FoodSafety magazine

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ACHIEVING EXCELLENCE IN FOOD SAFETY RISK MANAGEMENT:

Tackling Chemical and Microbiological Threats

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Monitoring All *Salmonella* Serovars in Poultry Production by Applying an Integrated Approach of PCR and HTS

Monitoring all Salmonella *serovars is important to establish a complete epidemiological picture and prevent foodborne illness*

By *Shu Chen, Ph.D., Senior Research Scientist and Manager, Analytical Biology Unit, Agriculture and Food Laboratory, Department of Food Science, University of Guelph; Carlos Leon-Velarde, Ph.D., Supervisor, Food Microbiology Unit, Agriculture and Food Laboratory, Department of Food Science, University of Guelph; and Nicola Linton, Ph.D., Molecular Assay Development Scientist, Molecular Biology Unit, Agriculture and Food Laboratory, Department of Food Science, University of Guelph*

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Salmonella infection is one of the most commonly reported causes of foodborne illness, resulting in over 80 million cases of foodborne salmonellosis each year globally. Most illnesses are characterized by gastrointestinal symptoms such as diarrhea, fever, and abdominal cramps, with more severe illnesses leading to disability or death.[1] While *Salmonella* contamination has been found in many types of foods, poultry and poultry products such as meat and eggs are well known to be the main sources of non-typhoidal *Salmonella*. Wild birds often carry *Salmonella*, which can be easily transferred among birds and via airborne movement of dust and fluff in poultry houses. *Salmonella* can be found in approximately 18 percent of birds, 22 percent of products, and over 29 percent of environmental samples, based on overall pooled prevalence of 157 studies from 15 countries.[2] The Centers for Disease Control and Prevention (CDC) estimates that one in every 25 packages of chicken sold in grocery stores is contaminated with *Salmonella*.

Salmonella comprises over 2,600 serovars, which differ in their prevalence rate, transmission route, and pathogenic potential. Select serovars are frequently associated with human illness, while many are not. For example, a total of 131 serovars were identified from 157 studies carried out in 15 countries, with *Salmonella* Heidelberg, Kentucky, Enteritidis, and Typhimurium being among the most prevalent in poultry samples and those with the highest prevalence of anti-microbial resistance.[2] While these serovars (particularly *Salmonella* Enteritidis and Typhimurium) are sources of

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numerous outbreaks, many other serovars have also been associated with outbreaks. *Salmonella* serovar prevalence also varies with location and over time. In the authors' recent study involving 192 poultry farms across Ontario, Canada, *Salmonella* Heidelberg, which showed high prevalence previously, has been drastically reduced.[3] As a result, monitoring all serovars is important to establish a complete epidemiological picture to implement effective measures to prevent *Salmonella* transmission from poultry farms to consumers' tables.

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Salmonella Proposed Framework Change

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One of the primary vehicles for infection with *Salmonella* are eggs and egg-derived products contaminated with *Salmonella* Enteritidis. The bacterium is able to penetrate poultry reproductive organs, resulting in contamination of egg contents.[4] As a result, regulatory agencies in many countries have established environmental hygiene monitoring programs for detecting *Salmonella* Enteritidis to identify potentially contaminated flocks for de-population and prevent contaminated eggs from reaching the market.

It is important to note, however, that other serovars can be involved in eggshell contamination. For example, 52 illnesses were reported across six states in 2015 due to eggs contaminated by *Salmonella* Oranienburg. Furthermore, 45 consumers from ten states were infected with *Salmonella* Braenderup in 2018, resulting in 11 hospitalizations and a recall of 207 million eggs throughout the U.S. Other serovars, such as *Salmonella* Typhimurium and Indiana, have been detected in eggshells collected from 41 farms in Australia.[5] Many studies have also suggested that insects and animals can act as vectors for *Salmonella* introduction into poultry.[6,7,8] As a result, in several jurisdictions eggs are required to be washed (sanitized) prior to release to market to mitigate the risk of eggshell contamination. In addition, infection of egg layers with certain serovars, such as *Salmonella* Gallinarum and Pullorum, can affect egg production and cause high mortality among flocks.[9] *Salmonella* Typhimurium can also cause lesions that may lead to degeneration of oviduct and adversely affect food production.[10]

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The current surveillance and regulatory programs are generally characterized by varied sampling practices and primarily rely on culturally confirmed results for regulatory enforcement. For example, in Canada, the Canadian Food Inspection Agency (CFIA) has a national *Salmonella* Enteritidis control program for the poultry industry; both CFIA and *Salmonella* Enteritidis insurance covered by the Canadian Egg Industry Reciprocal Alliance (CEIRA) require a confirmed culture result to make a claim for a flock depopulated due to a positive *Salmonella* Enteritidis test result.

In the U.S., the Department of Agriculture (USDA) and the Food and Drug Administration (FDA) have the National Poultry Improvement Plan (NPIP) with guidelines and specific measures to control the spread of *Salmonella* in poultry. This plan is voluntary, although most producers choose to participate for trading purposes. The NPIP also provides a cooperative industry, state, and federal program through which new diagnostic technologies can be effectively applied to the improvement of poultry and poultry products throughout the country. The NPIP was initiated in 1930s to help diminish the rampant spread of *Salmonella* Pullorum, which caused nearly 80 percent mortality in pullets. The program was later extended to include monitoring for other serovars, including *Salmonella* Enteritidis. The NPIP has approved or interim-approved 12 rapid detection methods, of which three focus on *Salmonella* Enteritidis, while the remaining methods focus on detection of *Salmonella* spp. and require culture isolation to determine a serovar.

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Under FSIS' proposed strategy, establishments would need to collaborate with their suppliers and contractors to ensure that they are implementing best practices for reducing Salmonella *in breeding facilities, hatcheries, grow-out, and throughout transport.*

In October 2022, USDA's Food Safety and Inspection Service (FSIS) released a proposed regulatory framework to reduce *Salmonella* contamination in poultry products. FSIS is evaluating whether establishments must consider *Salmonella* as a hazard and address *Salmonella* at receiving as part of their Hazard Analysis and Critical Control Point (HACCP) plans. In addition, the proposal would require that establishments monitor *Salmonella* levels or determine the serovars in incoming flocks. Under this proposed strategy, establishments would need to collaborate with their suppliers and contractors to ensure that they are implementing best practices for reducing *Salmonella* in breeding facilities, hatcheries, grow-out, and throughout transport. However, specific or additional rules, policies, methodologies, or protocols for implementing the strategy to achieve reduction goals are yet to be finalized.

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Methods for *Salmonella* Detection and their Limitations

Standard methods for *Salmonella* detection involve pre-enrichment of a sample in a non-selective medium such as Buffered Peptone Water (BPW). The pre-enrichments are then subjected to polymerase chain reaction (PCR) screening or secondary enrichment in selective media, such as Rappaport Vasiliadis Soy broth (RVS) and Tetrathionate Brilliant Green broth (TBG), followed by plating onto selective agars such as Bismuth Sulphite (BS), Brilliant Green sulfapyridine (BGS) agar, and Xylose Lysine Deoxycholate (XLD) agar. Suspect colonies with morphological characteristics of *Salmonella* are then subjected to confirmation via biochemical reactions. A confirmed colony from a sample is then serotyped in a reference laboratory based on antibody-antigen interactions following the Kauffmann–White scheme,[11] or whole genome sequencing (WGS) is used to determine its serovar.

The culture methods involve multiple steps that take several days to complete and require skilled technicians to perform and interpret. The current approach statistically favors the detection of the most abundant *Salmonella* serovars in a sample and misses less abundant *Salmonella* serovars, which can still be significant to public health. This discrepancy results in a partial and confusing epidemiological picture and compromises the effectiveness of preventive and intervention practices. Theoretically, testing more colonies from the culture plates would allow the detection of multiple serovars; however, this is practically prohibitive due to cost and labor increasing with testing an increased number of colonies.

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Moreover, enrichment in different selective media, such as RVS and TBG broth, can lead to biased detection of certain *Salmonella* serovars.[12,13] This issue becomes more profound when testing is required for identifying a specific serovar, such as *Salmonella* Enteritidis. The research is still limited to fully elucidate the impact that culture bias has on the probability of accurately identifying all *Salmonella* strains in a sample.[14,15] The traditional culture-based serotyping method involves over 250 antisera to determine O (somatic) and H (flagella) surface antigens based on the Kauffmann–White scheme,[11] and is performed mainly in reference laboratories due to demanding requirements of resources and technical skills. Polymerase Chain Reaction (PCR)-based methods can be used to detect a serovar without culture isolation, but it can detect only a limited number of pre-determined serovars at a time.[16] The WGS approach still involves culture isolation and is mainly used in public health laboratories for pathogen subtyping.[17,18,19]

HTS for Detection of All *Salmonella* Serovars

The application of high-throughput sequencing (HTS) technologies, based on amplification of targeted identity regions, allows for the profiling of samples with diverse populations. PCR primers are used to amplify the region of interest from all target organisms in a sample, eliminating the need for isolation of pure cultures for identification purposes. Following HTS, robust data analysis tools are used to sort sequences and assign identity to known taxonomic groups, facilitating the detection of organisms of interest in a sample and also providing relative abundance information. The use of PCR and HTS can circumvent the need for further enrichment and isolation steps required by standard culture methods in *Salmonella* detection and serotyping, as they provide the ability to profile all *Salmonella* serovars present in a sample by sequencing an identity region contained in all *Salmonella* genomes.

