conventional retort process, polyethylene terephthalate (known as PET) bottle hot-fill, or simple addition of preservatives in the food—to achieve pathogen control. However, today the market demands high-quality, nutritional, shelf-stable beverages, which can be produced only with modern technologies such as flash-heating pasteurization or Ultra-High Temperature sterilization process and cold-fill aseptic packaging technology.

Peracetic acid (PAA) or hydrogen peroxide sterilants are used in the vast majority of aseptic filling machines to sterilize beverage containers. Both demonstrate effective pathogen control. These chemistries are environmentally friendly, with hydrogen peroxide breaking down into oxygen and water, and peracetic acid breaking down into oxygen, acetic acid (vinegar), and water.

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Specialty Grade Sterilants

To exploit the full potential of the latest generations of high-speed aseptic filling equipment and to achieve processing efficiencies that yield environmental benefits, PAA and hydrogen peroxide sterilants need to be formulated specifically to address the unique requirements of each type of machine.

PAA is used for sterilizing beverage packaging in extended shelf life and low-acid and high-acid aseptic applications. A robust sterilization process is critical for controlling spore-forming bacteria of pathogens such as *Clostridium botulinum* and *Bacillus subtilis*. Special grade PAAs like from PeroxyChem are stable even in dilute form and have been known to demonstrate slower degradation during sterilization under the application parameters of aseptic filling processes. The elevated temperature of sterilization degrades PAA and diminishes PAA's effectiveness over time. Users are able to extend the production cycle and thus reduce the consumption of the chemical sterilant agent.

Hydrogen peroxide has been used as the primary sterilant in the aseptic packaging industry for over 50 years. With the increase in production rates and flexibility demands, the latest packaging machines require a much higher quality of hydrogen peroxide to reduce the maintenance downtime. Two major sterilization processes exist: bath and vapor or atomized spray. The bath process requires the peroxide to be stable in a bath at an elevated temperature for an extended time, while the vapor and spray processes require the peroxide to produce extremely low dry residue buildup to prevent clogging of the system. The choice of a high-performance grade of hydrogen peroxide, which is fine-tuned for the specific aseptic system, can greatly improve the production efficiency by reducing downtime for cleaning and reduce total cost of ownership of the beverage processor by minimizing labor time and maintenance costs.

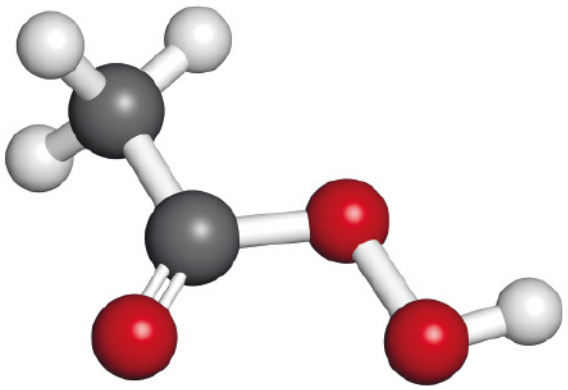
PeroxyChem has created a hydrogen peroxide that is both stable in the bath and low in residue for vapor applications.

Process Innovation

Given the constraints of the existing packaging processes and that these two chemistries are already widely used within the industry, the clearest way to introduce environmental advantages to organic packaging is through process innovation. Technology and formulation expertise is what will enable processors to increase plant efficiencies while decreasing their environmental footprint.

For example, PeroxyChem has been developing a vapor PAA sterilization for aseptic packaging applications. The technology uses dilute PAA vapor to sterilize plastic bottles and cartons in a highly efficient manner. PeroxyChem currently has two patents related to vapor PAA issued and granted; the third should issue in September. The technology combines the benefits of traditional PAA rinse systems with the latest advancements in hydrogen peroxide vapor systems.

The technology leaves minimal residue on the filling equipment and inside the packaging bottles, resulting in less production downtime for equipment cleaning and maximizing the production site's output efficiency. Additionally, processors are able to reduce energy needed to remove hydrogen peroxide residuals from the container after sterilization that is expected to lower the total organic carbon (TOC) and carbon footprint.



Peracetic acid disinfectant molecule.

Users are able to extend the production cycle and thus reduce the consumption of the chemical sterilant agent.

Vapor PAA technology enables processors to decrease input of chemistry in the packaging process by an order of magnitude, as well as increase run times, lower operating temperatures, and utilize lighter weight bottles. All these efficiencies result in improved energy efficiency and reductions in water usage. Vapor PAA alternative sterilization meets the manufacturer's microbial standards and allows aseptic beverage processors to reduce their TOC while at the same time delivering on commitments to sustainability.

Additionally, companies must look beyond the packaging process to introduce environmentally friendly practices that not only reduce energy and material waste, but that translate into cost savings for customers. For instance, PeroxyChem offers bulk handling and storage systems. One PeroxyChem customer, a major juice manufacturer, was able to eliminate over 1,500 one-way totes each year by switching all PAA needs to bulk supply, translating into considerable plastic saved.

Production plants using renewable energy, like PeroxyChem's peracetic acid plant in Tonawanda, N.Y., that operates on hydroelectric power, are examples of how chemistry providers should be moving in order to improve the environmental impact of all chemical processing.

Innovation is at the core of what will continue to improve the sustainability of the aseptic packaging process. Each processor faces unique challenges in terms of packaging, product type, sterilization demands, and more. With the continued growth of the organic market, chemical companies and beverage processors that are committed to innovation for their own benefit and for the benefit of their customers will be well positioned to provide efficient, cost-effective solutions that meet the strict regulations of the aseptic packaging market. ■

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Employee Behavior: A Leading Indicator of Food Safety Compliance

Coaching and routine employee observations are vital for keeping product, workers, and consumers safe

BY **LAURA DUNN NELSON**

Classroom training in food and workplace safety, despite its necessity, is not enough to produce the expected results. Experience shows that front-line workers continue to make mistakes, sometimes critical ones, even after classroom training and successful testing seemingly confirmed comprehension of the key learning objectives. The incorporation of knowledge gained from classroom training and consistent application of it in day-to-day operations is a commonly misunderstood facet of training. An employee who attends classroom lectures and scores well in examinations is presumed to comprehend the training's subject matter. Yet if food safety protocols and procedures do not translate to appropriate employee behavior on the line, knowledge may fade just as quickly as it does for college students who cram for a final exam and inevitably forget most of what they studied within days after taking the test.

Companies generally acknowledge the need for follow-up or refresher training to remedy bad habits and inconsistent employee behaviors, but all too often they lack the time and/or resources to reconvene a classroom training session. Inability to measure or ensure the retention of food safety and quality knowledge exposes the food manufacturer or processor to potential major risks and failure to achieve compliance to the satisfaction of the FDA, USDA, or third-party auditors. The FDA's own study corroborates the idea of ineffective training as a contributing factor to recent food recalls.

Many companies rely on front-line supervisors to ensure food safety programs are followed and to correct non-compliances, even though they may lack supervisory training and adequate tools. These responsibilities along with refresher training "on the fly" require more documentation and a greater time commitment than some supervisors are afforded or skilled to deliver. For effective management, supervisors are ex-

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pected to document and track employee mistakes in each worker's personnel file. Unfortunately competing responsibilities to assure production goals are met tend to take priority over refresher training. In this typical scenario, what is lost is the ability to coach employee behaviors that consistently keeps the focus on safe practices. In fact, overlooking the importance of behavioral change through coaching is to ignore a leading indicator of food safety and quality compliance.

The Impact of Behavior

Focusing on behavior in the workplace is nothing new. Behavioral theorists as well as progressive supervisors and executives have long understood that behavior has a powerful impact on accomplishment and goal achievement. The role of behavior has certainly not escaped the scrutiny of the U.S. Occupational Safety and Health Administration (OSHA), which often assesses it in agency audits. One does not need a plethora of statistics to prove that a motivated and engaged workforce is more likely to dedicate itself to successful outcomes than employees who are disengaged and feel no sense of teamwork or commitment. Employees' lack of motivation stems from a variety of factors common to the food processing and manufacturing industry: ineffective or lack of training, supervision and support, challenging work conditions, and complex and changing job responsibilities.

The goal has always been to influence behavior on a daily basis so that food safety, workplace safety, and compliance are in the forefront of everyone's priorities on the plant floor. Annual refresher training is simply inadequate to insure a robust organizational culture. An employee's high examinations score will not guarantee application of the same concepts months later. Without a routine focus on food safety, employees may not recognize the importance of their role or the depth of their accountability in achieving safety and compliance. Behavior has to be routinely observed, corrected when needed, and validated.

Attorney Shawn Stevens, who has represented some of the largest food producers in the U.S., understands the importance of behavior and worker attitudes. "When there is an absence in the culture to continuously motivate employees to do better, it is called complacency, and with it comes risk," Stevens says. "There has to be a commitment to supporting employee programs that highlight the importance of food safety." Further, Stevens believes there can be no excuse for failing to conduct recurrent training to keep employee behavior focused. "When it comes to food safety, it has to be continuous," he says. "There should never be anything like a bare minimum—it is unacceptable."

Understanding the driving forces behind behavior can help plants achieve compliance, but many QA/QC professionals lack this particular training. Each plant has its own operational culture that employees learn through experience, observation, and instruction. To positively influence their operational culture, it is essential for food safety professionals to assure the consistent execution of food safety protocols, including adequately addressing unacceptable behaviors. Additionally, it is incumbent upon frontline supervisors to verify that workers are exhibiting appropriate, consistent behaviors in support of the plant's food safety and quality programs.

