FoodSafety magazine

PSSI FOOD SAFETY SOLUTIONS

RISK-BASED, EFFECTIVE SANITATION FOR FOOD PROCESSORS

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Sanitation Success Rests on a Three-Legged Stool

Sanitation success is a prerequisite to food safety and quality and rests on three "legs": people, programs, and hygienic design and maintenance

BY ***DUANE GRASSMANN, CORPORATE HYGIENIST, NESTLÉ USA AND CANADA***

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Sanitation success rests on a foundation of three groupings of prerequisites—the legs of a stool, if you will. Although the premise of this idea is simple, the details are more complex and worthy of investigating. This article discusses the three legs supporting our sanitation success and the interrelationships between these supporting legs.

What are the three legs that support our sanitation success? They are people, programs, and hygienic design and maintenance. These three groups have interrelationships that are not always fully considered. Intentionally considering these interrelationships helps improve investigations of sanitation failures. It also allows existing sanitation successes to be recognizes and strengthened.

The author was formerly of the opinion that sanitation standard operating procedures (SSOPs) could make sanitation success challenges magically disappear. If SSOPs included extra detail, pictures, and specific things to watch out for, then it would help safeguard from variability in results. Looking back, however, this seems myopic. Rarely, if ever, have sanitation failures been strictly due to weak SSOPs—or any other single cause, for that matter. Sanitation failures are usually rooted in multiple causes. Application of this three-legged stool approach will make root-cause analysis more comprehensive, efficient, and effective.

Let us look at examples of the three legs of people, programs, and hygienic design and maintenance.

People

To support sanitation success, enough people are needed to clean in the time allotted. They need to be properly trained, supervised, and at work when scheduled. Factory culture and morale to support sanitation success is vital. High turnover often creates persistent open positions and is a common driver of sanitation failures. This problem is discussed in the author's earlier article, "The Top 10 Reasons Why I Couldn't Keep Sanitation People."[1]

Production that runs later than scheduled results in sanitation starting later than scheduled. This creates the temptation to use the usual number of people to clean in a shorter time. An on-time startup is often achieved by cutting corners. While this may be a short-term solution, over time, this cutting of corners tends to degrade standards and processes, which is rarely sustainable. The ideal solution is to complete the work based on the labor-hours needed to complete the tasks. In other words, a smaller cleaning window of time requires more people to clean.

Another weakness to the "people" leg comes from improperly trained personnel doing their best to perform important sanitation work. This generates significant variability in sanitation outcomes, increases the risk of damage to equipment, and jeopardizes personnel safety. Ensuring that only properly trained personnel perform these important sanitation tasks is always the best practice.

Effective supervision is also critical to sanitation success. Are supervisors knowledgeable, present on the factory floor during sanitation, attentive to detail, and using effective coaching methodologies? Are supervisors focused on processes and standards that are well-defined, clearly communicated, and uncompromised? If the answers are "yes," then the factory has a priceless strength in this stool leg supporting sanitation success. If the answers are "no," then there is important work to be done immediately to salvage the sanitation process.

Absenteeism also has a negative influence on sanitation success. Perpetual staffing shortages can be caused by third-shift schedules, factory culture and morale, as well as ineffective attendance policies and enforcement. Continually operating with fewer people than budgeted runs the risk of having that head count become the new budget number. Fewer people cleaning can only be sustained by having more time to clean, equipment that takes less time to clean, and/or cleaning processes that reduce labor requirements. Anything else is not sustainable.

Finally, positive culture and morale have a powerful influence on sanitation success. It is interesting how the integrity of the people leg drives culture and morale. Conversely, culture and morale drive the success of the people leg.

Weaknesses identified in the people leg of the sanitation success stool will require increased reliance on the other two legs: programs, and hygienic design and maintenance. When this occurs, consider increasing dependence on the examples listed in the next two section such as inspections, developing more robust SSOPs, intensifying environmental pathogen monitoring, eliminating hygienic design flaws that increase sanitation complexity, and other solutions.

Programs

Many programs influence sanitation success. Some of these programs include training, cleaning procedures, master sanitation schedule (MSS), sanitary preventive maintenance (PM), housekeeping, cleaning validations, cleaning verifications, cleaning monitoring, hygienic zoning, and environmental pathogen monitoring.

As mentioned in the "people" section, having properly trained associates is critical. If training programs are weak, then problems with sanitation success tend to compound. In addition to training required by regulatory and certification bodies, on-the-job training specific to cleaning procedures (SSOPs) and any unique elements of the facility setting is important.

A robust program of creating SSOPs and monitoring performance against them is always foundational to sanitation success. The cleaning process is described in, and controlled by, the SSOPs. The more controlled the sanitation process is, the more consistent and predictable are the cleaning outcomes. Furthermore, cleaning process improvement cannot be meaningful unless the process is under control. Typically, the more details that are provided in the SSOP that define the cleaning process and desired outcomes, the better are the control and consistency.

Similarly, robust programs of the MSS and sanitary PM are critical to support sanitation success. A weak MSS and sanitary PM eventually lead to larger accumulations of soils, more difficulty in cleaning, possible micro-issues, potential pest problems, elevated safety concerns, increased quality nonconformance, more unplanned line stoppages, and other issues. Strong MSS and sanitary PM programs define frequencies of work, details of each task, and the standards for outcomes. Compliance against the scheduled frequencies is a good measure of program strength.

Housekeeping programs have an important impact on sanitation success. Preventing soil accumulations not only makes cleaning easier, it also improves quality performance and line efficiencies. Furthermore, employee morale is improved when work environments are clean and organized. Setting housekeeping standards, monitoring against the standards, and eliminating sources of soils are good starts toward great housekeeping.