Salmonella genomes contain Clustered Regularly Interspaced Short Palindromic Repeat (CRISPR) sequences that can be used to differentiate among serovars. A recently reported method called CRISPR-SeroSeq (serotyping by sequencing) employs HTS to profile *Salmonella* serovars in a sample by targeting a defined region containing the CRISPR loci in the *Salmonella* genome.[20] The direct repeat regions are conserved and used as flanking sequences for PCR amplification. Publicly available *Salmonella* CRISPR sequences are used to construct a database to assign a *Salmonella* serovar identity to unknown sample sequences generated upon HTS of indexed PCR amplicons. The number of sequences assigned to particular *Salmonella* serovars enables both the detection and calculation of relative abundance of multiple *Salmonella* serovars in an individual sample, including both the predominant and less abundant serovars present in mixed populations. The CRISPR-SeroSeq method has been demonstrated to have a similar detection sensitivity and reproducibility as PCR, as validated using poultry environmental samples. It is also able to simultaneously detect common *Salmonella* serovars, with minority serovars being detected at abundances as low as 0.01 percent in a mixed *Salmonella* population.[3]

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The use of CRISPR-SeroSeq to profile Salmonella serovar populations offers a more complete picture and better understanding of shifts observed in Salmonella serovars detected at various stages of poultry production...

Complete Picture of *Salmonella* Serovars by HTS

The use of CRISPR-SeroSeq to profile *Salmonella* serovar populations offers a more complete picture and better understanding of shifts observed in *Salmonella* serovars detected at various stages of poultry production, as demonstrated in a recent study conducted by Siceloff and colleagues.[21] The study revealed *Salmonella* serovar prevalence in broiler carcasses and raw chicken parts from 2016–2020 in the U.S. and identified regional differences in *Salmonella* serovars, with the Atlantic and Southeast regions more frequently isolating *Salmonella* Typhimurium compared to the South-Central, Midwest and Mountain, and West regions.

The data from surveillance at different stages of production also revealed that across regions, *Salmonella* Kentucky decreased in relative proportion within samples from carcass to raw chicken parts, while *Salmonella* Enteritidis had the opposite trend. In Georgia, *Salmonella* Kentucky isolation increased between 2016 and 2020 in not only carcass samples, but was also the most frequently isolated serovar in samples taken from breeding flocks at 15–19 and 40–45 weeks of age. Other serovars, such as *Salmonella* Enteritidis, Typhimurium, variant I 1,4,[5],12:i:-, Infantis, and Schwarzengrund were not detected as frequently in breeder samples, but were found in samples taken during later processing. The authors consider that processes aimed at reduction of *Salmonella* during processing are effective at reducing *Salmonella* Kentucky, but less effective at reducing other serovars present in breeder flocks, which were undetected due to limitations in culture selection of only the dominant serovar.

Siceloff and colleagues[21] also applied CRISPR-SeroSeq to investigate the prevalence of multiple *Salmonella* serovars in poultry samples from Georgia between 2020 and 2021 and found that *Salmonella* Kentucky was the most common out of 134 samples tested, which aligned with the surveillance results. However, the CRISPR-SeroSeq approach also identified *Salmonella* Cerro and *Salmonella* Mbandaka as the next most common, as well as serovars *Salmonella* Enteritidis, Infantis, Montevideo, Thompson, and Typhimurium. In particular, *Salmonella* Infantis was detected in 12 samples; in 11 of these, it was the minority serovar (second most abundant after dominant serovar). The authors point out that the results suggest that antimicrobial interventions aimed at reduction of *Salmonella* serovars were effective on the identified dominant serovar. However, the lack of a complete picture of *Salmonella* serovars present in breeder flocks creates an opportunity for minority serovars to elude antimicrobial mitigation strategies.

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Successful application of the CRISPR-SeroSeq method was also demonstrated in a large-scale study conducted in Ontario, Canada, to survey *Salmonella* serovars on poultry farms across the province.[3] The CRISPR-SeroSeq method was used to analyze 442 *Salmonella*-positive (by PCR) environmental samples collected from 192 poultry farms, and revealed a comprehensive picture of *Salmonella* serovars on the farms. The samples were taken over a period of ten months from ventilation fans (n = 178), egg belts (n = 96), manure belts (n = 87), floors (n = 37) and other sites (n = 44). A total of 25 serovars were detected in 430 of the samples, with 73.1 percent of the samples containing multiple (up to seven) serovars in a single sample. The most common serovars identified on the farms were *Salmonella* Kiambu (55.7 percent), Infantis (48.4 percent),Kentucky (27.1 percent), Livingstone (26.6 percent) and Mbandaka/Montevideo (23.4 percent). Different serovars were distributed over ten producer geographical zones across the province (*Figure 1*).

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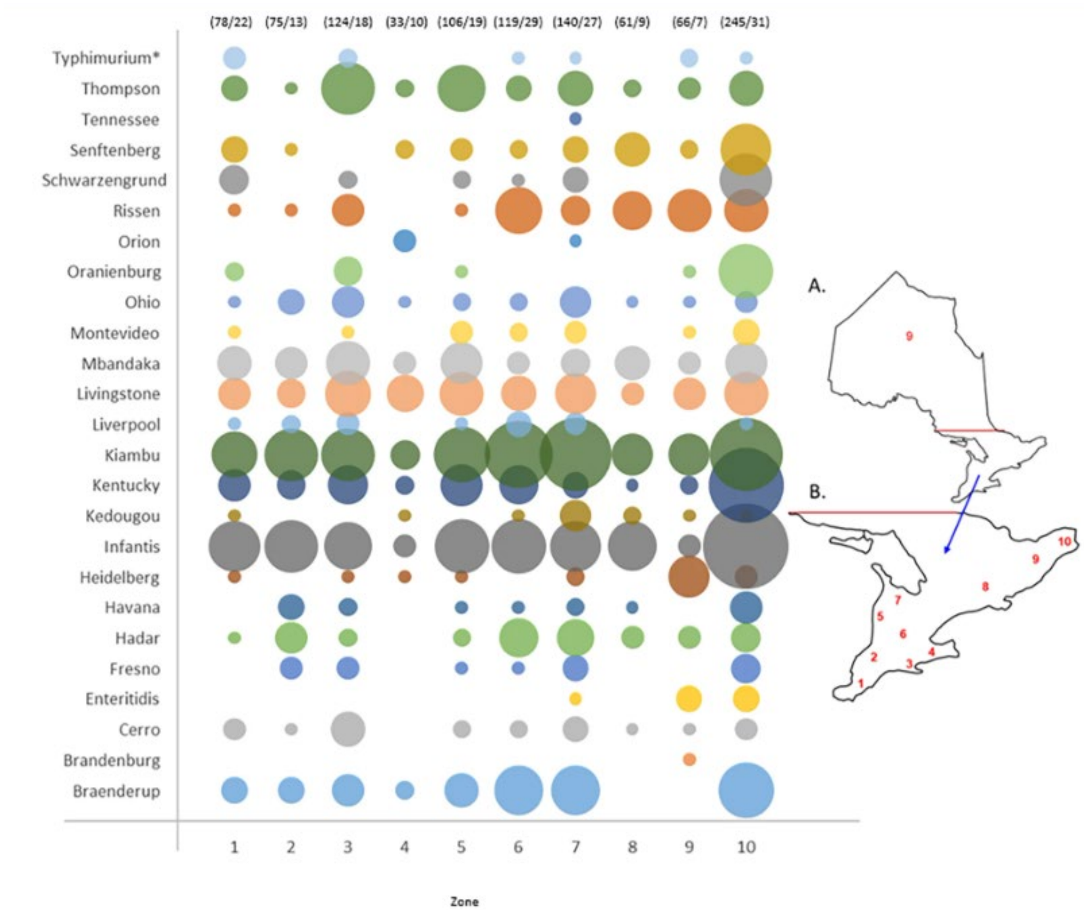

Figure 1.