Study and Survey Findings

The role of behavior and the use of coaching to influence a safe and productive process that facilitates compliance were tested in a comprehensive study. The results show that the approach works. Within the last few years, a U.S. study and a global survey have also provided data on both as a means for attaining compliance.

In 2012 and 2013, Robert Meyer, a food industry expert for more than 40 years, developed a study to examine whether a methodology could be established to sustainably influence and change the behavior of front-line food production workers. Specifically, the study concentrated on the use of supervisory coaching that could drive employee performance to sustain food safety practices. Meyer conducted the study at four U.S. food production plants in the Midwest, South, and West Coast. Production processes that required improvement were identified at each location, as were the standards for measuring effective job performance. Each one of those standards was sequenced into process steps that were then broken down into a sequence of effective behaviors. Finally, supervisors were required to conduct

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All the data is instantaneously entered in the employee's file, saving supervisors considerable time and paperwork required for manual data entry.

corrective observations through the use of detailed checklists that contained the steps and actions necessary for compliance. The supervisors immediately initiated corrective actions when they discovered non-compliance activity.

Compliance levels were measured in three steps of the study at each of the facilities: pre-training, post-training, and after corrective observations. The statistics are quite revealing:

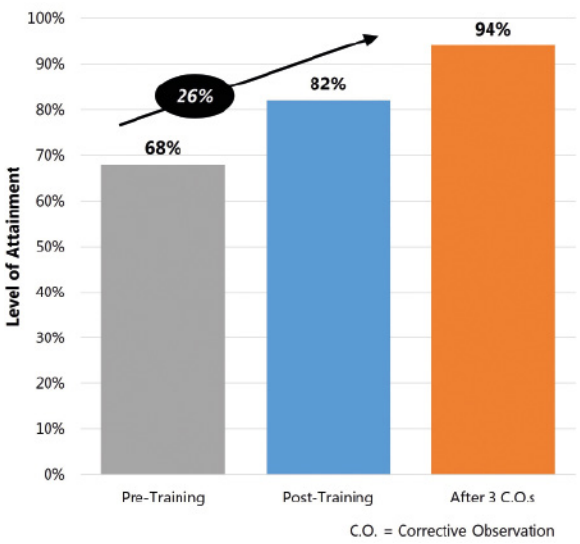
- The average pre-training compliance level was only 68 percent, certainly far below what should be considered acceptable;
- Post-training compliance increased to 82 percent—a higher figure, but one that still leaves room for improvement; and
- After three corrective observations, the compliance rate jumped to 94 percent on average for the participating facilities.

One can safely conclude based on the study's findings that behavior can be *positively* influenced to achieve safe food production. The same is true of increased productivity—an improvement noted by management at each of the four locations. Most of all, the findings from Meyer's study indicate that behavior qualifies as a leading indicator of a company's compliance.

Results from the 2014 Global Food Safety Training Survey provide more insight about the growing recognition of behavior and coaching as essential tools for compliance. The worldwide survey developed by Campden BRI in the U.K. along with several partners, including BRC Global Standards, The Safe Quality Food (SQF) Institute, SGS in Geneva, Switzerland, and Alchemy Systems, was submitted to 25,000 global food processors and manufacturers. Its purpose was to help companies compare and benchmark their training protocols with their counterparts worldwide.

Survey questions covered all aspects of food industry training including budget, training activities, deficiencies, and compliance issues. Data from respondents revealed a surprising number of audit deficiencies due to employee failure to either understand or apply concepts taught in the classroom. However for the first time, the survey looked into measuring sustained and positive food safety behaviors through coaching. Responses indicated an increased reliance on coaching, as respondents apparently recognized the importance of influencing behavior on the floor.

But can behavior, or anything else for that matter, be considered a leading indicator? Yes, according to a February 2014 article in *EHS Today,* a publication covering environmental, health, and safety issues. The article reported on a Carnegie Mellon University study determining that "75 percent in the variation in the frequency of safety incidents can be explained by the information derived from safety inspections and observations." Author Griffin Schultz notes that based on the study, employee behavior "can provide information about both the direct and indirect causes of future safety incidents." Schultz's conclusion: Safety leading indicators can be determined through inspections and observations. It's a finding that can and should be applied to observations of employee behavior in critical food safety and quality activities.



Food industry expert Robert Meyer's study chart showing improved compliance after coaching and corrective observations.

Coaching Through Technology

Management may be reluctant to get supervisors involved in coaching for several reasons. It can be time-consuming and work-intensive due to the heavy volume of record keeping that coaching necessitates. Then there is the question whether supervisors have been adequately trained to be coaches. How do they know specific questions to ask, let alone act upon? Leave it to today's technology to provide an answer. One example is a tablet-based app developed to provide supervisors with customized templates enabling them to ask the right questions and conduct corrective observations. All the data is instantaneously entered in the employee's file, saving supervisors considerable time and paperwork required for manual data entry.

Plants that are applying this technology have seen improvements as supervisors recognize the value of these tools. "Initially, our supervisors thought this was one more thing that would take away from their other responsibilities, but the automated tracking is making it easier and faster for them," says Esmeralda Garcia, training supervisor for OSI Industries, a global food provider. "Also our workers understand and accept that this is a safety element, and that was a critical point that has influenced their behavior." Garcia says the technology has made coaching much easier and less work intensive because "it is easy to identify problems, make adjustments, and see the positive results."

Leading indicators are important because they represent meaningful barometers of each company's current food safety compliance status. The OSI experience shows coaching can have a powerful impact on food safety and quality. Successful employee coaching as part of a well-developed behavioral change program offers tangible and intangible returns on investment— tangible in that companies will have reduced their risk exposure as well as help assure they are staying in compliance and intangible in that employees are accountable for their behaviors. Quality assurance and training officers should consider routine employee observations and coaching as a food safety leading indicator program—a vital step for keeping product, workers, and consumers safe. ■

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ALCHEMY SYSTEMS

The Many Faces of Food Contamination

Exploring the need for risk-based testing strategies in non-regulated contaminants

BY **MARKUS LIPP, PHD,** AND **CARLA D. MEJIA, PHD**

"Food contamination" is an expression that means many things to many different groups of people. Whether it refers to the undesired presence of microorganisms, heavy metals, pesticides, or any other forms of "natural" or "man-made" compounds, one could simply define a food contaminant as a chemical or biological agent present in food that may be detrimental to the health of consumers exposed to them.

Many chemical food contaminants (pesticides, for example) are regulated in the U.S., with very clear limits that must be monitored and followed. Regulatory agencies, such as the U.S. FDA, the USDA, and the U.S. EPA, have established limits of exposure for known contaminants to safeguard consumers. These limits are set at levels that will not put the health of consumers at an undue risk.

The issue becomes complex when the link between exposure and any potential impact on public health is not clearly established, and hence no limits are set even when such contaminants can be found in food. Hexabromocyclododecane, popularly known as a HBCD, for instance, is a flame retardant commonly used in many non-food items (such as thermal insulation and electrical equipment) that is not regulated in food, but can be found in numerous food items, possibly from leakage into water. It is considered a "persistent chemical," which means it accumulates over time in the fatty tissue of animals that have been exposed (including humans). The consumption of low levels of HBCD is not known to cause any hazard for humans. However, it has been found to be highly toxic to aquatic organisms and there is little evidence on the effects of its accumulation in the human body when consumed in food. Therefore, it is complicated to establish levels of "safe" exposure.

Traditional classes of contaminants in food ingredients are naturally-occurring contaminants (e.g. heavy metals from soil) and man-made materials (e.g. pesticides). Where there is a reasonable expectation of the presence of contaminants in a specific food item, regulatory agencies have established appropriate limits, but not all contaminants can possibly be regulated in all food matrices. Arsenic is a commonly used illustration. As many heavy metals, arsenic exists in organic and inorganic forms, with the inorganic form being a higher health risk to humans than the organic form, and the U.S. FDA monitors the level of arsenic in different types of foods accordingly. One of the foods that arsenic levels are monitored in is rice, where the plant takes up diverse forms of this metalloid element from the soil and the water where it grows, making arsenic levels in rice and rice products expectedly higher. On the other hand, arsenic in apple juice is not typically found in quantities that would cause any public health concerns, and it was not until samples of apple and grape juice showed limits above what the FDA considers safe that attention was dedicated to this food product in particular. Today, arsenic levels in foods are monitored on a case-by-case basis, with special attention to foods that are consumed by children.

In general, contaminants are regulated based on the highest intake observed, taking into consideration the whole diet of individuals of a certain age and living in certain regions. Food toxicologists are much more concerned about the

total exposure of consumers to a certain contaminant and, thus, always consider the whole diet of populations, including water consumption. The limits are usually set based on reports of food consumption that reflect the eating habits of certain populations and the exposure risk for each food group. Some food groups may contain a higher level of contaminants but are much less consumed than other groups with lower levels of that contaminant with high consumption rates. It is a very complex task to establish limits for contaminants in foods, when it comes to heavy metals and pesticides, for example.

The work of food toxicologists can become even more complicated when they have to consider possible interactions among the various contaminants. Luckily a large body of data is available to help understand how the body metabolizes the various contaminants, so that safe limits can be set. However, it is also fair to say that scientists are still learning to fully understand all the effects on how the body reacts to the simultaneous presence of a mixture of contaminants.

One Large Family of 'Bad Guys'

It is reasonable to assume that there is no such thing as zero risk for food contaminants. Contaminants are a part of the food supply and when controlled and monitored properly, they do not represent an undue risk for public health. However, dioxins are contaminants that escape the "minimum limit" notion that can be applied to other food contaminants.