The programs of cleaning validations, verifications, and monitoring are critical to predicting and assessing sanitation success. These programs are described in the author's article, "Validation, Verification, and Monitoring of Cleaning in Food Processing Factories."[2] In this article, the author describes how success is supported by knowing why cleaning is being performed, how clean the equipment and facility must be, and how soon cleaning must be performed again. The article also goes into detail about how control of the cleaning process must be demonstrated in the future (validation), in the past (verification), and in the present (monitoring). These programs provide the control that drives predictable and repeatable support to sanitation success.

The facility's hygienic zoning program is a prerequisite to sanitation success, and *vice versa*. An excellent hygienic zoning program will provide barriers and controls that prevent identified contaminants from entering sensitive facility areas. Likewise, sanitation success will prevent contaminants from residing in an area and potentially stressing hygienic zoning barriers and controls between areas. These principles are explained in more detail in the article, "Hygienic Zoning in Food Manufacturing Factories."[3]

Strong linkages exist between a facility's environmental pathogen monitoring program and the three legs of sanitation success. A robust program will serve to identify strengths and weaknesses in the three legs of people, programs, and hygienic design and maintenance. Interestingly, all three legs of sanitation success have powerful influence on the program results. This next point is important: Ensure that the program is representative of the actual factory environment. One of the author's favorite phrases is, "If you don't want to find environmental pathogens, then you won't." Approach your environment pathogen monitoring program with a "seek-and-destroy" attitude.

If the programs leg is weak, then more reliance should be placed on the people leg described above and the hygienic design and maintenance leg described below. Examples include increasing associate training, having a heavier supervisor presence on the factory floor, and improving equipment and facility hygienic design to promote more effective and efficient cleaning.

Hygienic Design and Maintenance

"You can't clean what is un-cleanable, and it's hard to clean what is hard to clean." While this is one of the author's favorite catchy phrases, the reality is that these conditions have the potential of existing in the best facilities. The "hygienic design and maintenance" leg is a critical part of any facility's three-legged stool for sanitation success, but if the equipment is well-designed and well-maintained, and if the equipment resides in a well-designed and well-maintained facility, then this leg of the stool can bear extra weight.

How can a facility's hygienic design and maintenance be evaluated? Assessment and indicators are a couple of ways to gauge success. Assessment of hygienic design conditions is an acquired skill. It comes from practice, and is greatly accelerated when cross-functional teams are utilized. Several trade associations provide excellent hygienic design checklists that can help guide the assessment criteria. Gaps identified in the assessment must result in immediate risk mitigation actions. If longer-term solutions are needed, then short-term mitigations must be put in place.

Another way to know if good hygienic design and maintenance are present is to establish and monitor leading and lagging indicators. Inspections and audits, combined with design assessments, are examples of leading indicators. These indicators demonstrate ongoing control and provide immediate feedback on the integrity of this leg. Lagging indicators include consumer complaints, finished goods micro-testing results, and environmental pathogen monitoring results. These are considered lagging indicators because the results and trends indicate what happened days, weeks, or months prior. When looking at leading and lagging indicators, analysis should lead to awareness of systemic issues and generate appropriate corrective and preventive actions.

A word of caution: the tendency can arise to focus on hygienic design and equipment conditions and not as much on where the equipment resides. Great equipment in a poor facility is a perpetual challenge to sanitation success, and *vice versa*. The goal is to have great equipment and great facilities supporting sanitation success.

Weakness in the hygienic design and maintenance leg should be counteracted with increased reliance from the people and program legs above. Examples could include more focus on training and supervision, bolstered MSS and sanitary PM, as well as inspection and monitoring programs.

Takeaway

When faced with sanitation failures, the author used to zero in on the cleaning process and drive improvement starting from that point. Today, the author recommends taking a more comprehensive look at the cause of the failure, which will result in corrective and preventive actions becoming more strategic. It is important to assess all legs of the three-legged stool, identify which leg has become weak, and determine how the remaining two legs can bear extra weight.

Sanitation success is a prerequisite to the safety and quality of food, and sanitation failures are usually rooted in multiple causes. This three-legged stool visualization can help create more awareness of which stool legs are strong and which are weak. This new awareness can help intentionally shift the weight of sanitation success to where it is most stable while identified weaknesses are strengthened.

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The Value of Intervention Services

With foodborne illnesses striking around 48 million Americans, the U.S. Department of Agriculture Food Safety and Inspection Service (FSIS) and the U.S. Food and Drug Administration (FDA) have instituted tough, new regulatory requirements that many food processing plant managers are finding difficult to meet

BY PSSI

With foodborne illnesses striking around 48 million Americans, the U.S. Department of Agriculture Food Safety and Inspection Service (FSIS) and the U.S. Food and Drug Administration (FDA) have instituted tough, new regulatory requirements that many food processing plant managers are finding difficult to meet—even with the most rigorous sanitation programs in place. A new white paper by PSSI Senior Vice President of Field Operations and Food Safety Jake Watts discusses how including intervention services as part of comprehensive, multi-discipline food safety approach can be extremely valuable.

Intervention in food safety comes to the forefront when talking about pathogen control and as its name suggests, it's the practice of "'intervening' in a process by adding additional control measures to reduce and eliminate food safety risks." Intervention services vary by facility and food type, among other factors, but when implemented in conjunction with other food safety measures, they add an even deeper layer of protection that ensures food facilities are clean and the products are safe and audit-ready.

Watts notes that intervention services differ from third shift sanitation as they are part of the real-time processing and production of meat, poultry, and produce products. He discusses the innovative equipment that has been pioneered by Safe Foods Chemical Innovations as well as the cleaning, sanitizing, and specialty chemicals they have access to and are approved for use in USDA and FDA facilities. Watts also discusses the importance of the tracking and analytics behind intervention services which help plant management understand the effectiveness of the process.

Finally, a fragmented approach to sanitation, intervention, and pest control can result in miscommunication and finger-pointing so plant managers should have an integrated solution portfolio and ensure that everyone is aligned on the processor's goals.