Figure 1. *Serovar distribution based on CRISPR-SeroSeq analysis of 430 Salmonella positive environmental samples collected from ten producer zones across the province of Ontario. Serovars detected within each of the zones are provided above each bubble column as frequency of all serovars detected/number of quota in which the serovars were detected. Poultry production zone numbers and their relative positions are shown in red within the map of Ontario.* **Notes:** *Zone 1 (n = 40), Zone 2 (n = 27), Zone 3 (n = 46), Zone 4 (n = 19), Zone 5 (n = 43), Zone 6 (n = 58), Zone 7 (n = 63), Zone 8 (n = 21), Zone 9 (n = 28), and zone 10 (n = 85). *Salmonella Typhimurium cannot be distinguished from its variant I 4,5,12:i:-.*

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Salmonella Kiambu and Infantis were the most common across the different geographical zones. *Salmonella* Rissen was detected more often in northern zones as compared with southern zones.Within a farm, different sampling surfaces were found to carry different serovars, although 1–2 common serovars were detected from all surface types sampled based on examination of a limited number of farms. The ventilation fan samples resulted in a higher average number (2.7) of serovars detected per sample as compared with the overall average (2.4). More serovars were detected in warm months (June–October), with an average number of 2.6 serovars detected per sample as compared with cold months (November–March), with an average number of 2.1 serovars detected. Overall, the CRISPR-SeroSeq method detected *Salmonella* serovars, on average, 3.3 times more frequently than those detected by traditional culture. In 616 instances among 384 samples that were serotyped traditionally, a serovar detected by CRISPR-SeroSeq was missed in the same sample by culture. This included *Salmonella* Enteritidis, the primary serovar of concern to egg farms, which was detected by CRISPR-SeroSeq and missed by culture among one of the three occasions when it was detected among 5,392 environmental samples tested over a ten-month period.

The most common *Salmonella* serovars (Kiambu, Infantis, Kentucky, Livingstone, and Mbandaka/Montevideo) detected by CRISPR-SeroSeq in the Ontario study reflect a significant change in predominant serovars, as reported previously. A study of pullet

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layer and pullet farms from 2002–2003 in Ontario identified serovars *Salmonella* Heidelberg, Typhimurium, Thompson, Schwarzengrund, and Agona as the most common.[22] A subsequent study of egg layer and pullet grower operations in Ontario from 2009–2010 again identified *Salmonella* Heidelberg (50.7 percent) as the most prevalent serovar, followed byThompson, Schwarzengrund, Agona, and Kentucky.[23] A more recent temporal study of fluff samples from Ontario poultry hatcheries from 2009–2018 revealed *Salmonella* Kentucky, Enteritidis, Heidelberg, and Senftenberg as the most frequently isolated serovars.[24]

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One of the most significant changes is *Salmonella* Heidelberg, which showed high prevalence in previous studies but was detected in only 5 percent of farms in the authors' recent study.[3] A decrease in *Salmonella* Heidelberg prevalence in poultry was also observed from 2016 to 2020 in a study conducted in the U.S.[21] Another significant change is *Salmonella* Kiambu, which emerged as the most frequently detected serovar by CRISPR-SeroSeq and the third most frequently detected serovar by culture on Ontario poultry farms,[3] although it was under-reported previously. This occurrence is of particular concern since *Salmonella* Kiambu was implicated in 23.5 percent (50/213) of the 2017 *Salmonella* outbreaks in the U.S.[25] *Salmonella* Rissen was another emerging serovar in the authors' study, with a detection rate of over 21 percent on the farms by CRISPR-SeroSeq, but it was detected in just 1 percent of farms by culture.[3] Significant underestimation of *Salmonella* Rissen previously or by culture is of concern since

Salmonella Rissen has also been recognized as an under-reported and emerging serovar among humans in different countries.[26]

Toward more Effective Monitoring of *Salmonella* on Poultry Farms

With the availability of numerous PCR methods and the validated CRISPR-SeroSeq method, it is now feasible to detect *Salmonella* serovars without culture isolation to improve current *Salmonella* monitoring programs on poultry farms or production facilities. An overall testing approach is depicted in ***Figure 2***. Poultry environmental samples are first pre-enriched in BPW for 18–24 hours. The pre-enrichments are then subjected to real-time PCR to screen for the presence of *Salmonella*. PCR-positive samples are analyzed via CRISPR-SeroSeq to identify *Salmonella* serovars contained in the samples. CRISPR-SeroSeq can deliver serovar results within 36–48 hours from DNA extracts of the PCR-positive samples. When culture confirmation is needed (e.g., upon detection of a critical serovar, such as *Salmonella* Enteritidis, or for outbreak investigations), PCR-positive pre-enrichments can be subjected to immunomagnetic separation (IMS) to concentrate the target cells, using magnetic beads covalently bonded with antibodies specific to *Salmonella* species, or to a selected subgroup (such as Group D) of *Salmonella enterica*. The *Salmonella* cell concentrates are then enriched in a secondary selective medium, such as RVS, TBG, or other selective media, for 18–24 hours. The secondary enrichments can also be subjected to CRISPR-SeroSeq to identify *Salmonella* serovars, or subjected to culture isolation by plating onto selective agars.

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Suspect *Salmonella* colonies are confirmed by biochemical reactions or by PCR. Confirmed colonies are serotyped traditionally or by WGS. In this case, a high number of target colonies from each presumptive *Salmonella* positive plate must be tested to increase the detection rate if all *Salmonella* serovars or less abundant serovars need to be confirmed culturally.

Figure 2.

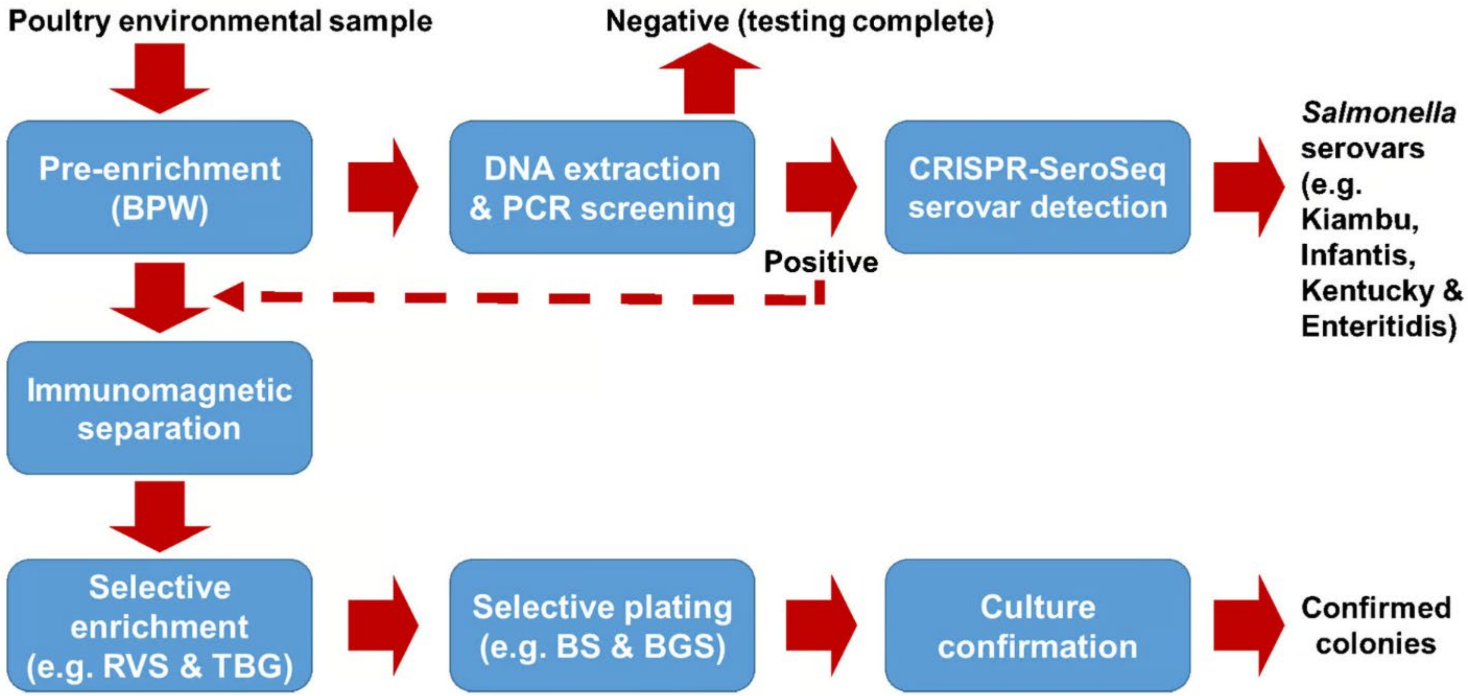

Figure 2. *An integrated approach to monitoring Salmonella on poultry farms, using polymerase chain reaction (PCR) and high-throughput sequencing (HTS) testing methods.*

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Summary

Salmonella outbreaks, poultry diseases, and poultry product contamination events associated with various *Salmonella* serovars emphasize the need for monitoring all serovars in the poultry production chain. This monitoring will help gain insights into serovar dynamics and emerging serovars, and ensure detection of serovars of critical concern to help improve mitigation practices. Environmental samples from poultry farms often readily reveal the presence of *Salmonella* in flocks, the ultimate source.

Rapid PCR screening methods are readily available for detection purposes. Detecting all *Salmonella* serovars routinely via advanced metagenomics tools is technically feasible at present in a limited number of food safety testing laboratories. Increased implementation of the available technologies and tools in monitoring programs—after proposed regulatory framework changes, specific guidelines, and protocols are defined—is expected to help reduce *Salmonella* infections linked to poultry products.