Dioxins are considered one of the most, if not the most toxic man-made substances. They may not necessarily cause acute health problems, but are harmful to health at very low levels. Dioxins are persistent organic compounds that once created, are extremely hard to eliminate. They are mostly fat soluble, accumulating in the fatty tissue of animals, including meat and dairy. Once consumed, these compounds do not degrade easily and will accumulate in the human body. Accumulation of dioxins has been linked to a number of health problems.

There are no tolerance levels of dioxins established by the FDA, but the agency is working in conjunction with the European Union and the EPA and USDA to address the issue of dioxins and other persistent organic compounds (such as PCBs) in animal feed.

In 1997, "ball clay," a mined clay product used as an anti-caking agent in animal feed, was found to be the source of high concentrations of dioxins in chicken, eggs, and catfish. After the findings, the FDA's Center for Veterinary Medicine worked with industry to test feed samples for other sources of dioxins in mined feed ingredients. Today, the risk of dioxin contamination from clay is minimal as it is very well understood how to avoid the use of clays containing larger amounts of dioxins. In 2008, USDA's Food Safety and Inspection Services (FSIS) completed a survey of 510 domestic beef, pork, and poultry samples for dioxins. The results of the survey showed very low levels of no toxicological concern, with turkey and beef presenting the higher concentrations.

There is not much consumers can do once dioxins are present in the food supply chain, but consumers can and should contribute to the reduction of dioxins creation. While dioxins cannot be generated in the home environment (temperatures needed to create dioxins are extremely high), one of the ways dioxins are created is through incineration of waste. Recycling metal materials, in particular copper—which catalyzes dioxin formation and is present in many household items, such as batteries—is a way to contribute to the reduction of dioxins in the environment.

Not All Harmful Contaminants are Man-Made

These contaminants are byproducts of fungi (mold) that essentially can grow on all foods provided that enough moisture is present. Not all molds produce mycotoxins, but once produced, they can get into the food chain and are extremely hard to eliminate. Preventing mold growth through good agricultural practices pre- and post-harvest are the only effective measures to limit the amount of mycotoxins in food. It should be noted that testing of suspect crops is extremely costly, thus stressing the need and value of preventative measures.

It should be noted that testing of suspect crops is extremely costly, thus stressing the need and value of preventative measures.

One of the most common mycotoxins found in foods are aflatoxins, of which aflatoxin B_1 is the most toxic and a potent carcinogen. Aflatoxins contamination is prevalent in cotton, peanuts,

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spices, pistachios, and maize produced in tropical and subtropical regions, which could be conducive to molds. Other mycotoxins that make it into the food supply are ochratoxins (mostly found in beer and wine); citrinins (associated with yellow rice disease in Japan, acting as a nephrotoxin in all animal species tested); ergot alkaloids (found in contaminated flours and cereals, even though modern methods of grain cleaning have significantly reduced the risk); patulins (associated with moldy fruits and vegetables, and connected to immune system damage in animals); and fusarium toxins, of which trichothecenes are most strongly associated with toxic effects in animals and humans and can more commonly be found in wheat and maize grains.

A careful evaluation of what to test and the impact of such testing on public health are within a risk-based approach.

Addressing Food Contaminants

As a standard setting organization for which public health is the core of its mission, USP has typically set limits for contaminants in food ingredients contained in the *Food Chemicals Codex* (*FCC*), a source of quality standards for food ingredients that industry uses as a tool to establish food integrity in the U.S. and abroad.

USP desires to strengthen and increase the role of the *FCC* to help limit the exposure of the consumer to contaminants through food. One of the efforts USP is engaged in is promoting risk-based approaches to food contaminants. Contaminant testing has associated costs that ultimately trickle down to the consumer. A careful evaluation of what to test and the impact of such testing on public health are within a risk-based approach.

Reasonable sources of specific contaminants, testing resources for quantifying contaminants, and determining whether certain risks are acceptable are topics that should be addressed to help guide questions on how to better predict hazard exposure and how to prevent it.

USP is holding an open workshop entitled "Chemical Contaminants in Foods—Risk-Based Approaches to Protect Public Health" on Nov. 20 and 21, 2014 at its headquarters in Rockville, Md., for experts, regulators, and industry to gather information and gauge the needs of stakeholders around the globe with the objective of setting or improving guidelines on what to do when there is no regulatory limit for a specific contaminant in a specific food. When a limit is known, compliance is easy to determine; however, many of the limits for food contaminants are yet to be established. When there are no limits for a contaminant, compliance becomes a more complex question and, therefore, more difficult to answer. ■

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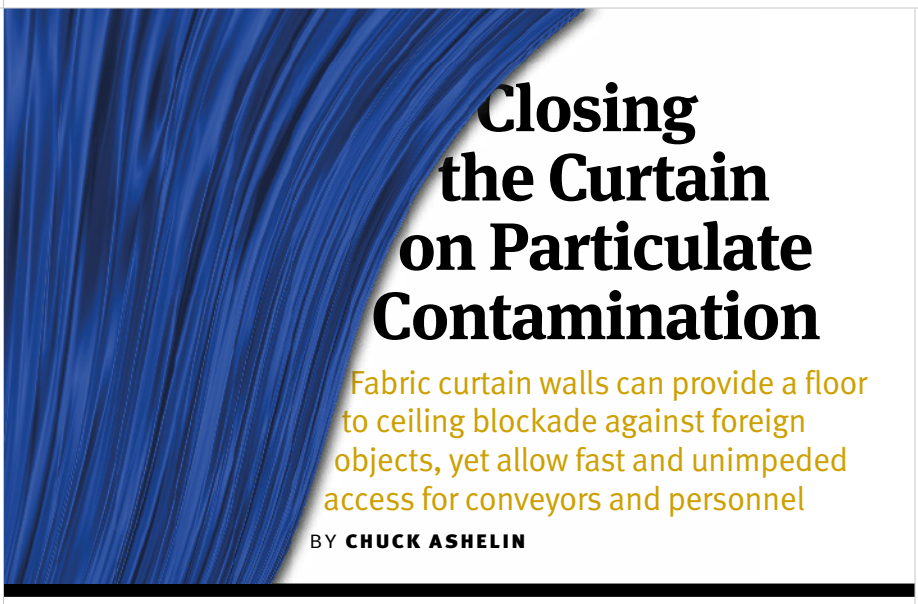

Closing the Curtain on Particulate Contamination

Fabric curtain walls can provide a floor to ceiling blockade against foreign objects, yet allow fast and unimpeded access for conveyors and personnel

BY **CHUCK ASHELIN**

Contamination control is critical in a wide spectrum of industries, none more so than food manufacturing and processing. From the mixing and packaging of powdered ingredients and spices to grain storage and loading dock operations, control is vitally important to a myriad of food industry processes.

At the very least, particulate matter in the air is a nuisance. However, it can cause serious quality and safety issues as well. At the nuisance level, particulate generated from cutting, grinding, mixing, etc., can settle on surfaces significant distances from the operation if containment equipment is not in place. Dust on neighboring equipment, furniture, office equipment, windows, and floors becomes a constant drain on cleaning and maintenance resources. On the more serious end of product quality, uncontrolled particulate matter can spoil or degrade batches of differing critical materials, particularly in food processing.

From a safety standpoint, there are many circumstances where high enough concentrations of airborne dust-sized particulate in a closed space can become explosive or flammable. This includes seemingly innocuous products we wouldn't normally think of as explosion hazards—including grain, flour, sugar, and powdered milk. Additionally, airborne particulate can be a health threat to employees. These risks can range from a skin, eye, or bronchial irritation to more serious issues for people with asthma. Most serious can be the potential for particulates to cause lung diseases like cancer.

Controlling Particulate Contamination

Several methods can be used to keep particulate in one space from contaminating another, including:

- Local exhaust – a high-velocity airflow stream captures particles at the point they are generated and carries them away;
- Exhaust with filtration – a high-velocity airflow stream captures particles and recirculates them through a filter medium, where they are removed;
- Area exhaust – a high-volume exhaust fan draws air from the full room volume to an outside vent or recirculates through a filtration/separation device; and
- Barrier separation – simply a wall or partition between affected areas. These are especially effective when used to separate clean from ambient spaces in a positive or negative air pressure environment, such as between a loading dock and a food processing area, or between food processing or packaging lines and surrounding areas.

Exhaust separation methods rely on moving a volume of air containing the contaminate particles. Barrier separation can be enhanced by creating a positive or negative pressure differential across the barrier. Each of these could be accomplished through the use of exhaust fans through ducts to create a negative air pressure environment. A local exhaust setup would incorporate some type of hood designed to collect the air and particulate being moved and funnel it into the exhaust ductwork. Area exhaust would include multiple draw points through louvered openings in the ceiling or wall. Either of these methods could, and most likely would, include some type of filtration or particle separator in line to remove particulate from the air stream. This is necessary prior to either recirculation of the air back into the space, or discharge of the air into the atmosphere.

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Conversely, in a clean space where offending particulate is not generated, but adjacent space contains foreign matter that could contaminate product in the clean space (e.g. food processing or packaging), a positive air pressure environment would be desired. In this case, filtered air would be pumped into the clean space, creating a positive air pressure within the space and

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preventing inwardly flowing air currents that could carry foreign particulate matter.