Although these services are primarily focused on microbial and pathogen reduction, there are other benefits that support additional business growth opportunities and cost savings, such as helping processors meet regulatory guidelines, increasing worker safety, improving product quality, and supporting enhanced sustainability.

Watts encourages plant managers to explore new product technology and innovative engineering solutions to enhance food safety management, especially with tightening regulatory audit guidelines. In other words, as Watts, quoting industrial engineer Allen Morgenstern, puts it—"work smarter, not harder."

You can read "Plant Manager's Guide to Food Safety Intervention Strategy" HERE.

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Maximizing Your Relationship with Your Pest Control Partner: Everything Food Processors Need To Know

To avoid a full-blown pest infestation, facility managers must have a continuous partnership with a reliable pest control company

BY ***CINDY MANNES, SENIOR VICE PRESIDENT OF PUBLIC AFFAIRS, NATIONAL PEST MANAGEMENT ASSOCIATION (NPMA)***

The abundance of food and shelter found inside food processing facilities make them the ideal hideaway for pests like rodents, cockroaches, flies, and others. However, there is a zero-tolerance policy when it comes to the presence of pests in these facilities. A singular pest can quickly grow into full-blown infestation, making it extremely important for facility managers to ensure that they have a year-round partnership with a reliable pest control company.

Food Processing Pests

Food processing facilities are most susceptible to rodent, fly, cockroach, and stored product pest infestations as they provide ample food, shelter, and moisture. These pests are extremely worrisome for food processors, as they contaminate food with their droppings and are known to spread many pathogens to humans, including *Escherichia coli* and *Salmonella.*

Rodents are also known for chewing through wiring, which can result in electrical fires and damage to essential machinery. While pantry pests, such as Indian meal moths and merchant grain beetles, do not transmit disease, they can still infest ingredients, resulting in the contamination of food products made in these facilities.

Choosing a Pest Control Partner

The first and most important step in ensuring a pest-free facility is choosing a pest control partner. It is best to meet with several companies to determine which one will be the best fit for your facility's location and needs. During the evaluation process, be sure to ask detailed questions about the company's pest control practices and other clients they serve in the industry. It can be helpful to inquire with industry peers and partners on their pest control experiences. Also, look for companies that are members of national, state, or local associations. These memberships speak to a commitment to protecting public health and property from the threats posed by pests, as well as a desire to receive ongoing education about new technologies and treatment techniques.

Once you have chosen the pest control partner best suited for your business, there are several ways to guarantee that you are getting the most out of your relationship. Scheduling regular inspections can help catch potential pest problems in your facility before an infestation takes hold. Your pest control partner is expertly trained to treat any potential problems discovered to ensure the safety of your employees and the products made inside your facility. On top of regularly scheduled inspections, it is helpful to maintain regular and open communication with your pest control partner on pest issues you are experiencing. This can help your pest control provider tailor inspections and treatments to your facility's specific needs.

Proper Pest Prevention

A commercial pest control partner will help develop an Integrated Pest Management (IPM) plan specially designed for your facility and its unique needs to ensure compliance with FDA regulations on pest control. IPM is a pest control method that focuses on three basic techniques: inspection, identification, and treatment by a pest control professional.

While it is imperative to have a continual partnership with a licensed pest control company, facility managers also play a vital role in keeping their facilities pest-free between inspections and treatments. To help keep pests out, facility managers should implement these IPM best practices:

- Ensure that employee kitchens and break rooms are clean by wiping down counter tops and sweeping floors to remove crumbs and residue from spills
- Vacuum and clean all areas regularly, including offices, hallways, lobbies, and public restrooms
- Routinely check under sinks and machinery for areas of moisture, and repair any leaking pipes or clogged drains
- Store all food products in sealed containers, and organize empty boxes to prevent harborage areas
- Keep trash in sealed containers inside the building, remove trash from the facility regularly, and ensure that dumpsters are far away from the building entry points

- Inspect the exterior of the building to ensure that there are no entry points for pests, paying close attention to areas where pipes and utilities enter the building, and seal any gaps or cracks in the foundation
- Install door sweeps on exterior doors to seal the gap between the floor and the door where pests can enter
- Remove debris from gutters and direct water away from the building through properly functioning downspouts, gutters, and splash blocks
- Install a gravel perimeter around the building to discourage vegetation growth that could harbor pests
- Ensure that the grounds surrounding the facility are properly maintained, as overgrown vegetation can attract pests to the property.

Pest control is essential to the success and longevity of all food processing facilities and should not only be addressed when an issue arises. Conducting regular inspections and treatments with your pest control partner and implementing a proactive IPM strategy can ensure that both your facility and the food made within it remain pest-free.

CINDY MANNES *is the Senior Vice President of Public Affairs for the National Pest Management Association (NPMA).*

Technical Services Team Offers Higher-Level Expertise to Support Food Safety Success

Specially trained food safety professionals provide in-depth, value-added services to validate food safety planning and performance

BY ***PSSI***

Managing food safety inside of food processing plants is a complicated, ever-changing job. As a plant manager or a food safety and quality assurance (FSQA) manager, we understand the significant amount of pressure to make sure every decision and action related to food safety is validated with scientific research.

Keeping up with regulatory and audit requirements, new microbial strains, new products and technologies, and environmental changes is not an easy task. However, the planning, testing, training, and ongoing education that happens behind the scenes is ultimately what dictates the success of your program. It is critical to have a team of specially trained experts across various categories who not only stay up to date on all of the latest research, but who also have the specific insight to understand how it affects your plant and what you should be doing about it.

"An effective sanitation program is the foundation of food safety," said Scott King, Vice President of Food Safety for PSSI. "The research and attention to detail in the beginning can have a significant impact on future outcomes."

PSSI's Technical Services Team validates every step of our food safety process and execution for our partners. Our team has more than 800 combined years of food safety experience, including a corporate microbiologist, field microbiology experts, Hazard Analysis and Critical Control Points (HACCP) practitioners and trainers, former FSQA managers, and more. We are PCQI, Food Defense, and GFSI Certified and participate across a wide range of national and regional industry organizations.