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Plant Manager's Guide to Food Safety Intervention Strategy

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Plant Manager's Guide to Food Safety Intervention Strategy

Managing food safety programs and compliance inside of processing facilities means staying ahead of customer demands and compliance

By *Jake Watts, Senior Vice President of Field Operations & Food Safety for PSSI Food Safety Solutions*

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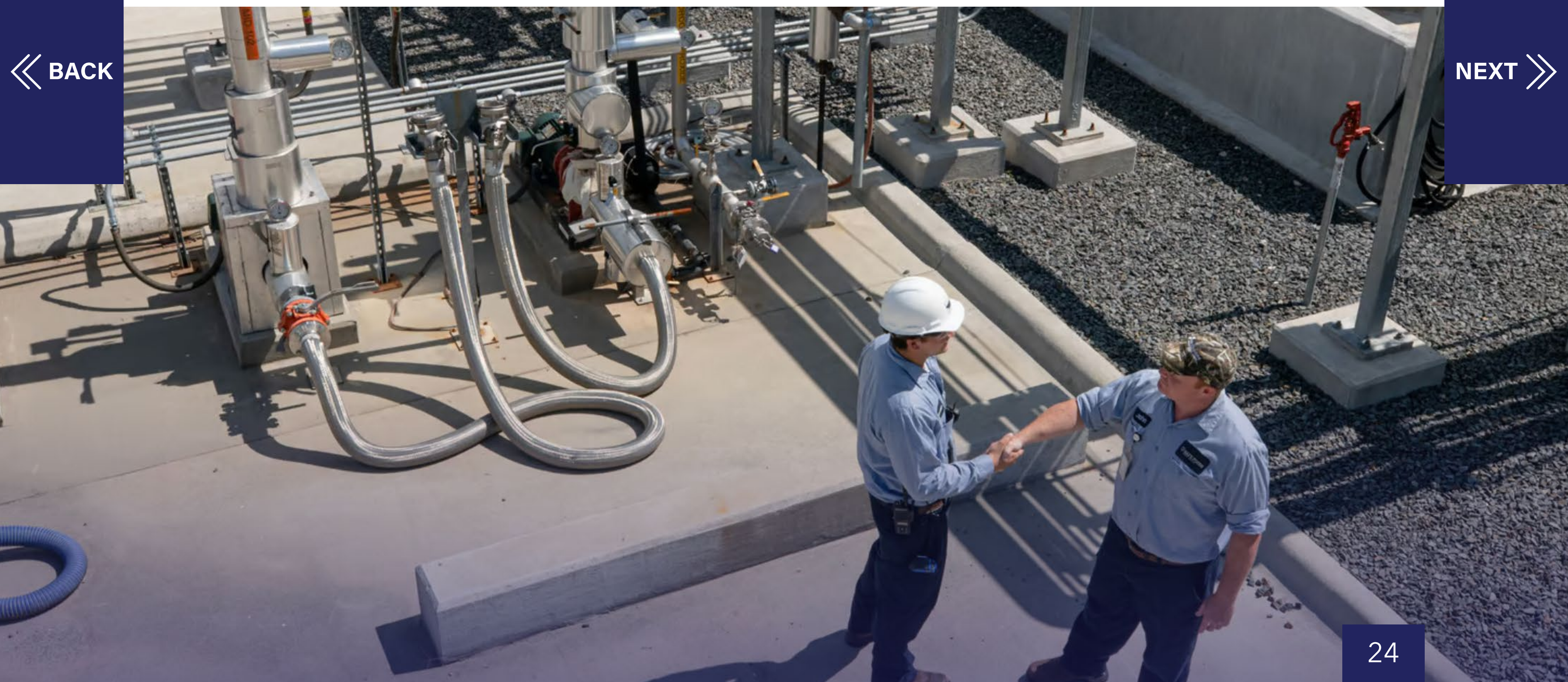

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Managing food safety programs and compliance inside of processing facilities is an increasingly difficult job for plant managers. The evolving and ever-changing regulatory landscape is becoming stricter and more complex every year. It puts significant pressure on plant managers and internal food safety and quality assurance (FSQA) teams to keep up with the equipment, resources, and processes needed to stay ahead of customer demands and compliance.

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CDC estimates that each year roughly one in six Americans (or 48 million people) get sick, 128,000 are hospitalized, and 3,000 die of foodborne diseases.

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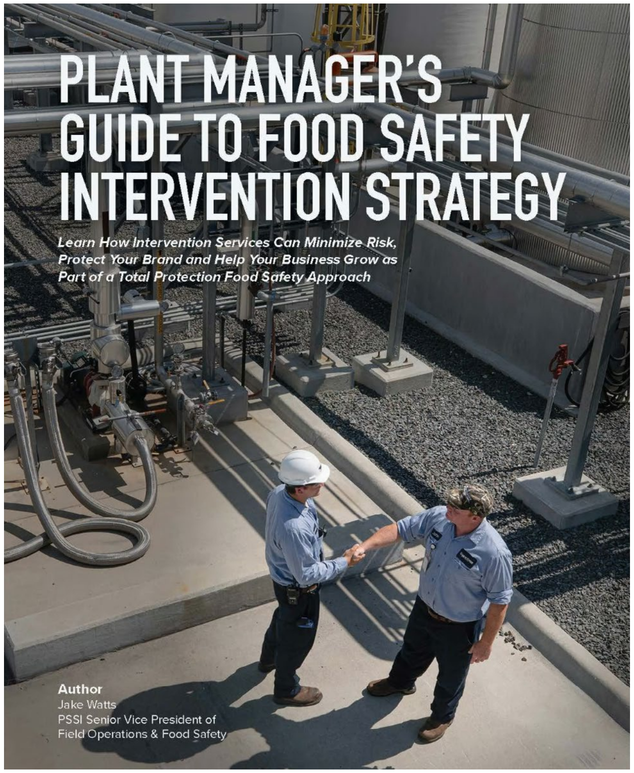
DOWNLOAD this report authored by Jake Watts, Senior Vice President of Field Operations & Food Safety for PSSI Food Safety Solutions, to learn how intervention services can minimize risk, protect your brand, and help your business grow as part of a total protection food safety approach.

Figure 1.



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Simplifying Sanitation Standard Operating Procedures

Simplifying Sanitation Standard Operating Procedures

Cleaning/sanitizing SOPs should not be integrated to the "regulatory" requirements of SSOPs, but instead maintained as a separate set of documents

By *Michael Cramer, CQA, PCQI, former Senior Director of Food Safety and Quality Assurance (retired) for Ajinomoto Foods North America*

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It is my hope that those who worked with me during my food industry career found me to be a logical, thoughtful, and rational individual when it comes to developing and implementing food safety and quality programs. However, there are certain things that I hear during discussions with food professionals that drive me crazy—and it is sometimes a very short drive! For example, I can feel myself starting to cringe when I hear someone refer to "my SSOPs" *plural*! Although I try not to sound incredulous, my retort is often, "Why would you have multiple SSOPs?" As the discussion progresses, it becomes clear that what they are referring to is a conglomeration of their SSOP and their general cleaning procedures, which then leads to another serious discussion as to why these documents have been combined.

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In this article, I present my thoughts on how general cleaning procedures (Standard Operating Procedures, or SOPs) differ from Sanitation Standard Operating Procedures (SSOPs) and why they should remain separate. First, I will define SOPs.

The Basics of Standard Operating Procedures

I like to use a quote from W. Edwards Deming when teaching about SOPs to help define their objective. Dr. Deming stated, "If you can't describe what you are doing as a process, you don't know what you're doing." The purpose of the SOP is to ensure that you understand the process and can define standardized steps in the process. By doing this, you can ensure an effective process to prevent food safety, quality, or productivity issues and to provide consistent output from the process. It is for this reason that the development of SOPs should be carried out with a cross-functional team of subject matter experts (SMEs) such as food safety and quality, operations, sanitation, etc. Their combined knowledge and perspective can help ensure that the details of the process, and even the terminology that is used, result in a document that shows the team understands the process and can implement continuous improvement or make corrections when challenges arise.

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Developing a cleaning/sanitizing SOP will be driven primarily by sanitation leadership, but it should include input from food safety and quality, maintenance, and operations. An effective SOP will include *what* is to be done [covering sanitation personal protective equipment (PPE), tools, and steps for cleaning and sanitizing], *how* it is to be done (including process details, frequency of the steps, and limits to demonstrate conformance), as well as *why* it is being done (such as to eliminate potential microbial contamination, remove allergen protein, or to enhance operational efficiency).

The completed document will be used to train sanitation personnel, including new sanitors, and performance will be monitored to ensure conformance, as well as efficacy of the procedure. Observation of cleaning/sanitizing SOP implementation may result in changes to the procedure to improve efficiency and efficacy. In working with chemical supplier technical personnel, sanitation leadership may determine that a new or different chemical is needed for efficiency or efficacy. Supply chain disruption may change the types of PPE, utensils, or chemicals that will be used to guarantee that the sanitation process can be continued without disruption.

