8 Food Plant Sanitation, Pest Exclusion and Facility Design

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Food processors or manufacturers can't afford to ignore sanitation, pest exclusion, and sanitary facility design. Consumers do not want insects or foreign material in their food. This chapter offers examples of ways to increase success in keeping pests out while ensuring that food products are safe and wholesome. For a complete guide to food plant sanitation, see Imholte and Imholte-Tauscher 1999.

Plant Exterior

For proper sanitation of food plants, warehouses, or storage areas, facility managers should know their neighbors. Stored product insects, rodents, and birds do not care where they live as long as they have access to food, water, warmth, and a shelter. Removing or modifying any of these critical needs stresses the population. If done well, pests will be eliminated or excluded because conditions will not allow survival. Elimination, not "control," must be the goal.

Food plant sanitation starts at the facility's exterior. A tour of the outside will reveal common situations that can cause pest problems. To see that pests' critical needs are not satisfied, food manufacturers should assess risks on adjoining properties as well as their own. Pests such as rodents are highly mobile and excellent climbers. Insects can fly or be windblown onto a property. It is important to determine neighbors' potential as pest harborage sites. Examples of situations that encourage insects and other pests are described below.

Low spots – Areas where water accumulates and becomes stagnant include obvious sites such as ditches but also places on the property or adjacent areas where low spots and holes can accumulate water. Water attracts insects, birds, and rodents. Eliminating the source will deter pests. Grounds should be smooth and properly drained.

Trash areas – Clean areas where trash, garbage, or litter accumulate to make them less attractive to rodents, flies, and birds. Place sites on a master sanitation schedule (MSS) for periodic cleaning and inspection. Approach neighbors to suggest working together to keep areas clean. If they also produce, receive, or store food and ingredients, teamwork will benefit them, too.

Collection areas near plant entries or dock areas, can entice pests into buildings. Pest-proof entries and make sure dumpsters have tight-fitting, accessible lids. Place garbage collection areas on the MSS for periodic cleaning. Cleaning may require a water source (preferably hot) and a hard, smooth, and properly drained surface under containers so water does not puddle and stagnate. Treat interiors of cleaned dumpsters with a labeled residual insecticide to aid in fly control during the summer months. It does no good to treat garbage or a dirty dumpster. Strengthen rodent control near these sites.

Landscaping – Fruit-bearing trees or landscaping, sweet-smelling flowers, nuts or seeds are attractive to insects, birds, and rodents. They provide food and potential nesting or roosting sites and should not

be located near a facility. Ideally, landscaping should be designed to be minimally attractive to pests. Many facility managers realize this too late and then remove plant material around perimeters and building foundations. Even low-growing shrubs such as arborvitae planted near the foundation can become a hiding place for rodents and other vertebrates.

Flowering shrubs such as spirea attract adult warehouse beetles to feed on pollen in the flowers. Shrubs located near the building can attract the adults, which can fly into the facility and lay eggs in grain-based food products. Larvae begin feeding and start an infestation.

Parking lots and lighting – Parking lots, adjacent properties, and similar sites should be constructed and paved so water drains properly, and standing water is eliminated. Lighting should be designed so it does not attract night-flying insects. Sodium vapor lights are a better choice than mercury vapor. Wherever possible, use sodium vapor lighting for exteriors and interior areas where light may be visible from outside. These lights, known for their orange or gold color, emit low levels of ultraviolet light that is attractive to insects. Another advantage of this type of lighting is that bulbs have a low mercury content, making them more environmentally friendly than mercury vapor lights.

Ideally, do not place lighting directly on building exteriors or above personnel or dock doors. Place security lights at least 15 feet from the doorway so they illuminate, but attract insects away from the building. This ensures that areas are well lit while minimizing insect congregation at building entrances. If entrance lighting is needed, specify sodium vapor or metal halide lights because of their low ultraviolet emissions. Place photocell sensors on the lighting, so they only come on as needed.

Use insect-attracting mercury vapor lights to lure flying insects away from the facility. Place lighting away from the building and cover to project the light down. This minimizes insects from surrounding areas attracted to ultraviolet emissions (Harris, 2006).

Pest control programs around perimeters – A pest control program should start at property perimeters, especially for rodents. The goal is to stress and exclude them. Typically, this involves using EPA-labeled toxic rodenticides placed securely inside commercially available tamper-resistant rodent bait stations (RBS) that are secured to the ground. In most cases, baits should be solid formulations to prevent rodents or nontarget organisms from removing them from the bait stations and taking them to another site where nontarget organisms may be killed or injured. Not only is harming nontarget organisms against the law, but it can also generate bad publicity.

Mark rodent bait stations on a schematic location map for periodic (at least biweekly and more often if rodent pressure is heavy) inspection and maintenance by trained personnel. Document observations in a log, and move bait stations as rodent activity decreases. Do not be lulled into rodent control, inside or outside of the facility, by guidelines of auditing companies that say control devices need to be placed "x" number of feet apart. Rodents may only move a few feet from their nests when food and water are easily available. They tend not to move in the open where they are exposed to potential predators. Experiment with different bait varieties to find the best one for the situation.

It is a good idea to disturb the rodent bait station before inspecting it because snakes and other vertebrates may be found there. Check for black widow spiders if known to inhabit the area. Do not place rodent bait stations in low spots where they can get wet and become ineffective. During winter it may not be possible to inspect the stations. Make sure they are working and well stocked with bait before the onset of bad weather.