Leveraging our specialized education and experience, PSSI partners benefit from a variety of unique value-added services that ensure optimal food safety performance.

Field Audit and Support Team (FAST)

PSSI has a dedicated team of food safety experts spread across the U.S. and Canada to support our partners on a localized level. The FAST representatives have in-depth education and training to monitor and manage a variety of technical details for food safety management.

- Proactive or for-cause food safety assessments and prioritized action plans
- Benchmarking current sanitation practices
- Swab-a-thons and other environmental pathogen investigations
- Sanitation verification and validation support
- Statistical and other analytical assessment of KPIs.

Team Meeting and Training Support

Education and training are a central, ongoing part of food safety success. PSSI has a team dedicated to organizing critical information and training our teams and our customer's teams across key topics that impact the safety and success of our work. These topics include:

- Sanitary design
- Performance-based sanitation approach
- Eight steps of sanitation

- Pre-operational inspection
- Master sanitation schedules
- Microbial control equation
- Clean-in-place and assisted cleaning systems (CIP/ACS)
- Fundamentals of wet and dry sanitation
- Verification and validation of sanitation
- Root cause analysis (RCA) and corrective and preventive actions (CAPA).

Risk Assessment and Management

Many different factors can impact food safety in a plant. When making any changes or adjustments to the function of a plant, it is critical to have a food safety expert as part of the proactive planning team. PSSI's Risk Assessment and Management team provides strategic consultative services to assist our partners with proper sanitary design related to:

- Construction and major maintenance
- Out-of-standard conditions (roof leaks, drain back-ups, floods, fires, etc.)
- New plant or line startups
- Sanitary design for new equipment or infrastructure.

Research and Development

Our team at PSSI is constantly focused on continuous improvement and committed to staying at the forefront of the latest research and innovation. We partner with leading industry organizations, companies, and universities on strategic research and development projects to help solve complex food safety issues. Most recently, we have partnered with the University of Wisconsin Food Research Institute and the Center for Biofilm Engineering at Montana State University to test the effects of different chemistry on biofilm elimination. We also tested our own eight-step sanitation process to validate it for pathogen elimination.

"Education is a foundational element to food safety," said Lindsey Perry, Director of Technical Services for PSSI's Safe Foods Chemical Innovations. "We go above and beyond to make sure we are making decisions and recommendations for our partners that are supported by validated research to provide the highest level of confidence in our work."

Addressing Biofilms through the Sanitation Process

The importance of biofilm prevention cannot be underestimated and should be addressed through effective sanitation programs

BY ***FOOD SAFETY MAGAZINE***

For years, food companies have struggled with biofilm prevention. Its importance cannot be underestimated and should be addressed through effective sanitation programs. With proper implementation of the sanitation process, biofilms can be removed and prevented, and potential health risks reduced.

Biofilms are a community of bacterial cells that adhere to each other and surfaces, protected by polysaccharides that act like glue.[1] These polysaccharides allow bacteria to attach themselves to surfaces and feed off the protein and soils that have not been removed. Bacteria such as *Listeria monocytogenes*, *Salmonella*, and *Escherichia coli* are some of the more well-known culprits that cause foodborne illnesses. Spoilage bacteria will also attach themselves to surfaces and are the main contributors to shortened shelf life of food products. Although biofilms are difficult to remove, they can be removed with the eight steps of sanitation (**Figure 1**), which incorporate the four factors of wash: concentration, temperature, time, and mechanical force. As in every aspect of problem-solving, there is no silver bullet that will address the problem exclusively. However, if these eight steps are used in conjunction with robust monitoring, biofilms can be removed and prevented.

FIGURE 1: PSSI's 8 Steps of Sanitation

Eight Steps of Sanitation

1. Dry Pickup

In this step, it is important to remove protein from product contact surfaces and the floor, as well as pick up any trash or obstructions in the areas that need to be cleaned. It is critical that necessary equipment is disassembled before cleaning is performed and the pieces are stored properly to prevent cross-contamination. The disassembly of equipment allows the inspection of hard-to-reach areas and enables identification of any interior niches that could cause microbial infestation or "harborage."

2. First Rinse

This step is completed to knock down protein and soils on all equipment and lower walls, starting from the top and working down to the floor, and utilizing a recommended water temperature between 120 °F and 140 °F and at least 130 psi, which is recommended for meat processing plants. Water temperature should not exceed 140 °F because it may bake the soil to the surface, which can increase the potential for microbial growth. Soil removal should be at least 95 percent before moving to Step 3.

3. Apply Detergent to Surfaces and Hand Scrub

The major function of cleaning chemicals is to lower the surface tension of water so that soils may be loosened and flushed away. This step is essential for the removal of biofilms on equipment. Cleaning chemicals help disintegrate any remaining soil, and hand scrubbing will continue that breakdown by releasing debris from surfaces for an easier rinse-down. Some key tips for step three:

- Ensure proper foam application from bottom to top on all equipment
- Foam should be left on the equipment for 10–15 minutes, but not be allowed to dry
- Hand-scrubbing should be completed while the foam is on the equipment or with a separate scrub bucket of general-purpose cleaner and a scrub pad
- Scrubbing drains should be performed during this step
- End-of-hose titrations should be conducted and properly documented daily.

During the chemical application and hand-scrubbing, it is important to consider the four factors of wash:

1. **Concentration:** The concentration of cleaning chemicals should be within the manufacturer's specified use range to effectively help penetrate, break down, and remove soil/debris.
2. **Temperature:** Water temperature affects the effectiveness of soil removal and chemistry activation.
3. **Time:** How long it takes for cleaning chemicals to adequately penetrate, break down, and remove soil from a surface.
4. **Mechanical force:** Refers to the optimal water pressure or utilization of a scrub pad during the sanitation process to assist with the breakdown and removal of soil on surfaces. Other options also exist, such as clean-in-place and clean-out-of-place (CIP/COP). Optimal water pressure may not be available; therefore, it is imperative that the concentration, temperature, and time meet the proper ranges to be effective.