For these reasons, the general cleaning/sanitizing SOPs should not be integrated to the "regulatory" requirements of SSOPs, but instead should be maintained as a separate plant operational set of documents. To further explain the rationale for keeping these separate, it will be beneficial to review SSOPs to define their requirements and how they differ from general SOPs.

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Sanitation Standard Operating Procedures

Following some of the foodborne illness outbreaks of the late 1980s and early 1990s, particularly involving meat and poultry products, the U.S. Department of Agriculture (USDA) took significant steps to implement new regulations to protect consumers and the food supply. These regulations included requirements for implementation of Hazard Analysis and Critical Control Points (HACCP) and Sanitation Standard Operating Procedures (SSOPs) with a focus on prevention rather than detection of food hazards. The regulations for SSOPs can be found in 9 CFR 416: Sanitation.[1] The regulations state that USDA establishments will develop and implement procedures to prevent direct contamination or adulteration of meat and poultry products. Specifically, they address cleaning, inspection, and sanitizing of USDA facilities, as well as maintenance of sanitary conditions during operations. SSOP regulations are supplemented by FSIS Directive 5000.1: Sanitary Performance Standards, which address maintenance of the facility and grounds conditions that may impact sanitary operations. The SSOP document and the maintenance of operational conditions will be monitored by FSIS inspection personnel on a routine basis, specifically depending on the daily tasks they are assigned.

The SSOP document is usually reviewed by FSIS inspection personnel when they rotate into a facility. It is also reviewed by an enforcement investigation and analysis officer (EIAO) when they conduct a food safety assessment. They will specifically seek to determine if the regulatory elements of the SSOP are addressed. The specific requirements for the SSOP include the following:

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1. The business name and address of the establishment, establishment number, and contact information

2. The names of the establishment management personnel who are involved in decision-making and the sanitation process (this may include the owner/CEO, quality assurance manager, and sanitation manager)

3. Specific verbiage regarding responsibility for implementation and upkeep of the SSOPs, monitoring, record keeping, and documentation of corrective actions,

including the maintenance of checklists and their availability to inspection personnel

4. Specific verbiage instructing that all food contact equipment and facility surfaces, including utensils, will be cleaned and sanitized prior to the start of production on a specified frequency

5. General cleaning procedures that include verbiage such as:

- Equipment will be disassembled as needed prior to cleaning
- Product debris will be removed
- Equipment and parts will be rinsed with clear, potable water to remove remaining debris
- Chemical cleaner will be applied to parts and equipment to remove soils
- Equipment and parts will be rinsed with clear, potable water to remove cleaning chemicals
- Parts and equipment will be inspected, and all findings will be documented including corrective actions for non-conforming findings
- Sanitizer will be applied, and equipment will be reassembled

6. Operational sanitation will be monitored to ensure that all operations are properly conducted

7. Documented operational inspection will be conducted, including corrective actions for any non-conforming findings.

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The SSOP document will be signed and dated by the person at the establishment with the highest authority for decision-making. The SSOP will also be reassessed for needed changes at least annually, or if significant food safety issues (microbiological, chemical, or physical) occur or a product removal action (such as a recall) is initiated. Any modifications will be signed by the person with the highest authority at the establishment.

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Simplicity is Key (and Highly Beneficial)

The SSOP document is straightforward and fairly simple. It can be as short as two pages and should not be longer than three. It meets regulatory requirements, but does not delve into specific details such as water temperatures, chemical strengths, mechanical actions, or specific chemicals and tools used for sanitizing.

Why is simplicity important in an SSOP? As previously mentioned, the SSOP is a document that USDA inspection personnel can request to review. If it is written to meet specific regulatory requirements, then it will comply with regulation and should not result a noncompliance report or noncompliance findings during a food safety assessment. Remember, the more detail that is included in an SSOP, the more elements USDA will be able to assess for compliance. Unnecessary details provided in the SSOP that may not be specifically or consistently met (i.e., water temperatures, chemical strengths, tools used) can result in noncompliance reports.

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Your company may occasionally trial different chemicals, or you may experience supply challenges that restrict the availability of PPE, or new personnel may not prove to be proficient at their job. All of these can result in a noncompliance finding by inspection personnel. For this reason, I recommend keeping SSOP information and general cleaning/sanitizing documentation separate, as this allows you the flexibility to clean the plant effectively even if it is not consistent with your general procedures.

References

1. *Code of Federal Regulations*. Title 9, Chapter 3, Subchapter E: "Part 416—Sanitation." July 25, 1996. https://www.ecfr.gov/current/title-9/chapter-III/subchapter-E/part-416.

***Michael Cramer, CQA, PCQI,** retired in July 2021 as Senior Director of Food Safety and Quality Assurance for Ajinomoto Foods North America. He is a graduate of West Chester University with a B.Sc. degree in health science. He has spent over 40 years in food manufacturing for meats, poultry, and frozen entrées. He authored the book* Food Plant Sanitation, *as well as numerous articles for* Food Safety Magazine, *where he is a member of the Editorial Advisory Board. He is a Certified Quality Auditor and PCQI.*

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Prioritizing Chemical Handling Safety

Steps you can take to minimize risk of chemical accidents and improve performance

By *Dr. Todd Coleman, Director of Research and Development at Safe Foods Chemical Innovations*

When it comes to managing sanitation and food safety inside of food processing plants, one of the most overlooked topics related to safety is chemical compatibility and inadvertent mixing. It is the cause of some of the most frequent and catastrophic injuries.

Chemistry is a complex and confusing topic. The chemical names can be long and difficult to pronounce, much less spell. For example, take sodium chloride and sodium chlorite. The difference in spelling is just a 'd' vs. a 't,' but the reactivity is monumental. Sodium chloride is common table salt, while sodium chlorite is a power oxidizer which ignites into flames in a dry state.

To further the confusion, the chemicals are sold under trade or brand names. These trade or brand names have great marketing power, but generally disguise the composition of the product. Unless a person is trained or curious enough to find and read the safety data sheet, there is a lack of awareness for the product composition. Sanitation products are sold as KC-568, KC-644, and KC-410. Intervention products are sold as Promoat® XL, Cecure®, or Citrilow®.

Most of the time, the sanitation or intervention teams that are handling these chemicals are not trained chemists, so training and education is extremely important. However, high turnover in both the sanitation and intervention industries make it especially challenging. The inconsistency and general lack of knowledge and understanding of the products among users is a leading cause of personal exposure and chemical compatibility incidents.

Dr. Todd Coleman, Director of Research and Development at Safe Foods Chemical Innovations, is dedicated to helping plants solve these issues and minimize as much risk as possible. He and his team of cross-functional experts work together with food processing plants to develop and design customized solutions to help minimize risk with chemical use.

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While unfortunately the turnover in labor is not something that can easily be solved, Dr. Coleman has several recommendations to help simplify the training and handling of chemicals to avoid compatibility or mixing issues, outlined below.

1. **Deliver chemicals in bulk.** Specifically in larger facilities, Dr. Coleman recommends bulk delivery and receiving systems whenever possible. It is not only a more cost-effective and environmentally friendly solution over the long term, but it also cuts down significantly on the number of people that handle the chemicals. This is not feasible for all products, but consideration should be given for larger-volume products.
2. **Use color-coding strategies.** Color-coding can be a very effective strategy in simplifying the training for chemical products. Dyes can be added to products in see-through bulk tanks, or color-coded packaging can help minimize the mix-

up of certain products. This type of quicker reference can help with efficiency in sanitation, as well as minimize product mixing errors.

3. **Invest in safety-first engineering solutions.** Work together with your chemical partner to design engineering and automation solutions that are built specifically with safety in mind. Dr. Coleman says that facilities that request the retrofitting of existing tanks often experience safety or performance issues. The Safe Foods Chemical Innovations team has designed bulk delivery systems for peracetic acid (PAA) and Ajust® (liquid caustic). The systems are designed to: 1) measure and communicate key parameters (temperature, pressure, level, etc.); 2) detect leaks and prevent overfills with interlocking safety systems; and 3) comply with Chemical Federal Anti-Terrorism Standards (CFATS) and other regulatory standards.

   Customized engineering solutions can also play a key role in protecting and innovating food safety, as well as employee safety. The Safe Foods Chemical Innovations team focuses heavily on R&D, helping its partners solve problems and advance food safety at all levels. The team recently developed an innovative solution, adapted from other processing industries, that assists the elimination of debris inside scalder units, thereby significantly reducing the level of microbes, reducing water usage, and improving the sanitation process.

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Be proactive to get ahead of the risks related to chemical use before they happen. Find a partner with the expertise and experience to help develop customized solutions to solve your needs. Safe Foods Chemical Innovations is a team of professionals ready to help, with varied skill sets ranging from animal science to synthetic chemistry to engineering disciplines to formulation chemistry, dedicated to aid food processors in maximizing quality and minimizing risk.

CONTACT PSSI to learn more.

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COMPLIANCE FOCUSED.
SAFETY DRIVEN.
TOTAL SANITATION SOLUTION.