In some cases, a simple partition (wall) between a clean space and an uncontrolled ambient space (such as between a processing area and a loading dock) is an effective means of separation. If negative air pressure differential exists across the wall between the clean and ambient space, the wall acts as a physical barrier, blocking most of any potentially contaminating foreign matter from crossing the barrier. Depending on the degree of particle separation required, and the need and frequency for traffic to move through the partition, a more effective solution would be to introduce a positive air pressure differential to the clean space, as described in the paragraph above.

Fabric Curtain Walls Can Help

Curtain walls can significantly improve the effectiveness of these systems, as well as offer the opportunity for cost savings, both in the initial cost of the equipment and in the direct operating cost.

Anytime a space is to be exhausted, the smaller the space can be made, the smaller the exhaust equipment can be specified. Partitioning around a dust source with a fabric curtain wall takes full advantage of this relationship. By reducing the volume of the space to be exhausted, smaller fan(s) can be used, reducing the total air movement. Lower air velocity through filter media increases the effective particle separation of the device. Additionally, lower airflow through the filter reduces the frequency required for change out or cleaning.

In a situation where a positive pressure space is desired, some sort of enclosure, or "box," around the space would be optimal to maintain the pressure differential. Fabric curtain walls are an ideal partition solution. They are less expensive to install than hard walls and create an enclosure seal just as effective as a hard wall (in some cases more so, if there are many penetrations through the partition like piping, conduit, etc.).

Separation between a loading dock area and a desired clean space in a packaging or processing facility is a common issue. In many cases, leased or previously purposed buildings make no provision for this kind of separation. Production efficiency mitigates toward minimizing product transfer distances and times between production and shipping or receiving areas. With dock doors often open, and truck traffic traveling into and away from the dock, a negative air pressure condition in the building can readily draw airborne contaminants into the building and clean space.

The addition of a fabric curtain wall in this application creates an effective barrier between the uncontrolled environment of the dock area and any clean area. The inclusion of standalone, high-speed, roll-up doors in the curtain wall allows for efficient thoroughfare, while minimizing time the interior is open to the loading dock area. Infiltration could be further reduced by positively pressurizing the interior clean space.

As described above, in addition to reducing the volume of space to be exhausted or supplied, fabric curtain walls act as a very effective physical barrier on their own, blocking transfer of particles from space to space. Curtain walls can be single-layer fabric or multi-layer insulated. They can easily be fitted with clear vision panels for visual communication between spaces.

Curtain walls are flexible by nature, yet very durable. They can withstand contact from machinery or product, and simply "bend without breaking," in contrast to a hard permanent wall. They are also relatively easy to reconfigure if a space needs to be enlarged, reduced, or the shape of the space footprint needs to change. No "deconstruction" is required. Fabric curtain walls are easily installed, can be simply trimmed around conduit, piping, ductwork, etc., and can be anchored to the floor to withstand pressure differential across them.

Depending on the application, a curtain wall can be suspended from the room ceiling or can be supplied with a standalone framework to hang from. They are available as stationary as well as sliding (suspended from roller track), and can be fitted with strip curtains, personnel doors, or high-speed industrial doors for full range of access to the space.

Curtain walls can be an ideal choice for facilities looking to control particulate contamination. As a flexible and economical way to partition space, they make exhaust, supply, and separation systems for dust more efficient—regardless of the application. ■

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Foreign Material Controls in the Red Meat Industry

Meat facilities achieve a higher level of product quality by following proper detection, segregation, and final product disposition procedures | BY **STEVE SAYER**

The USDA Food Safety and Inspection Service (FSIS) is responsible for ensuring that U.S. meat and poultry products offered to consumers are safe, wholesome, unadulterated, and properly labeled. In fulfilling these responsibilities, the agency's laboratories perform microbiological analysis of meat products, including investigations for foreign materials in the likes of metals, wood, and glass.

Prevention of this type of contamination begins on the farm or ranch where the livestock are raised. Producers of livestock have implemented their own safeguards to assure foreign materials do not enter the meat supply.

For beef, both national (USDA) and state regulatory programs work diligently to ensure domestic and imported beef, and beef by-product is the safest and highest quality beef possible.

Only wholesome, unadulterated products are eligible to bear the mark of USDA when they enter into the general commerce. In the case of foreign material contamination, the latest statistics evinces that the incidence in USDA-inspected establishments remains small: less than four hundredths of 1 percent.

If USDA inspectors find products containing foreign materials because the establishment did not properly segregate and dispose of contaminated product, inspectors have the power to take regulatory control actions by issuing non-compliance records that require the establishment to develop a written corrective action and preventive measure(s), while contemporaneously ensuring no harmful product has entered into the general commerce. In the event contaminated product does enter into commerce, establishments are advised to initiate a recall that would be announced by the USDA through the media and its website.

FSIS encourages, but does not require, meat processing establishments have detection technology available in the likes of metal detectors (ferrous, non-ferrous, and stainless steel) and/or X-ray machines (metals, glass, wood, plastics, etc.) in order to eschew physical contamination.

USDA-inspected establishments must have supportable justification from academia studies and/or in-house validation studies regarding how the procedures they employ will detect any possible foreign materials present. If foreign material contamination occurs, inspection program personnel must verify that an establishment follows their detection, segregation, and final product disposition procedures to ensure the contamination is removed.

This is all accomplished by having mandatory Hazard Analysis and Critical Control Points (HACCP) designed to preclude any chemical, physical, or biological hazard(s) from cross contaminating the otherwise wholesome meats.

HACCP and Prerequisite Programs

USDA inspectors verify that the HACCP requirements associated with a Prerequisite Program for foreign material are met on a continuing basis. For example, inspectors verify the requirements associated with a Prerequisite Program for foreign material in a raw ground beef process

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by performing verification procedures on the detection devices themselves and by reviewing the establishment's applicable HACCP recordkeeping.

A USDA-regulated HACCP system requires that an establishment must conduct a hazard analysis to determine the food safety hazards *reasonably likely to occur* in the production process and identify the preventive measures that the establishment can apply to control those hazards. Historical data and customer complaints are also considered when creating a hazard analysis.

If the establishment's detection equipment is calibrated and finds product with foreign material contamination within the levels of detection, the Prerequisite Program would be considered as operating as designed, and detection is successful (e.g., a metal detector rejects boneless beef). The establishment should evaluate the rejected product and, based on the findings of the product evaluation, determine the root cause of the contamination. Then the establishment should evaluate the incident to determine whether additional controls are needed to preclude the presence of foreign material in the future.

The study of foreign materials found in food is called Microanalytical Entomology. The U.S. FDA and the Association of Official Analytical Chemists (AOAC) have published reference articles, books, and methods on this subject that discuss methods of analyses, contaminant identification, and contaminant significance.

Livestock

In addition to the large dollar amounts that processors and manufacturers spend annually to ensure foreign objects are detected and removed from domestic meat products, livestock producers are also implementing their own safeguards to keep foreign objects, like buckshot, from entering the food supply. Livestock producers are educating their employees and neighbors not to fire shotguns for herd control, and not to allow hunting of other wildlife in the vicinity of cattle herds.

Buckshot can inadvertently hit cattle from such practices, and the financial losses are magnified when the plant must detect and remove this foreign material later in the manufacturing process. As a result, livestock producers are increasing their efforts to reduce this potential source of contamination.

Voluntary Safeguards

There presently exists a voluntary governmental program for beef establishments that produce fresh boneless beef and frozen ground beef for the nation's schools and a variety of institutions that requires objectionable materials to be removed. This program is named the National School Lunch Program (NSLP).

The program requires a written technical proposal approved by governmental auditors from the Agricultural Market Service (AMS) that involves written procedures from the transportation of livestock (humane handling of livestock) thru the entire continuum of beef slaughter, fabrication, and ground beef.

The NSLP involves and promotes both food safety (HACCP program and FSIS inspection) and food quality requirements (i.e., fat percentage, net weights, and objectionable materials removal) that must meet AMS set parameters addressed within each USDA establishment's technical proposal requirements.

The AMS' technical proposal is based on the ISO 9000 series and requires the *plan*, *do*, *check*, and *act* format on every process step (from transportation of livestock to final delivery of finished beef products) to generate excellent conditioned boneless beef and frozen ground beef.

One key element of the program is the detection and elimination of objectionable materials (natural tissues of meats) as well as foreign physical materials (metals, plastics, stones, and glass).

A typical description involving objectionable materials in a *plan*, *do*, *check*, and *act* format of a NSLP technical proposal is partially cited below.

Description of Process—objectionable materials. Major lymph glands (pre-femoral, popliteal, and pre-scapular) thymus gland, and the sciatic nerve (lies medial to the outside round). All bone, cartilage, and the following heavy connective tissues; white fibrous—shoulder tendon, elbow tendon, silver skin (from the outside round), sacrociatic ligament, opaque periosteum, serous membrane (peritoneum), tendinous ends of shanks, gracilis membrane, patelleras ligament (associated with the stifle joint), Achilles tendon, and the yellow elastin, back strap, and abdominal tunic.

Trained quality assurance personnel ensure that the following objectionable materials are removed using a knife: the major lymph glands (pre-femoral, popliteal, and pre-scapular), thymus gland, bone cartilage, sciatic nerve, shoulder tendon, elbow tendon, sacrociatic ligament, opaque periosteum, tendinous ends of the shanks, patellar ligament (stifle joint), and internal fat (kidney, pelvic, and heart fat).

Plan: How will QA meet the production step? All boneless beef products that are intended for the NSLP program shall be subject to visual inspection to ensure that the above objectionable materials are removed and placed into an inedible container. An approximate 30-pound sample shall randomly be taken from a combo bin (containing raw boneless beef) and re-inspected for any objectionable materials; approximately every 30 minutes, plus or minus 15 minutes.