4. Rinse and Inspect

During this step, it is recommended to rinse the foam from all surfaces, starting at the top and working down to the floor. Using high-volume/low-pressure hot water, all chemicals and soil should be removed. A best practice during the rinse step is to inspect equipment, using flashlights to verify the removal of soil.

5. Remove and Sanitize

This steps encompasses production, maintenance, and sanitation working together to reassemble equipment following proper hygienic procedures and Good Manufacturing Practices (GMPs), and to remove condensation and standing water. A best practice directly after this step is to conduct a flood rinse of equipment prior to preoperational inspection.

6. Preoperational Inspection

When conducting the preoperational inspection, the use of a flashlight, organoleptic senses, and hands is helpful in verifying the cleanliness of equipment. This is an extremely important step to help identify any missed opportunities during the cleaning process and address them immediately. Preoperational inspection is not merely walking up and down a line with a flashlight at eye level. An excellent robust preoperational inspection consists of bending down to inspect the lower framework, inside of belts, and hard-to-see locations. It also means climbing ladders to get to the overhead belts or structures that cannot be seen thoroughly from the floor. During the inspection process, the senses of smell, touch, and sight must be utilized, along with any tools possible to increase the opportunity of identifying any deficiencies prior to turning the floor over to the plant.

7. Reassemble

The finishing step to help prevent and control biofilms is the application of a no-rinse level sanitizer. It is important that the sanitizer is titrated before application to ensure regulatory compliance by following the manufacturer's labeling requirements. The no-rinse level sanitizer should be applied prior to the start of production from the bottom to the top, with 100 percent coverage of all product contact and noncontact surfaces. The underside of equipment, high inside framework, and niche areas should be included.

8. Documentation

The purpose of documentation is to assist in the record-keeping of key elements within the sanitation process. Maintaining accurate records will ensure compliance with customer requirements and regulatory compliance by verifying the cleanliness of the plant.

Characteristics of Soils

Other factors to consider when implementing the eight steps of sanitation can have a tremendous impact on the cleanliness of the plant. It is helpful to take a look at the characteristics of soil and soil attachment. The soil or protein must first be identified. The optimum water temperature range will depend on the type of soil and protein found on plant surfaces. The range commonly used in meat plants is 120 °F to 140 °F with a target of 130 °F to remove soils and proteins. The types of soils and proteins will also determine which detergent or cleaner is used.

After the characteristics of the soil have been identified, the water hardness will then need to be considered before selecting the detergent or cleaner that will best fit the process. Water hardness is determined primarily by calcium and magnesium salts in the water. As the surface dries, hard water causes water spots on the equipment, and when reacting with soap these minerals can form soap scum. Water hardness deactivates detergents and can negatively affect sanitizers and disinfectants. This is where certain chemical products are formulated to tie up the calcium and magnesium ions so that the cleaner or sanitizer can tolerate water hardness.[1] Once the soil or protein is identified and water hardness is factored in, then the eight steps of sanitation can be implemented. Nevertheless, some hurdles will still need to be addressed for optimum prevention.

Soil Attachment and Sanitary Design

Sanitary design plays a crucial part in the prevention of biofilm. Food equipment must be constructed to ensure effective and efficient cleaning over the life of the equipment. The equipment should be designed to prevent bacterial entry, survival, growth, and reproduction on both product and non-product contact surfaces of the equipment. Soil removal becomes more difficult when there are cracks, crevices, uneven surfaces, or hard-to-clean areas, such as rough welds, broken welds, pitted metal, hollow framework, or rollers. These cracks and crevices become niches or harborage points that make the cleaning process more demanding. Additional tools for cleaning and specific chemical compounds can be used, but will not completely remove what could be embedded within these hard-to-clean areas.

Plant management, food safety, and sanitation must partner to identify these areas for immediate repair or replacement to ensure that they do not create harborage for bacteria. An example of a simple repair would be to cap off the rolled metal that is being used as legs for tables or as a framework for belts. Of course, a best practice would be to systematically remove rolled metal and replace it with angle iron for easy access for cleaning. Another example is to smooth out rough welds to eliminate small holes or pitted areas. If the cleaner is to be effective at separating the soil from the surface, then the soil and surface must be thoroughly wet, which is sometimes difficult if the surface is hard to reach or still contains niches or harborage points.

Construction Events

Another factor that should be taken into consideration is construction events. Any time a construction event is planned in a plant, a strategy must be developed to ensure that any potential risks are identified before construction. This plan should also have preventions in place for each identified risk. A coordinated effort among operations, maintenance, food safety and quality assurance, and sanitation is necessary to develop and implement a plan that prevents uncovered biofilms from becoming a problem after construction is over. Construction events have the tendency to uncover or "loosen up" hidden biofilms that have been embedded in floors, walls, and equipment due to poor sanitary design or extensive wear and tear over the years. The construction plan should also incorporate a chemical "script" specifically addressing the area of concern. This chemical script not only includes the eight steps of sanitation and the four factors of wash, but also encompasses intensified cleaning. Intensified cleaning includes, but is not limited to:

- Breaking down equipment to the "bare bones," which is the removal of all sandwiched parts.
- Use of specific chemicals to address specified equipment, areas, and microbial problems. Success is measured by the results of how closely the strategic plan was followed.

Conclusion

In preventing biofilms from taking over any production area, there is no one-size-fits-all scenario. It takes a reliable sanitation program; a dedicated sanitation team; a partnership with production, maintenance, and sanitation; and diligence to stay on top of identified harborage locations. Starting with the eight steps of sanitation, including the four factors of wash, biofilms can be reduced to a matter of preventive maintenance. It is important to keep in mind other factors that will impact the removal of biofilms, such as sanitary design and construction events. Furthermore, utilizing sanitation resources, such as contract cleaning companies, can be a valuable addition to biofilm reduction and prevention efforts.