Building a Culture of Hygiene in the Food Processing Plant

One of the crucial building blocks for a successful food safety or quality culture is basic food hygiene

By *Richard F. Stier, M.S., Consulting Food Scientist*

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It seems that today's world is becoming one of different cultures in all walks of life and business. In the food processing and handling industry, "food safety culture" is a growing and evolving concept. Food quality cultures have been established in the past, but the fact remains that one of the crucial building blocks for a successful food safety or quality culture is basic food hygiene. It is a logical progression that the industry must make a commitment to creating a hygiene culture. Far too many problems can be traced back to failures in basic hygiene such as poor cleaning, insufficient pest management, inadequate personal hygiene, improper clothing, or a failure to follow basic procedures.

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In 1778, Reverend John Wesley used the phrase, "Cleanliness is next to Godliness" in a sermon. He was urging his parishioners to live a clean life with God and humankind. The author mentions this because of the importance of cleanliness in the world of food and how the commitment to what seems so simple can minimize a myriad of problems in a society that seems to become more litigious by the day. It is imperative that processors try to do all that can be done to protect their business.

So, where does hygiene start in a food processing facility? How about the entrance(s) to the facility? This means the front door where visitors and office staff enter, the access point(s) for plant workers, and the entryway that more and more facilities have established—the trucker's entrance. Depending upon the operation, there may be another one or two entrance points.

Building Access

Everyone entering a food processing facility needs to know and adhere to a set of rules that address food safety, basic sanitation, proper hygiene, and safety. This includes visitors of all kinds—customers, regulators, auditors, salespeople, and any other visitors. This is something that an auditor will expect to see, and it will be included in the auditing process. The expectation today is that anyone entering the facility will be presented with a list of plant rules that they must read, as well as a form they must sign acknowledging that they have read and understand the rules. The sign-in form may look something like that shown in Figure 1.

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Figure 1.

VISITOR SIGN-IN								
DATE	NAME (Print)	SIGNATURE	COMPANY	VISITING PERSON	ESCORT	TIME IN	TIME OUT	READ AND UNDERSTAND PLANT RULES (YES/NO)

The rules vary between plants, but they will usually include requirements regarding the following:

1. Handwashing
2. Clothing
3. Hair and facial hair covers
4. Jewelry
5. Makeup and perfume
6. Illness/injury
7. Cellphones
8. Photography
9. Escorts.

Details as to what each of these points require in terms of hygiene will be addressed later in this article.

Some operations have set up small projection rooms near access points. Visitors of all persuasions will be asked to watch a short video that addresses plant rules; a picture is worth a thousand words. The visitors are then asked if they understand the rules and to sign a form that they watched the video and understood the contents. The author has also visited facilities over the past few years that have a second set of rules addressing COVID-19 protocols.

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The procedures and restrictions making up the plant rules are all elements of a good hygiene culture and are there to minimize the potential for cross-contamination of foods, equipment, utensils, other people, and ultimately your customers.

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What is Expected from Visitors and Staff

Visitors to a facility only need to read and understand the rules and follow them. They will also be escorted whenever they are in the production area or warehouse, so there will be a member of the team supervising their conduct within the facility. The supervising staff will be expected to remind or reprimand a visitor if an incident occurs that is against the rules.

The author witnessed such an incident during his work in industry. A corporate staff member from the main office visited the plant and wanted to tour the production floor. A junior member of the quality group refused to let him onto the floor until he was properly kitted up—meaning a hair net, work coat, proper shoes, etc. The corporate guy ranted and raved in response to the request, and then stormed upstairs to the main office with the quality person trailing behind. He burst into the plant manager's office and demanded that the junior quality worker be fired. After getting to the bottom of what had happened, the plant manager brought the quality worker into his office, commended him in front of the corporate guy, and asked that the man apologize because the quality worker had done his job.

The procedures and restrictions making up the plant rules are all elements of a good hygiene culture and are there to minimize the potential for cross-contamination of foods, equipment, utensils, other people, and ultimately your customers. Some of these rules have other roles, such as personal safety.

Handwashing

Handwashing is perhaps number one on the list of good hygienic practices that protect products and people. Every year, numerous outbreaks are caused by fecal-to-oral transmission of pathogens. Processors must mandate and indoctrinate their employees on the importance of good handwashing practices. They must ensure that the facility is equipped with enough hands-free handwashing stations, and that these stations are properly supplied at all times. Instilling handwashing discipline starts with the orientation of new employees, continues with yearly (or more frequent) refreshers, and perhaps includes surprise hand swabbing.

Two excellent programs can be used to help demonstrate the importance of handwashing. One is to bring your team together and have several individuals place their unwashed fingertips on petri dishes with plate count agar. Have them wash and dry or wash, dry, and sanitize their hands, and then repeat the exercise. It is a graphic demonstration of the efficacy of handwashing. Another program entails the use of a proprietary hand oil, followed by handwashing and examination of the hands under ultraviolet (UV) light to expose how well the person has washed their hands.

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Clothing

Clothing should be designed to be comfortable, yet pose no potential risks for product contamination. Buttons and chest or shoulder pockets should never be part of the uniform or clothing provided to plant workers. Buttons can pop off and end up in product, so snaps or Velcro are recommended. If the garb has pockets above the waist, one tempts fate. Someone will put something in the pocket that can fall out into product on the processing line. Many operations mandate that the shirts, lab coats, or smocks they provide have long sleeves with elastic wrist bands at the end to further protect product from sweat or hair shedding. Uniforms should be tight-fitting and made of materials that do not easily tear or shred and are easily cleanable. This for both comfort and safety. Loose-fitting clothing can get caught in belts or moving parts and result in injury to the worker. The clothing must also be appropriate for the operation. People working in meat processing operations (which generally are held at 50 °F/10 °C or below) must be provided with warm clothes befitting the environment.

Most companies provide their plant or warehouse workers with some kind of uniform. What kind depends upon the type of operation. A processor whose operation consists of a "kill step" of some kind will clothe the workers on the "raw/uncooked" side of the plant with a uniform or hat of one color, whereas those working on the cooked side, after the kill step is implemented, will be outfitted with different colors. If one wishes to move between the two sides of such an operation, they must pass through a changing room, where they will wash hands and change uniforms and boots or shoes, to avoid cross-contamination from raw to cooked product. Some processors do allow their teams to work in street clothes, but these are typically low-risk products such as soft drinks. In these operations, the processing system is closed and the lines are high-speed, so the chances of product contamination are low.

Finally, let us touch on uniform cleaning. More and more companies have moved to a service that provides uniforms, repairs them, and picks up the clothing for cleaning.

This can also be done in-house. The bottom line is, if a company does elect to use a uniform service provider, it is important to treat the candidates as one would any supplier—e.g., subject them to the vendor approval process, which includes conducting an audit of their facilities. It is important to ensure that the uniforms are not only being properly cleaned but that they are also being cleaned and handled under conditions that will ensure product safety and minimize the potential for contamination. Lastly, do not rely on your workforce to bring work clothing home and launder it themselves. I have seen companies who have established this as a policy and had it backfire on them.

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Additionally, many companies will fund the purchase of a specific kind of work shoe that can only be worn in the plant. These are often non-slip and have steel toes or shanks for safety, and are cleanable.

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Hair and Facial Hair Covers

Hair restraints are essential for all employees and must be worn so that all hair is covered and held within the restraints. Many companies mandate that hair restraints cover both the hair and ears to ensure that a worker's hair is fully contained. If a man is wearing a moustache and/or beard, then it must be covered with a snood (beard cover). Companies should not try to regulate how much facial hair a man can have before it must be covered; both pencil-thin and bushy moustaches need to be covered. Some plants have strict rules against facial hair, negating the need for snoods.

Hair restraints also have another benefit—worker safety. Many years ago, the author was asked to be an expert witness in a case in which a woman with long hair was killed because her hair became caught in the moving parts of a piece of equipment. It turned out that she had lobbied her boss to waive the hair restraint requirement because she did not want her hair to become messy.

Hats may also be worn, and the industry is moving toward mandating hats that can be easily washed and sanitized. This means that baseball caps are now forbidden in many plants. Why? Baseball caps go everywhere—fishing trips, softball games, gardening rounds. They cannot be cleaned well, and they are often downright filthy.

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The illness rule for food plant workers is very simple: if you are sick, then you do not work. This basic rule is addressed during orientations for new employees and during refresher sessions.

Jewelry

Jewelry is also not allowed in food processing facilities. Why? It poses a potential risk of product contamination. This includes visible piercings—even oral jewelry, such as a tongue piercing. The only pieces of jewelry that are allowed in some plants are plain wedding bands and medical alert bracelets or necklaces. The latter must be completely covered by a long-sleeved garment with elastic wrist bands. Medical alert necklaces must be worn underneath the shirt. Many operations mandate that any person wearing a plain wedding band must wear a glove over the hand with the band.