Do: The actual production step. Beef carcasses are de-boned by skilled butchers. Achilles tendons and external fibrous tissues are removed by the butchers prior to de-boning the hind shank. The rump portion of each carcass is opened by knife

Criteria for Objectionable Materials

4 defects › 0.5 inch in its greatest dimension = re-work the entire bin

(the definition of 0.5 inch in its greatest dimension is 0.5 inches in length, width, and/or diameter)

cuts to separate muscle groups, exposing other tissues, such as silver skin, gracilis membranes, sacrociatic ligaments, popliteal lymph nodes, abdominal tunic, and pre-formal lymph nodes, which shall be removed. Back straps are removed by butterflying open the neck and back portion of the beef chuck, once the bone is removed. The neck portion and the strap are trimmed off. The back portion are pulled out to expose the attaching membrane, which is cut by a knife and cleanly pulled away from the muscle tissue.

USDA-inspected establishments must have in place supportable justification from academia studies and/or in-house validation studies regarding how the procedures they employ will detect any possible foreign materials present.

Boneless shoulder clods are then turned upside down exposing the interior side of the muscle and the pre-scapular lymph nodes. At the two areas where the shoulder and elbow tendons protrude, the clod is checked on the butt end where the shoulder tendon protrudes approximately 1 to 2 inches, depending on the size of the shoulder clod, and at the point portion where the elbow tendon protrudes is also checked for defects.

Afterwards, the boneless beef travels down a conveyer belt and ends up accumulating directly into a combo bins. At this juncture, personnel visually examine the boneless beef trimmings. The boneless beef that is destined for the NSLP program is placed into cardboard bins lined with a food grade plastic liner, fully and properly labeled at the end of pack-off. At this point of the process, QA personnel perform the on-line inspection for objectionable materials.

Check: How do you verify using quality assurance check?

As the combo bins of boneless beef that are destined for the NSLP are in the filling process, an on-line Partial Quality Control program is performed and documented by trained QA personnel. At approximate 30 minute intervals (beginning from the start of each production shift if school lunch product is being processed), plus or minus 15 minutes, an approximate 30-pound grab sample of product is removed from a combo bin and placed inside an edible labeled tote and inspected by a trained QA.

An off-line organoleptic (visual) re-inspection is performed afterwards under enhanced lighting. The boneless beef is then scored using a criterion for on-line inspection for boning defects. If the criterion is exceeded, all product produced from the last acceptable check will be tagged, re-worked, re-inspected, and documented.

In Summary

The NSLP is a demanding and unforgiving program that's stricter than any other commercial or governmental program today. By reading through the *plan, do, check,* and *act* format, it's imperative that constant employee training is required in order for the program to meet all of the AMS requirements and guidelines. Failure to follow selected AMS guidelines can lead to a disqualification status. Plants can get reinstated by forwarding a cause and effect corrective action that is approved by selected officials at the AMS.

The Global Food Safety Initiative (GFSI) involving Safe Quality Food (SQF), British Retail Consortium (BRC), and the FSSC 22050 does not contain any such detailed requirements. However, if USDA establishments have the ability to adopt both the NSLP and GFSI programs into their operations, such pro-active programs will power their operations several levels higher than that of their competitors.

I've always advised qualifying companies who are vertically integrated (slaughter, fabrication, and grinding) that want to have the NSLP and GFSI programs integrated within their company operations to successfully implement and accomplish the myriad standards involving the NSLP first before attempting GFSI certification.

The trails of documentation, management commitment, and employee training that's required to meet the many standards of the NSLP naturally prepares a company's operations towards the even more demanding, but rewarding, international standards of GFSI. ■

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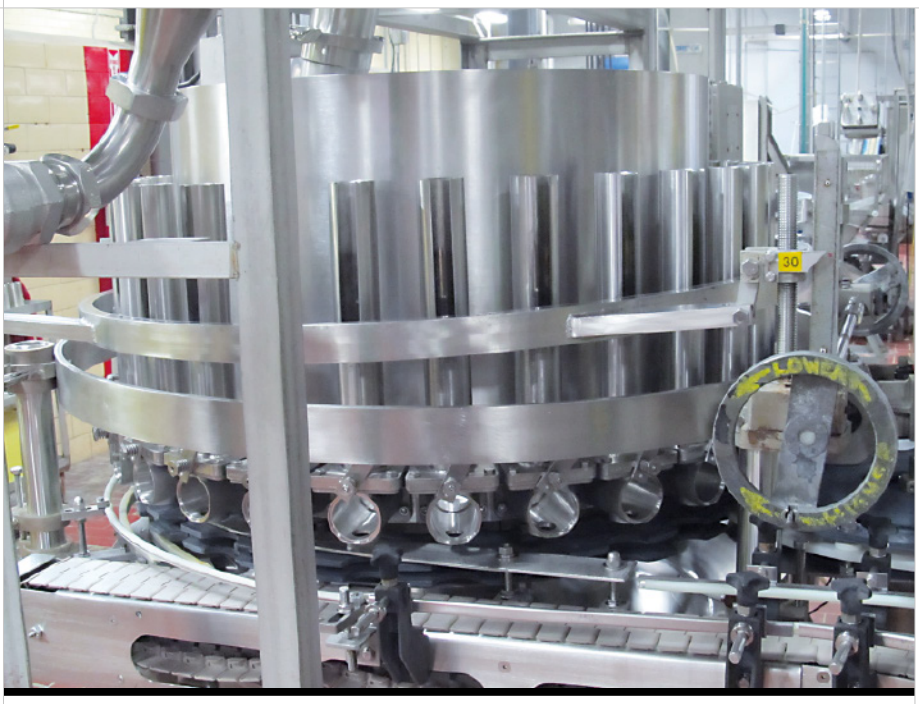

New piston filters come surrounded by a complete guarding package to protect the operations; however, the perimeter guarding must be added to used ones.

ED GERKEN, SSOE

Selecting, Retrofitting, and Integrating Used Equipment

How to assess the risk versus the payoff while still meeting safety and quality guidelines

BY **ED GERKEN, PMP, LEED AP**

Capital savings is a major driver of a food processor's decision to purchase used equipment. The savings can be even greater if a processor can reuse idle assets from another plant. An equally strong driver is a fast-track project schedule because the reuse of immediately available equipment can shave off many months.

However, processors must select equipment that complies with their safety and quality criteria or select equipment that can be cost-effectively retrofitted as well as cost-effectively integrated with the other equipment on the processing line. To do so, consider the following questions.

How High is the Bar? Many food processors are raising the bar on their safety and quality criteria for equipment, including Category 3 safety circuits and guarding on rotating fillers. Components such as these were not in the equipment specifications even a few years ago. Many are adopting the Safe Quality Food (SQF) 2000-Level 3 standards developed by the SQF Institute, and more stringent criteria for methods of construction to facilitate ease of cleaning, including well designed clean-in-place (CIP) systems. For this reason, it is important that the equipment selected be capable—through retrofitting if necessary—of meeting the safety standards set by the industry going forward.

How Old is the Equipment? Age and type are the primary factors in food processors' selection of used equipment. For simple equipment, such as tanks and blending vessels, used equipment that is 10 to 15 years old usually meets current quality criteria, provided that the materials of construction meet the project needs and provided that there is no evidence of corrosion due to poor sanitation or attack on the welds by high-acid or high-sodium ingredients. Used cookers/retorts and fillers are often acceptable since, other than guarding, there have not been significant changes in technology in the last 20 years.

On the other hand, used computer-based equipment is often not a good candidate because it rapidly becomes obsolete—often within less than five years—as newer models are introduced with increased speed, capability, and functionality. Examples include personal computers, programmable logic controllers, and human-machine interfaces.

Does the Source Have a Track Record? To ensure quality with productivity, many companies have purchase agreements with preferred vendors, including used equipment dealers. Although they may be reluctant to add new vendors to their accounting system, it is critically important to assess the source in light of all project success criteria. The benefits to a fast-track project of obtaining good used equipment usually outweigh the effort needed to add a new vendor to the accounting database.

More Buying Questions.

- Does the used equipment already meet current quality design specifications, or can it be upgraded to current standards easily and cost-effectively?
- If it passes the quality hurdle, can the used equipment perform at the expected production throughput speed?
- Does the used equipment have a remaining life expectancy that meets the goals of the project?

Criteria for Success. Before a food processor can write specifications for the purchase of any equipment, the owner must define the criteria for safety, quality, productivity, and project schedule. This should be a team effort that includes quality operations and engineering managers, as well as subject matter experts for particular processes, such as packaging.

Each success criterion should have measurable attributes that can be used to assess used equipment. The criteria and attributes guide the owner when writing the request for a proposal. Top industry leaders use a Best Value Options Analysis to compare available equipment for safety, quality, reliability, and maintainability.

Some companies have made their best practice guidelines available for purchase, such as vertical startup methodologies used by global manufacturing companies.

Evaluating for Retrofit Success. After locating suitable equipment, confirm that the retrofit will be economically viable and, following that, determine which party is best equipped to carry out equipment changes. The final steps include updating control panels as necessary and performance testing the retrofitted devices to ensure they conform to all standards and expectations originally specified.

Used equipment normally requires retrofitting to meet safety or quality criteria, or both. Determine whether the capital savings of purchasing the used equipment over purchasing new equipment will be sufficient to cover the upgrades needed to meet safety and quality standards.