Acknowledgment

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Sanitizers: From Effectiveness to Tolerance

Which sanitizer works best depends on your food microbe of choice

BY **RICHARD BROUILLETTE, DIRECTOR OF FOOD SAFETY, COMMERCIAL FOOD SANITATION, AND THOMAS HALEY, FOOD SAFETY SPECIALIST AT COMMERCIAL FOOD SANITATION**

With the appearance of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), there was a renewed interest in sanitizers and disinfectants. Most food safety professionals in the U.S. are aware that sanitizers and disinfectants are not the same and must be approved by the U.S. Environmental Protection Agency (EPA). List N (disinfectants for coronavirus) gained in popularity as more people and companies were trying to eliminate the virus from their environment. It is a long list of chemicals with different contact times, depending on the product. During the initial period, some users may not have realized that all disinfectants are not created equal, although they have to meet the same acceptance criteria; some will be effective at lower concentrations, others act more rapidly, etc. To review a few facts:

- In the U.S., sanitizers and disinfectants are considered pesticides, so they are subject to the rule that the "label is the law," meaning that only concentrations that are specified on the label are allowed. Further, most sanitizers specify a no-rinse concentration for food contact surfaces and an acceptable range of concentrations for environmental applications.
- Both concentration and contact time are critical factors.

EPA's List N covers disinfectants effective against SARS-CoV-2. When trying to control other viruses, EPA may have approved specific antimicrobials. For example, there are lists for hepatitis C, avian (bird) flu, etc. However, for most food processing facilities, the concerns are for pathogens such as *Listeria monocytogenes*, *Salmonella*, pathogenic *Escherichia coli*, etc. As we will see in this article, the acceptance criteria for sanitizers are the same, whether the sanitizer contains quaternary ammonium, chlorine, iodine, etc. If you had to eliminate a resident population of *L. monocytogenes* or *E. coli*, you are likely to know that not all sanitizers will perform the same. As we will see, there are a few reasons for that.

The EPA document *OCSPP 810.2300: Sanitizers for Use on Hard Surfaces—Efficacy Data Recommendations* defines sanitizing success for nonfood contact surface sanitizers. The results should demonstrate a reduction of greater than or equal to 99.9 percent (a 3-$\log_{10}$ reduction) in the number of each test microorganism over the parallel control count within five minutes. And for food contact surfaces, the requirement is to evaluate sanitizing success of non-halide formulations. Acceptable results should demonstrate a reduction of greater than or equal to 99.999 percent in the number of each test microorganism within 30 seconds. The test organisms differ if the test is for food contact or nonfood contact surfaces. In both cases, there is a minimum of two microorganisms (one gram-positive and one gram-negative).

The EPA document *OCSPP 810.2200: Disinfectants for Use on Environmental Surfaces—Guidance for Efficacy Testing* requires a 6-log reduction or 99.9999 percent in ten minutes or less for both nonfood contact and food contact surfaces. A disinfectant is usually a chemical agent (but sometimes a physical agent) that destroys disease-causing pathogens or other harmful microorganisms but might not kill bacterial spores. EPA groups disinfectants by product label claims of "limited," "general," or "hospital" disinfection. For the food industry, a label claim of "limited" means that only one of the two types of test organisms (the gram-positive or the gram-negative) met the reduction criteria, while a label claim of "general" means that both types of test organisms were reduced to the acceptable criteria.

Similar criteria apply to towelettes or sanitizing wipes. However, hand sanitizers are regulated by the U.S. Food and Drug Administration. What about in the rest of the world? It depends—many countries require approval by the national or provincial authorities. Before exporting food products to another country, it is important to verify the local regulations. Besides requiring their own approval, they may have further requirements, such as rinsing the disinfectant with potable water before processing foods.

Should I Sanitize or Disinfect?

The answer depends on your target organism(s) and the log reduction targeted. EPA defines disinfection as "used on nonliving surfaces and objects to destroy or irreversibly inactivate infectious fungi and bacteria but not necessarily their spores" and sanitizing as "used to reduce, but not necessarily eliminate, microorganisms from the inanimate environment to levels considered safe as determined by public health codes or regulations."[1] Food processors will typically sanitize their production environment and equipment. Some products may be labeled for both. However, the contact time or concentration may be different. The key is to read the label, or the technical data sheet, provided by the chemical supplier. In both cases, it is important to remember that the surface must stay wet for the time specified. In an environment where the relative humidity is low, a product requiring a contact time of ten minutes may need to be reapplied at different intervals within those ten minutes to provide the targeted log reduction.

Should I Rotate Sanitizers?

A question that is often asked is whether you need to rotate sanitizers. The answer is not a simple one; it depends on the reason(s) for rotating. Sanitizers are sometimes rotated because there is a perception that microorganisms have or will become resistant to a specific sanitizer. Generally, this is an incorrect assumption. Apparent sanitizer ineffectiveness is more likely due to the following:

- **Inadequate cleaning:** A failure in applying the seven steps of cleaning can leave organic matter on the surfaces that can interact with the sanitizer to neutralize it.

- **Poor design:** Inadequate design of equipment can lead to unidentified niches that harbor microorganisms, allowing for biofilm formation.
- **Poor application:** Applying the sanitizer sparsely, not covering the entire surface, or not keeping the surface wet for the required time can result in ineffective sanitization.
- **Biofilms:** The presence of biofilms that encase the organisms, preventing the sanitizer solution from contacting remaining microbes, can be another factor that could negatively affect the efficacy of the sanitizer.

Any combination of these, if not corrected, can lead you to assume incorrectly that the sanitizer is not working, or that microbes became resistant and rotation is needed.