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Let us not forget gloves. Most food processors mandate that any worker handling food must wear gloves of some sort, depending on the operation. The food industry has evolved in this area. Industries using disposable gloves now use gloves made of nitrile, as latex gloves are associated with severe allergies in some people. Many operations use gloves that can be worn repeatedly. If this is the case, then the workers and management need to monitor the gloves for wear and tear and replace damaged gloves. It is important to remember that just because one is wearing gloves does not mean that they cannot contaminate product. Gloves must be cleaned and sanitized or replaced if they get dirty or if someone does work away from the line, such as dumping a trash barrel.

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The author has visited food processing facilities that post photographs of exactly how a worker or a visitor should dress, including a step-by-step progression of how each item—from smock to boots to hair nets—should be worn. This provides visitors with an excellent road map on how to dress, and a constant reminder to the workforce of what is expected of them.

Makeup and Perfume

Processors also need to establish policies regarding makeup, scents, and accoutrements like false eyelashes, nail polish, and false nails. These items are simply not allowed in food plants. Nails and eyelashes can fall into product; nail polish can chip, and makeup can flake off. Perfumes, aftershave lotions, and other scents may be absorbed by foods, especially foods that contain fats. These policies may seem discriminatory, but the bottom line is product and consumer protection.

Illness/Injury

The COVID-19 pandemic raised awareness around the world regarding contagion and the spreading of disease. This was an event in which the food processing industry was ahead of the curve. Most food processors had established policies regarding sick or injured workers and their participation in process operations. Some companies already mandated masks for workers in the pre-COVID-19 days.

The illness rule for food plant workers is very simple: if you are sick, then you do not work. This basic rule is addressed during orientations for new employees and during refresher sessions. Workers who have infections or open wounds either do not work (depending upon the severity of the wound or infection), or must keep the injury completely covered. The industry has evolved in the area of bandages. Today, processors usually maintain a stock of brightly colored (blue or green) metal-detectable bandages. The bright colors make them visible if they fall off, and the metal component allows them to be detected by a metal detector if they happen to end up in a food product. Of course, each delivery of metal-detectable bandages must be checked to verify that they are metal-detectable when they are delivered. A sub-sample from each lot will need to be tested.

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Challenges with employee health are a continuing issue. It is up to workers to indicate to management that they are ill, and it is up to management to monitor workers to ensure that someone who is ill is taken off the line. Workers may not want to report a problem because they "need the hours," so what should a processor do? Hopefully, the company has a fair sick leave policy in place that allows people to miss a few days due to illness. Some companies deal with a sick employee by giving them a task where they are not exposed to products on the line or to other people.

If one has had a chance to travel in other countries, one may have observed much more stringent policies regarding worker health than those established in the U.S. Some countries subject potential food plant employees to a battery of tests including tuberculosis, blood tests, stool samples, urine samples, and a complete physical exam. Both new and existing employes can be subjected to this kind of screening. If they fail, then they are not allowed back to work until they test negative. This practice would be deemed "discriminatory" in the U.S.

Cellphones

Let us touch on another point: cellphones. Processors should mandate that personal cellphones be kept in the employee's car or locker. Cellphones pose a risk because they cannot be sanitized and they have a camera, which are not allowed in most plants and which are both a potential distraction and safety risk. Keep cellphones out of the plant and warehouse.

Photography

It is up to each and every food processor, handler, and warehouser to develop, document, and implement a policy regarding photography of their operations. This is a much greater challenge today compared to 20 years ago because nearly every cellphone has a high-quality camera with the ability to capture both pictures and video.

Additionally, most people tend to carry their cellphones on their person at all times, which means they are always in possession of a portable camera/video recorder. With this in mind, every thorough photography policy must include a ban on cellphones within the plant, as explained above. This should be described in a separate policy that specifically addresses cellphones.

Food processing operations that are regulated by the U.S. Food and drug Administration (FDA) must also factor the agency into their camera policy. Ideally, every processor or handler should have established, documented procedures on how to address a regulatory inspection—a procedure that should start with the receptionist or whomever is responsible for meeting visitors to the facility. The *Investigations Operations Manual* (IOM) emphasizes that FDA investigators have the right to take photographs:[1]

Since photographs are one of the most effective and useful forms of evidence, every photo should be taken with a purpose. Photographs should only be taken for evidentiary purpose, e.g., to document violations and environmental surface subsample sites. Photographs should be related to insanitary conditions contributing or likely to contribute filth to finished product, or to practices likely to render it injurious or otherwise violative.[1]

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The IOM lists seven specific conditions or examples of insanitary practices that could be photographed:

1. Evidence of rodents or insect infestation and faulty construction or maintenance, which contributes to these conditions
2. Routes of, as well as, actual contamination of raw materials or finished products
3. Condition of raw materials or finished products
4. Employee practices contributing to contamination or to violative conditions
5. Manufacturing processes
6. Manufacturing and various control records showing errors, substitutions, penciled changes in procedure, faulty practices, deviations from GMPs, NDAs, or other protocols, altered or inadequate assays or other control procedures, and any variation from stated procedure
7. Effluent contamination of water systems.[1]

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The IOM also describes two court cases that support FDA's position on its legal right to take photographs. The food industry may not agree with FDA's policy, but industry must abide by it. One point that should be mentioned is that the photography policy may vary between investigators and districts. This situation has created some tension between the industry and FDA.

Now, this is not to say that pictures should never be taken in a warehouse or plant. There are many conditions that might demand a photograph or two. Examples would be the delivery of a damaged or contaminated load, or a photograph of a rail car or truck to verify that it was properly loaded and that dunnage is properly located. With these kind of situations, it is the responsibility of management to give a one-time approval to document the situation. An example of how a photography policy for a food processing facility might read is described in this article.[2]

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Escorts

As previously explained, all visitors to a facility will be escorted whenever they are in the production area or warehouse. This means that a plant staff member will supervise their conduct within the facility at all times, and the supervising staff will be expected to remind or reprimand a visitor if an incident occurs that is against the rules. Neither visitors nor staff may bring unexpected visitors into the plant without approval from the appropriate person in charge. Also, it is recommended to record which staff member(s) served as the visitor escort(s) on the visitor sign-in sheet at the time of reception, in case any questions arise later pertaining to the visit.

In a food safety culture, quality culture, or hygiene culture, the ultimate goal is to ensure that the workforce understands why their tasks are important, their role in the program, and the consequences of failure to do the work as expected.

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Keeping the Plant Clean

An integral element of hygiene culture is making sure that the plant and grounds are kept clean. Most food processors have a dedicated sanitation crew that cleans up at the end of the day, usually on a cleanup shift. Cleanup crews have evolved over the years from what some might have considered the "dregs" of the workforce to a well-trained, well-paid group who take great pride in their work. Some operations reward cleaning excellence for different departments by pitting each operating group against one another for overall cleanliness. The group that performs the best for the week, month, or quarter are acknowledged among the entire workforce and given small bonuses, like grocery coupons, to reward excellence.

Most processors include pre-operational inspections of the processing lines, so the cleanup crews are evaluated not only by management, but also by the production staff prior to startup. If the lines were not cleaned properly, then production will flag the area that failed and hold up production until the area is cleaned and approved by the quality group. This wastes time and money, so the mantra for the cleanup crew is "Do it right the first time."

Educating the Workforce

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Creating a culture of hygiene among plant workers starts with proper education. An integral component of education is not only teaching someone how to do something, but also successfully conveying *why* the work is important and *how* to do it the right way. In a food safety culture, quality culture, or hygiene culture, the ultimate goal is to ensure that the workforce understands why their tasks are important, their role in the program, and the consequences of failure to do the work as expected.

The educational programs should include orientations for new employees on food safety, quality, sanitation, and basic hygiene, as well as specific programs on how to do their assigned tasks, along with regular refreshers to review new or old issues. Hopefully, these programs will instill in workers a sense of pride in the processing facility, its products, and the company, so that they will feel their roles are necessary and important.

Management's Role

Of course, none of this is possible without a firm commitment from management. It is up to management to develop the policies and provide the financial and top-down support for the programs. One of the great strengths of the ISO 22000 food safety standard, "ISO 22000: Food Safety Management Systems—Requirements for Any Organization in the Food Chain,"[3] is the emphasis on management commitment and its role in building and maintaining a food safety management system, in which good hygiene is part of the foundation. This element of ISO 22000 is now an essential element in the Global Food Sfety Initiative (GFSI) and, therefore, part of most third-party audits.

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Years ago, the author worked with a company that printed its quality and safety mission statement on its business cards. Understanding and working hard to meet this goal was ingrained in the management team, and they worked hard to instill the same spirit throughout the organization. The CEO would visit his plants regularly and would talk to staff at all levels. He would occasionally ask the person with whom he was talking if they knew the mission statement. Workers who did, and who repeated it to him, were instantly rewarded with a $20 bill. Now, that information got around quickly, so people figured, "I think they mean it." And they did.

So, is cleanliness next to Godliness? It is, if one makes the commitment through management, education, and execution. Without commitment, cleanliness would be next to impossible.