In some cases, it's adequate for the initial assessment to have the vendor send photos of the equipment under consideration. Other cases require sending a team or representative to the vendor's site to assess equipment in person.

If the used equipment passes the first retrofit test, determine whether the seller can make the required upgrades. If not, the second alternative is to send a request for proposal to the original equipment manufacturer (OEM) to refurbish/upgrade the used equipment to bring it up to the new standards. If the OEM has a new model of the equipment, request the specs on the new model and a quote for the cost of upgrading the used equipment to the standards based on success criteria. Once the OEM agrees to perform the upgrade, a warranty on the equipment should be provided. As a third alternative, an in-house group can refurbish the used equipment.

Used equipment must be integrated into an overall control scheme for the production. If the used equipment includes a control panel that is outdated or does not match the receiving plant's standard brand, the upgrade can be expensive. The upgrade should also be one that can be maintained by the plant and one with an acceptable life expectancy.

As listed above, options for upgrading the control panel include having the upgrade performed by the seller, by the OEM (preferable), or by a control panel shop that can swap out the old controls for new. Lastly, equipment integration requires adapting overall line controls to manage the flow from one operation to another.

Many food processors are incorporating a CIP system into equipment to clean piping and tanks, whether for a new system or for a retrofit of an existing system. In this case, the retrofitted equipment must be cleanable with a CIP skid as opposed to hose and hand scrubbing. Modifications to tanks may be required to eliminate "shadows" created by agitators and pipe penetrations and nozzles that leave debris or film that would be missed by the spray balls. Moreover, open-top tanks need to have domed tops added to protect surfaces outside the tank from overspray.

Acceptance testing, the final step, sometimes gets overlooked in a fast-track project in the rush to get the line up and running. The best practice is a risk evaluation *before* the equipment is shipped to the plant. If it is a tank, ask the vendor to send photos. If it is a filler, be well advised to send production and maintenance teams to go through a factory acceptance test and require the vendor to run it at production conditions. If other factors don't allow for performance testing at the vendor site, a site-acceptance test (running the test at production conditions) can still be performed in lieu of a factory-acceptance test.

Saving Time, Trouble, and Money. If you need help navigating this process, select a process engineering consultant that offers added value. Evaluate firms for their history with various OEMs and other vendors, and ability to leverage these relationships as the project team evaluates the option of used equipment versus new.

When considering used versus new equipment, a food processor must always balance total purchase price, delivery schedule, potential increased maintenance costs, and increased risk of purchasing. If the risks are properly managed, used equipment can yield significant savings in capital and time while still complying with current safety and quality criteria. ■

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Preventing Norovirus is in Hands of Food Workers

Food service industry can help prevent norovirus outbreaks by ensuring workers practice proper handwashing and avoid touching RTE foods with bare hands

BY **CATHERINE SHAFFER**

A new report by the CDC on norovirus outbreaks in the food industry revealed that the virus is a more important cause of foodborne illness than previously thought and ill food workers are a significant cause of outbreaks. The report underscores the importance of hand hygiene and the challenges of increasing compliance in restaurant and other food service settings.

A surprising finding of the report has been that noroviruses, not bacteria like *Salmonella*, are the leading cause of foodborne illness. According to the CDC, about 20 million people are sickened by norovirus each year, through contact with infected people or by eating contaminated food. Most cases are not formally diagnosed by a physician, who may suspect norovirus, but gives a diagnosis of gastroenteritis or "stomach flu." Thus, in spite of the widespread nature of the illness, there is not much awareness of it as a problem, especially in the food supply.

The CDC found that between 2001 and 2008, there were about 365 foodborne outbreaks of norovirus per year, resulting in 156 hospitalizations and one death, on average. Leafy vegetables were the most common food culprit in the outbreaks, followed by fruits and nuts, and mollusks. However, between 53 and 82 percent of outbreaks were attributable to infected food handlers.

The source of an outbreak can be very difficult to identify. Human noroviruses cannot be cultured in a cell line, so identification in foods is carried out by polymerase chain reaction, or PCR, analysis. That analysis confirms the presence of norovirus ribonucleic acid, but does not give information on the infectivity of the virus. A positive identification of norovirus in a food only proves that the food has been contaminated at some point, but not whether that food was actually the cause of an outbreak.

"Norovirus is just an extremely contagious virus," says Aron Hall, an epidemiologist in the CDC division of viral diseases. Hall leads the norovirus epidemiology program at CDC. "It takes just a few viral particles to make someone sick. Somebody that's infected is shedding billions of virus particles. Even with a little bit of hand hygiene or occasional lapse, there could still be enough virus on someone's hands to spread the infection."

Unlike many bacteria, human noroviruses are not transmitted through animals and manure. Contamination of food, therefore, is most likely to occur either before harvest through irrigation water contaminated with feces, or through handling by infected food workers. Once an outbreak has occurred, it can be nearly impossible to trace the source.

Features of norovirus that facilitate transfer include low infective dose, rapid onset of gastroenteritis symptoms, high load of virus particles in the feces and vomit, asymptomatic early disease, and long persistence outside the human host. Contaminated surfaces are a very efficient mode of transmission of the virus.

Contamination of foods and surfaces occurs through viruses on the hands or aerosolized vomit, and infection of susceptible individuals occurs through hand-to-mouth contact, so the role of hand hygiene in preventing outbreaks becomes crucial.

Some food workers mistakenly believe that a continuous cold chain of storage for foods will prevent transmission or destroy norovirus, as is effective with bacteria. According to University of Helsinki scientist

Maria Ronnqvist, however, that is not true at all. "The fact that keeping a continuous cold chain for foods does not destroy viruses but rather preserves them has to be kept in mind in the food industry, for if the virus is transferred to the final, ready-to-eat [RTE] food product in the preparation phase, it could easily stay infective in the product until consumed," she says.

Meticulous hand hygiene is the most effective way to prevent norovirus contamination. Even gloves are not fully effective for preventing transmission, although they lower the amount of virus that can be transferred.

Compliance

The FDA produces a document known as the Food Code that recommends best practices for safety in the food industry, including hand hygiene, according to Lee-Ann Jakus, a Food Science professor at North Carolina State University. "A huge issue in this country is compliance. You can tell people you should wash your hands this way for this amount of time, with soap and water, and you need to do it after you use the bathroom, but you have no way of ensuring people are actually doing that."

The CDC recommends washing hands frequently with soap and warm water for at least 20 seconds, particularly after using the restroom. Also, workers should use utensils and single-use disposable gloves to avoid touching RTE foods with their bare hands. Kitchen surfaces and objects should be sanitized with a product approved by the EPA for use against norovirus. Fruits and vegetables should be carefully washed and shellfish should be cooked to at least 140 degrees.

Hand hygiene in food service is well below 100 percent in observational studies, according to Hall. In one study, it was only performed in about 20 percent of cases. "Clearly there's room to improve in hand hygiene compliance," says Hall.

There are some measures known to improve compliance. Training and certification of kitchen managers in food safety can improve compliance and decrease incidence of norovirus outbreak, Hall says.

However, perfect hand hygiene is difficult in a fast-paced food service environment. "There are so many instances in the chain where you have to wash your hands in a busy food service establishment—it becomes overwhelming," says Jaykus. "It adds a level of complexity. This particular workforce in many instances is not as highly skilled as other workforces."

Sick Time

Another intervention possibly even more powerful than hand hygiene is sick time.

One of the other major findings of the CDC report was that people shed virus in their fecal material before they show symptoms, and for most of the time after they show symptoms. Although it's difficult to identify workers who are shedding virus, but not yet sick, excluding workers who are ill is an obvious way to minimize norovirus outbreaks.

Food service workers often don't have paid sick time, and so are reporting to work when actively sick and contagious. In addition to handwashing, the food industry can prevent outbreaks by encouraging workers to stay home when ill.

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The CDC recommends washing hands frequently with soap and warm water for at least 20 seconds, particularly after using the restroom.

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Although norovirus is a clear and persistent problem in the food industry, there are not many options for intervening and preventing outbreaks. The CDC findings that fresh produce, mollusks, and RTE foods are most likely to be contaminated, and that food handlers are a significant source of outbreaks offer guidance as to where to focus prevention efforts. The CDC also advocated development and validation of more advanced analytic methods, particularly those capable of correlating virus levels with infection risk. More study is also needed on the role of food handlers, particularly those that are asymptomatic.

The CDC also advocates for better surveillance by public health agencies and development of vaccines. In the meantime, hand hygiene is potentially the most powerful front-line tool for controlling norovirus outbreaks. Increasing hand hygiene awareness and compliance can stop outbreaks at the source, whether that source is the farm or the point of service, since all human norovirus requires a human vector, and it requires little investment beyond time spent on training and awareness. ■

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How Committed Are Your Food Service Employees?

BY **BILL SIMS JR.**

The ideal food service culture should consist of employees moving beyond simple compliance of workplace rules to being truly committed to the jobs they perform.

One way to cultivate committed employees is to become a committed leader. For example, Steve Provost, the president of Maggiano's Little Italy, which has more than 50 restaurants throughout 20 states, is very much a servant leader. When Provost visits his restaurants, the first thing he does is bus tables with the busboys, then wash dishes in the kitchen. This voluntary extra effort shows employees what commitment to the job looks like. When the leader of the company does something extra, what do you think the employees are going to do?

Another way to move people to commitment requires positive reinforcement in the leadership system. Employee engagement has been identified as a key driver of business profitability and human performance. Unfortunately, only 15 percent of employees say they are "actively engaged" at work.