Periodic rotation can be useful to address certain situations based on specific circumstances, not apparent resistance. An example is a facility using a chlorine solution at 100 ppm for daily sanitizing during the week and applying quaternary ammonium during downtime or over the weekend because of its residual effectiveness against microorganisms. Another example could include the use of an acidic sanitizer. Applying an acidic sanitizer can provide the added benefit of assisting in breaking down biofilms and mineral deposits. However, this is not a replacement for thorough cleaning. A third example could be to target a specific organism, such as *Listeria*, by temporarily switching to peroxyacetic acid (PAA) to mitigate the concern. None of these examples is suggesting that rotation is necessary due to a decrease in the effectiveness of or a developed resistance to a sanitizer, but rather because of the added benefits exhibited by the sanitizers.

Tolerance to Sanitizer

Microbial populations may become tolerant to a sanitizer if a biofilm is formed and the sanitizer does not effectively penetrate the biofilm. Typically, sanitizer effectiveness and EPA approval does not involve biofilms. In real life, if a bacterial population can establish a residence or can become resident, a biofilm may have formed, and the sanitizer that is routinely used may not have the necessary properties to eliminate the biofilm.

Resistance to Sanitizer

Resistance is generally referred to as acquired resistance, meaning that the organism has acquired genes allowing it to be resistant. For example, a microorganism may be resistant to an antibiotic because it has acquired a gene allowing it to metabolize that antibiotic.

Resistance to sanitizers seems to be rare. One exception appears to be resistance to sanitizers containing quaternary ammonium. A number of authors have linked the presence of specific genes to the survival of different microorganisms in the presence of quaternary ammonium compounds. For example, Katharios-Lanwermeyer *et al.*[2] demonstrated the transfer of benzalkonium chloride (BC) resistance between nonpathogenic *Listeria* spp. to *Listeria monocytogenes*. More recently, Cooper *et al.*[3] analyzed the genome of 1,279 well-characterized *L. monocytogenes* isolates from a variety of foods and food manufacturing environments and identified the *bcrABC* gene cassette associated with BC resistance in 41.5 percent of isolates.

Selecting a Sanitizer

Many factors must be considered when selecting a sanitizer:

- Type of process: A sanitizer leaving a residue may not be desired in a fermentation process.
- Target organisms, not only from a pathogen perspective but also from a spoilage perspective. As is the case for disinfectants, some sanitizers may be more effective against a certain group of microorganisms than another.
- Water hardness.
- Material of construction (of the environment and equipment).
- If there is a wastewater treatment at the facility, the type of sanitizer may impact its efficiency.
- The type of product manufactured. For example, some sanitizers are not allowed in organic facilities.
- Cost.

Battling Biofilms

At times, our environmental samples may keep testing positive or out of specifications—for example, for *Listeria spp.* or other microorganisms. It is as if our cleaning and sanitizing procedures were somehow enabling contamination instead of eliminating it. The cause might be the presence of a biofilm. Once a biofilm has formed, it is difficult to remove, especially if the location is hard to reach. In most cases, a good mechanical action is sufficient to remove a biofilm, but in some circumstances, mechanical action may not be an option. For example, if a biofilm developed under a piece of equipment and is leaching out, it may not be practical to try lifting the equipment to scrub the floor and the equipment to remove this biofilm.

Under such circumstances, different sanitizing or disinfecting methods may be needed. This may mean using a physical treatment, such as heat, or using a different sanitizer or combination of sanitizers. Years ago, our options were limited. We could use chlorine, quaternary ammonium, iodine, and for the more audacious, chlorine dioxide, but now we can safely and more easily use chlorine dioxide in an aqueous or gaseous form, as well as "newer" combinations of chemicals such as PAA, or even more complex formulations that will allow the sanitizer to penetrate cracks or crevices to kill the microbes present in the biofilm and "dissolve" it.

As mentioned above, both concentration and contact time are critical factors, even more so when dealing with biofilm because they are less effective against a microbe if not applied at recommended levels. There are also sanitizers that are formulated to remain present and active on surfaces much longer than the time required in the approval protocol for sanitizers and disinfectants. Considering the complexity and substances present in biofilms, it takes more time for a sanitizer to penetrate and reach the microorganisms forming it. Therefore, the usual contact time of 30 seconds to ten minutes may not suffice, depending on the sanitizer used.

Further, chlorine dioxide is more effective than chlorine to battle biofilms. Increasing concentrations and contact times may also work. An example is the application of PAA at about 1,000 ppm and keeping the surface wet for more than 20 minutes, providing it will be rinsed at a no-rinse concentration on food contact surfaces. Other formulated sanitizers can be very effective. For example, Wang *et al.*[4] reported on the effectiveness of a multicomponent sanitizer consisting of a quaternary ammonium compound, hydrogen peroxide, and diacetin to inactivate and remove biofilm formed by *E. coli* O157:H7 and *Salmonella* enterica under meat processing facility conditions.

Once the applications are done, it is important to verify their effectiveness by continuing to sample for the pathogen or indicator of concern after the treatment. Sampling should be performed for weeks (a minimum of three consecutive weeks). If positive locations are not already part of the routine environmental sampling program, they should be added to provide early detection of any resurgence of the biofilm.

Fogging

Fogging can be a cost-effective method to apply a smaller amount of sanitizer onto a given surface. However, the method will be challenged if conditions favor the rapid evaporation of the sanitizer. The required contact time to obtain the desired effect may not be achieved. This is especially important to consider when applying a disinfectant with a required contact time of ten minutes. It should also be noted that when fogging, the droplets may be larger than some of the cracks where there could be a pathogen; if the sanitizer does not come into contact with microorganisms, it will not eliminate them.

Conclusion

In summary, on clean surfaces, sanitizers applied at the specified concentration and contact time can destroy many types of microorganisms. When dealing with viruses, a disinfectant is needed. However, if a population establishes a biofilm, it may be tolerant to the sanitizer used, and a different one may be needed to penetrate the biofilm and destroy the microorganisms forming it. Regulations on the use of sanitizers vary between countries, so it is important to verify these regulations in the exporting countries to ensure compliance.