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Safe Foods Partners with Category 3 Processing Plant to Address *Salmonella* Threat

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Safe Foods Partners with Category 3 Processing Plant to Address *Salmonella* Threat

The Safe Foods team worked together with plant leadership to create a joint action plan to bring the plant back to Category 1 status

By *Lindsey Perry, Ph.D., Director of Technical Services for Safe Foods Chemical Innovations, a division of PSSI Food Safety Solutions*

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A poultry processing plant in the U.S. was struggling with frequent positive *Salmonella* samples over an extended period. This plant was averaging more than one *Salmonella* positive per month on poultry parts. Several contributing factors were identified including both process and application inefficiencies.

The U.S. Department of Agriculture (USDA) Performance Standard for *Salmonella* on poultry parts is eight positive samples in a 52-week window. To be Category 1, the plant must be half the standard, or four positive samples out of a 52-week window. Anything over eight positive samples places the plant in Category 3, potentially subjecting it to a food safety audit in addition to intensified sampling.

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Additionally, when a plant has a positive sample for *Salmonella,* it remains on the plant's record for one year.

Solution

The plant partnered with Safe Foods to develop a food safety action plan to return to Category 1 status for poultry parts. Safe Foods, a PSSI company, is an industry leader in food safety with a strong history of helping processors meet or exceed regulatory standards. The Safe Foods team worked together with plant leadership to create a joint action plan with accountability assigned to both groups.

The action plan included a variety of process and equipment modifications targeted at ensuring proper coverage and concentration targets. The Safe Foods team also conducted root cause investigations into operational anomalies and led training sessions with the plant to improve consistency and control. Additional enhancements included the installation of new sensors that tie into the PSSI and Safe Foods MARC™ data analytics software.

Biweekly meetings between Safe Foods and the processing plant kept all stakeholders up to date on progress toward the end goal and assigned action items that each team was accountable to complete. These regular bilateral meetings are an essential part of the PSSI and Safe Foods proven process for food safety performance. As the meetings progressed and various improvements were implemented, the plant team was empowered to establish and maintain process control. Using MARC's™ data monitoring, alerting, and reporting capabilities, the team was able to track key metrics and make incremental changes to ensure the efficient operation of all food safety systems.

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Result

Since implementing the joint action plan, the plant has decreased the monthly number of *Salmonella* positives on poultry parts by more than 55 percent. In addition, the plant is on track to achieve Category 1 status on poultry parts.

The Safe Foods team created a partnership for success with the processing client through honest feedback and mutual accountability. They continue to work together to manage the new food safety plan, monitoring the new processes and data closely to ensure consistency and continued progress.

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How to Create a Culture of Food Safety

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How to Create a Culture of Food Safety

Delivering safe and high-quality food must be a top priority for everyone involved in the food industry

By *Jennifer Vincent, Consultant, Intellex*

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When it comes to food manufacturing, the safety and quality of the food we produce and serve are paramount. Creating a culture of food safety yields not only significant public health benefits in the form of consumer well-being, but also economic advantages. While the Centers for Disease Control and Prevention (CDC) reports that millions of Americans are affected by foodborne illnesses annually,[1] many of these are preventable. Preventing one food recall[2] could save a manufacturer millions of dollars in fines and lost sales from reputational damage.

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The *Food Safety Modernization Act* (FSMA), signed into law in 2011, serves as a guide for proactive food safety measures, with the goal of preventive practices over reactionary measures. While legislation such as the FSMA has helped the industry make progress toward reducing food contamination, food safety and quality cannot hinge on regulatory requirements alone.

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Delivering safe and high-quality food must be a top priority for everyone involved in the food industry, from food manufacturers and suppliers to grocery stores and restaurants, and from CEOs and CFOs to manufacturing plant workers. Food manufacturers can eliminate the risk of food contamination anywhere along the supply chain by creating a culture of food safety.

Why Food Safety Matters

The safety and quality of the food we eat have broad economic, business, and public health implications. Food safety is important for several reasons, including:

- **Public health protection.** Food is not just a product; it is something that humans ingest. When a company manufactures food products, the safety of what it produces directly affects public health. Failure to ensure food safety can result in serious consumer health risks.
- **Customer satisfaction.** Food is personal. A single bad experience with a particular food product will leave a lasting impression. Consumers are more forgiving when it comes to non-food items such as clothing, but a bad experience with food can lead to loss of trust and a loss of customers.
- **Cost savings.** Complying with food safety regulations and consistently producing high-quality food lead to cost savings in the long run. A strong commitment to food safety and quality results in customer loyalty, repeat customers, good product reviews, and a positive brand reputation. On the other hand, a breakdown in food safety can be costly, both in terms of financial losses and damage to a company's reputation.
- **Regulatory compliance.** Food manufacturers and their suppliers must comply with food safety and quality regulations put in place by the U.S. Food and Drug Administration (FDA), other government agencies, and local health departments. Companies must adhere to these regulations to operate legally, or risk fines, plant shutdowns, and worse if they do not.

How to Create a Culture of Food Safety

Food safety is a shared responsibility among many different points in the global supply chain. To ensure the safety and high quality of food, everyone involved in that supply chain must understand the impact of their role. Food manufacturers can create a culture of food safety across their business in the following ways:

1. **Remind workers of their main goal.** Make sure all employees understand that their primary responsibility is to protect consumers and keep them safe. Workers throughout the supply chain should realize that they are not just manufacturing widgets; they are producing food that people will consume. For example, the potato chip they are inspecting could land in their child's lunch. Make connections between the product that workers handle and their own lived experiences.

2. **Conduct regular training.** Ongoing training is crucial for maintaining a culture of food safety. Companies should provide onboarding training for new employees and require annual retraining for all staff. Every food manufacturer and supplier should think about the "Four Cs" of food safety—Cleaning, Cooking, Chilling, and Cross-Contamination—so that employees understand the essentials of food safety. Training is another chance to link what workers do every day to what they do in their own kitchens. For example, they would

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not prepare carrots and cucumbers without properly cleaning and disinfecting a surface that previously held raw chicken. Food safety culture hinges very much on proper training. If workers do not feel that they are being trained properly, then the food safety culture will be impacted negatively.

3. **Educate workers about the regulations and processes that are important to protecting food.** Part of formal training and everyday process should include educating employees about various food safety regulations and processes, ranging from FSMA and Good Manufacturing Practices (GMPs) to Hazard Analysis and Critical Control Points (HACCP). Some regulations may be intuitive, while others may require more explanation. For example, workers understand the purpose of GMPs such as wearing hair nets and changing into clean clothes when they arrive to work. However, best practices around allergens might be less clear. For example, they might trail microscopic amounts of peanut dust into a room, not understanding that products in an allergen-free area could be contaminated. Mandated audits and quality assurance (QA) checks serve as excellent opportunities to refresh training protocols. Food auditors and QA professionals help educate workers on the "why" behind different regulations and processes, which goes a long way toward ensuring compliance.

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4. **Empower employees.** Employees should be confident playing an active role in food safety culture. This commitment must come from the top down, with quality leaders, management sponsors, and leaders from operations, engineering, marketing, and sales actively supporting the Food Safety and Quality program. Tips for empowering employees include:

    - Put in place whistleblower policies, which are designed to encourage employees to report any unsafe practices within the organization, without fear of retaliation
    - Establish an anonymous way to report issues
    - Recognize and reward employees who demonstrate food safety excellence.

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These practices and policies are critical for maintaining transparency and addressing potential issues promptly.

Common Food Safety Pitfalls

There are a few pitfalls to watch out for when it comes to food safety. If you are aware of the following challenges—and how to deal with them—then you will be better equipped to build a strong food safety culture:

- **Time and money investments**. Building a strong food safety culture requires buy-in at the leadership level. It can be time-consuming and costly in the short term, but the long-term benefits far outweigh the initial investments.
- **High staff turnover**. Frequent staff turnover in the industry can hinder the development of a deep and lasting food safety culture. Consistent and continual training and education are essential.
- **Language and literacy**. If you have bi- or multi-lingual staff, building a strong food safety culture will require more work. If any employees have limited education or literacy levels, then they may face challenges in understanding and implementing food safety practices. This goes beyond making sure trainings are translated for all audiences. It includes making sure daily events, such as pre-shift meetings, are accessible for all employees. Ensure that you translate not only trainings, but also regular meetings, into all languages used by your staff.
- **Supplier compliance**. Companies are only as good as their suppliers. Food manufacturers should ensure that all suppliers adhere to Global Food Safety Initiative (GFSI) standards by auditing them regularly. Food manufacturers might have their own auditors in-house, but small- to midsize organizations might consider third-party auditors to complete GFSI audits. Some of the

largest food manufacturers choose to conduct both in-house and third-party audits to ensure compliance

Creating a culture of food safety is not only a regulatory requirement, but also a moral and economic imperative. Food manufacturers must prioritize the safety and quality of the food they produce, ensuring that it reaches consumers in the best possible condition. By educating and empowering their employees, adhering to regulations, and continually reinforcing food safety practices, food manufacturers will build a sustainable culture that protects public health, satisfies consumers, and ultimately contributes to the long-term success of the business.

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