When it comes to engagement, every organization has three kinds of workers:

Non-Compliant: "I will not follow your rules because I am convinced the only way to get high production is to take risks and shortcuts."

Compliant: "I will follow your rules as long as someone (a manager, a supervisor, or a peer observer) is standing there watching me. But when that person leaves, I'll take more risks and shortcuts."

Committed: "I will follow the rules, when nobody is watching. This is who I am."

How precisely do you shift your workplace culture from "I have to do it or I'll be in trouble" to "I want to do it because I believe in it"? True positive reinforcement needs to be individualized and delivered immediately after an employee does something right. That way, the employee will be more likely to repeat those behaviors in the future. If food service workers go above and beyond their responsibilities, they should be recognized. Consider them your internal customers. Yes, they are doing their job and are paid to do it, but studies show a paycheck is not as big a motivator as feeling like you are making a difference at work.

Without positive reinforcement, your employees will be less committed. With less committed employees, you're getting less performance from your team and your food service culture will suffer. However, using positive reinforcement to cultivate engaged workers will improve all aspects of their work.

Sims is president of The Bill Sims Company, Inc. Reach him at bill.sims@billsims.net.

NEW PRODUCTS

Automated Analysis of Fiber

The Fibertec 8000 is an automated solution for unattended determination of crude and detergent fiber in raw materials used in animal feed and finished feed products according to standard reference "crucible" methods, such as Weende and van Soest. It can manage up to six samples simultaneously and there is no handling of individual samples or filter bags. It can also be set up to run overnight. Automatic functions take care of heating and dispensing of reagents and antifoam as well as rinsing with water. It also includes automatic heat reduction when the boiling point is reached to prevent spillage. **FOSS, 800-547-6275, www.foss.us.**

Dual-View Atomic Spectrometer

According to the company, the 5100 Inductively Coupled Plasma – Optical Emission Spectrometer (ICP-OES) enables users to run samples faster, using less gas and without compromising performance on challenging samples. Users have the capability to take the guesswork out of method development with ICP Expert software and Dichroic Spectral Combiner technology. They can also capture all wavelengths in one measurement for higher precision without delays. The system's vertical torch will enable them to measure even the most challenging samples—from high matrix to volatile organic solvents. **Agilent Technologies, 877-424-4536, www.agilent.com.**

Triple Quad GC-MS/MS

The GCMS-TQ8040 with Smart MRM features Smart Productivity for high-efficiency sample throughput, Smart Operation for quick method development, and Smart Performance for low detection limits and Scan/MRM. With over 32,000 MRM transitions in a single run, the GCMS-TQ8040 with Smart MRM can combine more than 400 compounds into a single MRM method without sacrificing sensitivity or selectivity. Smart MRM with flexible MS events prevents compounds from being lost or missed when retention times shift in the presence of a complex matrix. In addition, the Automatic Adjustment of Retention Times function updates retention times in both the acquisition and data processing methods after column maintenance without changing chromatographic conditions or requiring multiple injections of standards. **Shimadzu Scientific Instruments, 800-477-1227, www.ssi.shimadzu.com.**

Juice Station

The vertical setup of the Abbemat Juice Station refractometer avoids sedimentation of particles, e.g. pulp in fruit juices, on the measuring prism. The attached filling funnel allows for a quick serial analyses, e.g. in quality control. The next sample flushes out the previous one, so users do not need to clean the measuring prism between samples. An internal temperature control assures the correct measuring temperature. Measured data can be recorded and printed. A menu-guided adjustment procedure allows easy adjustment of the instrument. For cleaning, the measuring cell can be removed by loosening the supporting ring. **Anton Paar USA, 804-550-1051, www.anton-paar.com.**

Laboratory Fume Hood

The new U.L. 1805 Classified LE Constant Volume Fume Hood is available in 3-, 4-, 5-, 6-, and 8-foot widths. It incorporates a unitized superstructure, with non-metallic dual wall construction for total chemical resistance. Integral one piece fume chamber is glass smooth with all coved corners. The Vara-Flow baffle system directs the air through the fume chamber and through the exhaust outlet with minimum turbulence and airflow efficiency. **HEMCO Corp., 800-779-4362, www.HEMCOcorp.com.** *(Continued on p. 44)*

(Continued from p. 43)

Water QC Kits

EZ-Hydro Shot is designed for water testing. Ready-to-use EZ-Hydro Shot organisms have been validated for membrane filtration and enzyme substrate methods and can be used for a variety of other test methods as well. It comes in the form of a quantitative, lyophilized organism pellet; the strains included in EZ-Hydro Shot kits are indicator organisms—organisms that readily indicate water contamination. The product has been validated for use with multiple tests including Standard Methods for Examination of Water and Wastewater, and EPA test methods. While the product is designed to test drinking water and wastewater, it's also effective in any industry where manufacturers are required to test for water quality. No pre-incubation steps are required to prepare EZ-Hydro Shot and the pellets instantly dissolve. **Microbiologics, Inc., 800-599-2847, www.microbiologics.com.**

Disposable Gowns

The PolyWear personal protective disposable gown is designed to replace traditional poly aprons and sleeves that are disposed of after a single use. Gowns feature full frontal coverage for splash protection, and a full-length open back design incorporating a tear-away feature for quick and easy removal. A contoured thumb loop secures gown sleeves under the employee's protective glove. One-piece construction with a single heat-sealed seam behind its sleeves reduces the potential for "pass-through" of fluids and other contaminants. Gowns are made of lightweight linear low polyethylene and are available in three sizes: regular, large, and extra large. **PolyConversions, 888-893-3330, www.polycousa.com.**

Metal Detection

CEIA MS-21 Multi-Spectrum metal detectors eliminate the waste and delay of false rejects to increase inspection productivity and efficiency, according to company. It uses a simultaneous and continuous spectrum of frequencies to distinguish between metal contaminants and product effect conditions without reducing metal detection sensitivity. This prevents product effect errors for difficult-to-inspect products like fresh ground meats and multi-product meal kits while still detecting the smallest-possible particles of all types of metal, including Type-316 stainless steel. Built for wet operating environments, the detectors are IP69K-rated for wash down protection, and feature conformal coated circuit boards to prevent damage caused by internal condensation. **Heat and Control, 800-227-5980, www.heatandcontrol.com.**

Produce Treatment System

The Sonic Fresh Produce Treatment System is designed to treat post-harvest fruits and vegetables. The unit works in conjunction with BioSafe Systems' line of activated peroxygen treatments, including StorOx 2.0 bactericide/fungicide and SaniDate 5.0 sanitizer/disinfectant. It removes toxic pesticides, pathogens, and decay-causing organisms from fruits and vegetables. The self-contained unit generates ultrasonic waves to create an intense scrubbing action to lift away soils, waxes, and microscopic contaminants. This process is not pH dependent and no rinse is required after treatment. Organic compliant, the system will not affect produce color or taste. **BioSafe Systems, 888-273-3088, www.biosafesystems.com.**

Total Hydrocarbon Analyzer

The Series 2300 Total Hydrocarbon Analyzer is designed to continuously measure concentrations of hydrocarbons and, utilizing an optional catalytic methanizer, CO and CO_2 in gas streams. An alternative version is also available for beverage-grade CO_2 applications. The microprocessor-controlled instrument employs a flame ionization detector where ionized carbon atoms are produced when burned in a hydrogen flame. The ionized atoms are detected by the instrument and displayed as a concentration in ppm or ppb on an LCD. The graphical LCD touchscreen accompanied with a membrane keypad allows for straightforward navigation through settings and functions. **GOW-MAC Instrument, 610-954-9000, www.gow-mac.com.**

In Other Product News

3M's Petrifilm *Salmonella* Express System is verified by AOAC as a First Action Official Method for the detection of *Salmonella*.

Bioo Scientific launches its Lab Testing Group, offering full-service testing for contaminants in complex food matrices using analytical testing methods, including HPLC analysis and ELISA.

Birko's Beefxide is validated as effective against *E. coli* and *Salmonella* by the Center for Meat Safety & Quality in the Department of Animal Sciences at Colorado State University.

Microbiologics partners with **Biomatrica** to use DNAstable and RNAstable technology in its line of molecular controls for diagnostic instruments and assays.

Microbac Laboratories adopts Invisible Sentinel's *Veriflow* technology for detecting bacterial pathogens in food.

Nelson-Jameson adds pink to its color-coded products for material handling, janitorial, safety, lab, and processing applications.

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Events

AUGUST

26
Microbiology & Food Safety Course
Fresno, Calif.
Visit www.food-safetynet.com/docs/Training_Sellsheet.pdf
or call 888-525-9788 ext. 229.

27
Artisan/Farmstead Food Safety Workshop
Ithaca, N.Y.
Visit www.dairyevents.com/Login.aspx.

SEPTEMBER

15-16
The Food & Beverage Marketing & Advertising Law Summit
Chicago, Ill.
Visit momentumevents.com/foodsummit/.

16-17
Dairy Plant Food Safety Workshop
Denver, Colo.
Visit sites.usdairy.com/foodsafety/Pages/pathogencontrol.aspx.

17-19
BRC Global Standard for Food Safety Implementation & Internal Auditor Course
Columbus, Ohio
Visit www.food-safetynet.com/docs/Training_Sellsheet.pdf
or call 888-525-9788 ext. 229.

23-24
Food Safety Workshop – Introduction to Food Microbiology: The Basics
Green Bay, Wis.
Visit www.cherneymicro.com/resources/foodsafetyworkshop.

23-24
Supplier Food Safety Management
Rosemont, Ill.
Visit hsites.usdairy.com/foodsafety/Pages/supplychain.aspx.