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Six Steps for Building a More Effective Safety Program

At every level, collaboration is critical and sharing best practices is essential for building an effective safety program

BY **PSSI**

"Safety is no secret," PSSI Vice President of Safety Todd Mitchell writes in the introduction to *Best Secrets Behind Successful Safety Programs for Plant Managers*, a new report that draws on his 25 years of experience at PSSI.

At *every* level, collaboration is critical and sharing best practices is essential for building an effective safety program.

In that spirit, Todd details the steps team members have taken to build PSSI's safety program and shares the six most impactful lessons learned along the way:

1. *Culture*: Safety and compliance at every level are part of the company's core values and culture.
2. *Training*: Prioritize training and coaching oversight. Employees who have the proper training and coaching to make them feel supported and prepared are more likely to avoid injury—and help others avoid it, as well.
3. *Goals*: Set clear, measurable goals and monitor consistently. Start by identifying the most important Key Performance Indicators (KPIs), and create goalposts and deadlines.
4. *Data*: Identify strategic data or technologies to enhance safety programs, such as a Learning Management System (LMS), to simplify and streamline the training process.
5. *Design*: Partner with vendors to advance safety design when there are elements of safety around your plant that are not in your control but could pose significant risk to your employees.

6. *Celebration*: Celebrate success! Celebration is an empowering tactic that should be included in safety strategy. Recognizing employees for doing well keeps all team members focused on goals and helps build culture and camaraderie.

From organizational structure to culture to technology changes, our team has worked hard to adjust how safety is valued and managed at every level at PSSI. The results speak for themselves—we have decreased our OSHA recordables by more than 67 percent. Our team members should be proud of this achievement! The full whitepaper can be found here.


Microbial management is a complex task. Ensuring food safety and compliance with government regulations are crucial to your operational success. At Safe Foods Chemical Innovations, we pride ourselves on producing superior sanitation and intervention chemistry, processing aids, and engineering innovations that set the industry standard for food safety solutions. With our expertise and tailored chemical solutions, you can effectively manage microbial risk, optimize performance, and protect your brand.
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Food Processing Facilities at Risk for Rodent Infestations

The fall and winter seasons bring new challenges for food processing facilities and the teams that work to maintain them. One of the most notable challenges they face is increased pressure from rodents that seek out food and shelter within these facilities when outside temperatures fall

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Image credit: Denitsa Kireva (denitsa-kireva-2915302) via Pexels

The fall and winter seasons bring new challenges for food processing facilities and the teams that work to maintain them. One of the most notable challenges they face is increased pressure from rodents that seek out food and shelter within these facilities when outside temperatures fall. A rodent infestation can be extremely detrimental to a food processing facility, as it can lead to a facility being shut down if the problem is not addressed promptly and properly.

Rodent infestations are extremely dangerous to not only the health and safety of employees who work in the facilities, but these pests can also transmit serious diseases like *Salmonella*, which can contaminate food manufactured in the facility. In fact, rodents are known to contaminate or consume about 20 percent of world's food supply.

To keep their facilities safe, food processing facility managers need to regularly inspect the building and machinery for signs of an infestation. The top six signs of a rodent infestation to look out for include:

- **Droppings:** Finding mice or rat droppings around the facility is one of the most common signs of a rodent infestation. These pellets are often left behind in places where food is stored, such as storage areas, as well as under sinks, inside chewed cardboard boxes, along baseboards, and on top of wall beams.
- **Gnaw marks:** Rodents can cause serious property damage by chewing through almost any type of material—including plastic and lead pipes—to obtain food or water. House mice and Norway rats are also known to gnaw on wires behind walls, sometimes causing fires.

- **Nests:** Rodents prefer to nest in dark, secluded areas where there is little chance of disturbance. House mice, specifically, like to build their nests from shredded paper products, cotton, packing materials, wall insulation, and fabrics. If facility managers find these materials scattered around guest rooms or common areas, it might be a sign that rodents are nearby.
- **Tracks or rub marks:** Rats tend to leave dark grease or dirt marks along walls and floorboards as they follow a trail throughout the building between their nest and food sources. Facility managers should keep an eye out for these rub marks, which are caused by the rat's oily fur.
- **Strange noises:** Getting complaints that employees are hearing strange noises in the walls? Chances are these sounds can be attributed to a family of rodents scurrying about the facility, between the walls, and up in attics. Rodents are especially fond of storage spaces because they provide dark, secluded spots to build nests.
- **An actual rodent:** Mice can breed rapidly, so if a facility manager or a customer spot one mouse in the building, it is likely there are others playing hide and seek. In fact, a female house mouse can give birth to around 6–8 (or more) babies in ten litters per year, or around 70 young per year.

In addition to regularly keeping watch for signs of a rodent infestation, facility managers should implement prevention tips to avoid unwanted rodent run-ins:

- Trim back trees and foliage close to the foundation
- Seal any cracks or holes on the outside of the building

- Repair any broken vent covers, loose siding, or shingles
- Keep storage areas clean and organized to eliminate potential nesting grounds
- Properly ventilate storage areas and machinery to prevent moisture buildup that can attract pests
- Keep food products sealed and stored properly in airtight containers
- Clean high-volume areas often, including employee breakrooms, bathrooms, and lobby areas where crumbs and trash accumulate daily
- Dispose of garbage regularly and store in sealed receptacles that are placed at a distance from building entrances
- Work with a licensed pest control professional to perform regular inspections and recommend treatment if an infestation is found.

The most important step listed above is maintaining a regular inspection and treatment schedule with your licensed pest control partner. A professional can implement an integrated pest management (IPM) plan—a holistic and customized approach to pest control that comprises inspection, identification, and treatment to help ensure that commercial facilities are clean, compliant, and pest-free. These inspections should not stop at the end of peak pest season or after a problem is addressed. Pests, especially rodents, are a year-round threat to the safety of food processing facilities.

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