29-30
Sensory Evaluation at Rutgers
New Brunswick, N.J.
Visit www.cpe.rutgers.edu/courses/current/lf0606ca.html or call 732-932-9271.

OCTOBER

1
Making Sense of the Numbers: Statistics for Food Scientists
New Brunswick, N.J.
Visit www.cpe.rutgers.edu/courses/current/lf0607ca.html
or call 732-932-9271.

8-9
Food Safety and Pest Management Symposium 2014
Atlantic City, N.J.
Visit www.rkenvironmental.com/seminar
or call 800-996-4402.

14-16
Food Safety & Sanitation for Food Manufacturers
University Park, Penn.
Visit agsci.psu.edu/sanitation.

15-17
HACCP Plan Development for Food Processors
New Brunswick, N.J.
Visit www.cpe.rutgers.edu/courses/current/lf0403ca.html
or call 732-932-9271.

15-17
BRC Global Standard for Food Safety Implementation & Internal Auditor Course
Atlanta, Ga.
Visit www.food-safetynet.com/docs/Training_Sellsheet.pdf
or call 888-525-9788 ext. 229.

22
Artisan/Farmstead Food Safety Workshop
Bowling Green, Ky.
Visit www.dairyevents.com/Login.aspx.

SCIENTIFIC FINDINGS

For access to complete articles mentioned below, go to the "Scientific Findings" section of the August/September issue at www.foodqualityandsafety.com.

ARTICLE: Thin-Layer Infrared Drying of Mint Leaves

Since herb plants are usually used in their dried state, determination of their drying characteristics is essential for their preservation and storage for longer periods. Drying is one of the oldest methods of food preservation and represents a very important aspect of food processing. In addition, infrared heating can offer advantages over conventional drying under similar drying conditions. The objectives of this study were to observe the effect of drying temperature, to determine the color changes of mint leaves, and to find the best suitable drying model during infrared drying of mint leaves. ***Journal of Food Processing and Preservation, Volume 38, Issue 4, pages 1480–1490, August 2014.***

ARTICLE: Natural Additives in Wheat-Based Pasta and Noodle Products – Opportunities for Enhanced Nutritional and Functional Properties

Many additives are being used today in pasta and noodle products for various purposes. However, due to lack of knowledge about specific uses, they are sometimes misused by manufacturers. This can lead to opposite technological effects instead and may even cause damage to human health. Due to consumer demands, interest now focuses on natural "green" food additives with broad-spectrum functions, high effectiveness, and low toxicity. In order to provide references for noodle and pasta production, as well as to provide ideas for developing new types of these products, this review summarizes the types of natural additives that are being incorporated in pasta and noodle products, mainly for quality improvement and food preservation. ***Comprehensive Reviews in Food Science and Food Safety, Volume 13, Issue 4, pages 347–357, July 2014.***

ARTICLE: Nutritional and Physical Properties of Organic Beauregard Sweet Potato as Influenced by Broiler Litter Application Rate

Organic farming has been on an upward trend in recent years. However, the manures used like broiler litter have variable nutrient content, making it important to establish optimal application rates for maximum crop yield and quality. Additionally, some states like Alabama restrict the amount of broiler litter to control excessive nutrients accumulation that can lead to surface and ground water contamination. In this study, the nutritional and physical properties of organically grown Beauregard sweet potato were evaluated to determine the effect of application of broiler litter at rates of 0, 0.5, 1, 2, and 3 tons per hectare in meeting the application rate recommended by Alabama Cooperative Extension Program. ***Food Science & Nutrition, Volume 2, Issue 4, pages 332–340, July 2014.***

ARTICLE: Essential Oils – Extraction, Bioactivities, and Their Uses for Food Preservation

Essential oils are concentrated liquids of complex mixtures of volatile compounds and can be extracted from several plant organs. The use of essential oils as the natural additives for the shelf-life extension of food products is gaining attention due to the risk in using synthetic preservatives. Essential oils can be incorporated into packaging to provide multifunctions, termed "active or smart packaging." Those essential oils are able to modify the matrix of packaging materials, thereby rendering the improved properties. This review covers up-to-date literatures on essential oils including sources, chemical composition, extraction methods, bioactivities, and their applications, with the emphasis on preservation and the shelf-life extension of food products. ***Journal of Food Science, Volume 79, Issue 7, pages R1231–R1249, July 2014.***

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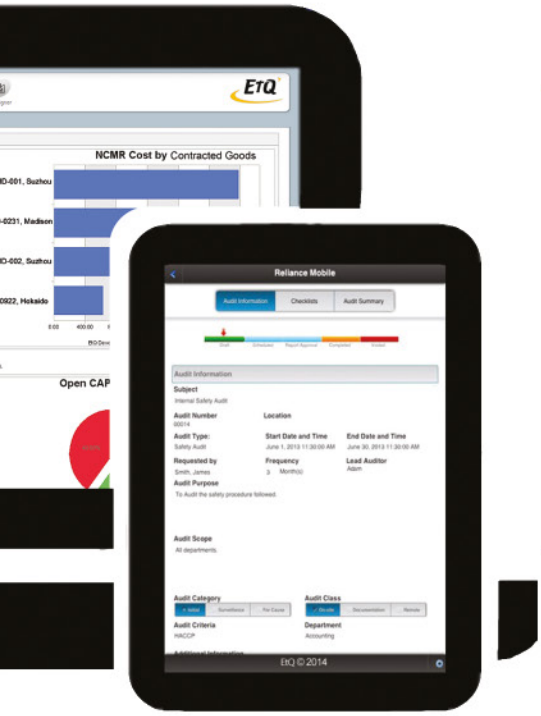

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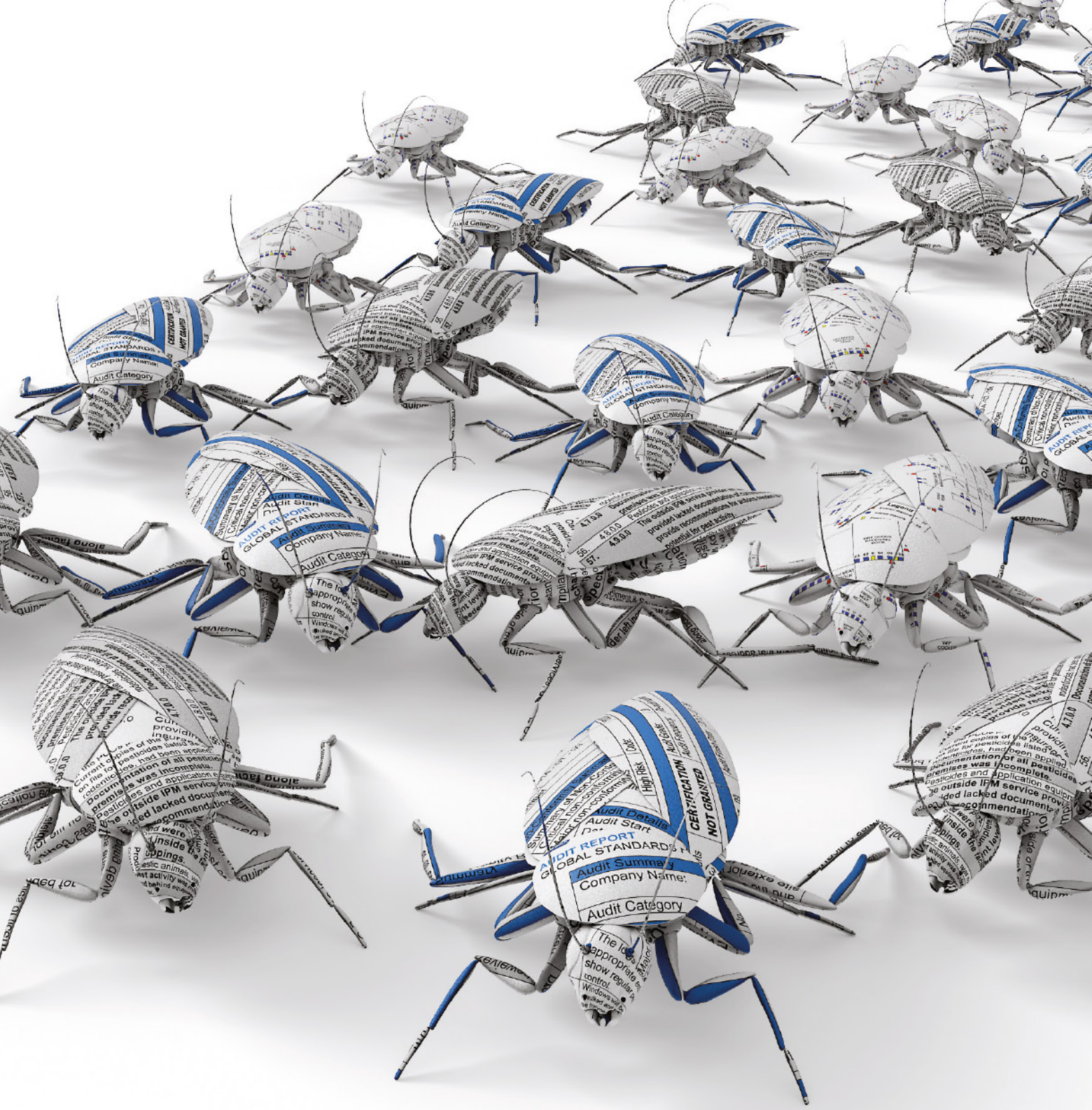

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