It is not necessary to use toxic baits inside the bait station all the time. Nontoxic rodent attractant blocks are available that can be used as a monitoring tool to indicate rodent feeding. Once activity is noted, replace the nontoxic material with the toxic bait. Keep doing this until the feeding stops. Repeat the process as needed. This regime greatly limits the amount of toxicants used and liability associated with nontarget organisms.

Another nontoxic method of controlling rodents along perimeters is placing glue boards inside bait stations. Keep in mind that glue boards become ineffective if they get wet or dirty and may be difficult to maintain. They catch insects and other small invertebrates or vertebrates that should be monitored. A combination of methods might work best in a particular situation. Be creative as long as it is legal and works. Snap traps typically are not used outside

because they are ineffective after they have been tripped. They require more maintenance because they must be checked frequently.

Other key sanitary design issues for plant perimeters and building exterior – Walls, roof, and foundation areas must be constructed to remain dry with no water accumulation. Water is not only a critical need for warm-blooded animals and insects, but it plays a key role in the survival and transmission of microbiological pests. *Salmonella*, *Listeria* and *Escherichia coli* are transmitted through water and are of particular concern to those in the food industry.

Building color can increase insect attraction. White and yellow are more attractive because of their reflective qualities. If possible, minimize the use of these colors on the exterior and in critical interior areas. If present, minimize the amount of light shining on and reflected from these surfaces.

A vegetation-free building perimeter is a must. An 18-inch band of pea gravel is also recommended. Pea-sized gravel is difficult for rodents to burrow in for nesting. Larger gravel does not collapse when moved and may not deter burrowing. Place rodent bait stations along this perimeter, with or without toxic bait, if rodent activity is observed during good manufacturing practices (GMP) inspections.

Many facilities now only place glue boards inside bait stations. The boards must be protected from weather and debris. Frequent inspection is required to remove catches before they decompose, replace glue boards, and log activity. Third party inspectors should not find decomposed rodents in traps. It will likely trigger an automatic unsatisfactory rating due to neglect or lack of disciplined checks.

If grass is allowed to grow too long and pallets are stored outside next to the foundation, pests will find shelter there. Inspect and clean pallets before moving them indoors. Birds and rodents also nest in pallets and can raise a contamination issue.

Psocids, commonly called booklice, rusty and flat grain beetles, foreign grain beetles, and hairy fungus beetles are a few common stored-product insects that can feed on mold and fungi found on wet pallets, inside or out. Wood pallets threaten sanitation and good management practices. Wood can splinter and contaminate production areas. Inspect pallets for pest evidence not only near the floor, but also several feet high in a stack. Rodent droppings can be found on pallet boards several feet up in a stack that ends along warehouse walls. If using pallets, implement a documented cleaning program. This may be even more important if pallets are stored outside and moved inside when needed.

Regulatory inspectors are now making the roof area a primary focus of inspections. Roofs are often neglected because they are out of sight. Secure and monitor roof access points from inside the plant so personnel do not use them as break areas, leaving behind food and debris. This is unacceptable from a GMP standpoint.

Roof areas should be part of a good management practices inspection. Inspections should be done monthly by a multidisciplinary team. Deficiencies should be noted for proper corrective action and to determine the cause. Act promptly to resolve issues. Similar observations noted repeatedly indicate a breakdown in the sanitation program.

Check HVAC (heating, ventilation, air conditioning) units and venting for proper functioning with no leaks. Leaks can deposit food debris on the roof that will attract pests. Roofs should be constructed of an easy-to-clean, smooth surface and must drain properly to prevent water accumulation. Roofs with a gravel base make cleaning and debris removal difficult. All HVAC utilities should be properly screened or filtered to keep out pests. Personal safety is the priority when working on the roof.

Entrance, exit, rail, or dock doors should not open directly into plant manufacturing areas. Open doors allow pests and unfiltered air into the plant. Negative rather than positive air pressure is needed inside the plant to prevent pests from being sucked in. Doors can be screened during warmer months when ventilation is needed. Emergency exit doors that open directly to the outside should have security alarms.

Doors should be tightly sealed along the bottom so rodents cannot enter. Air curtains above doors are not recommended because, more often than not, they malfunction and do not adequately keep pests out. Plastic strip doors are seldom a good option. They deteriorate and need constant repair to keep pests from getting in, adding to maintenance and upkeep costs.

Dock levelers must be fitted for pest prevention and exclusion. Rodents can easily crawl into the plant through the leveler pit when the plate is not sealed. Plates usually are equipped with brush seals or pieces of heavy rubber. Rodent mechanical multicatch traps can be placed inside the leveler pit as part of the rodent control program. Pit areas should be placed on the MSS for periodic cleaning and be part of the GMP inspection program.

Exterior food ingredient commodity storage tanks should be constructed of materials that will withstand the rigors of the outside environment and will not rust. Tanks should be smooth and cleanable, inside and out, for easy maintenance. Preferably, they should not be painted because peeling paint can become a product contaminant. Dust collection units or other HVAC ductwork must be screened or filtered to prevent pest entry. It should be watertight and non-leaking. Place sites on the MSS and preventative maintenance program to document upkeep.

Welded joints should be continuous and not stitched. Stitching creates cracks and crevices where food debris can accumulate and stored-product insects such as red or confused flour beetles or sawtoothed grain beetles can live. The Indian meal moth is another insect that can infest interior tank headspaces and HVAC units. Check these sites periodically for pests. If applicable, monitor sifter tailings coming out of the bins to detect pests and foreign material. Do not log these problems without finding the cause.

Moisture supports mold or fungi inside a dry ingredient storage tank. Precautions to prevent condensation and leaks should be designed into the system. Condensation can occur when warm ingredients are unloaded into a cold silo during cold months. This can become a problem without adequate ventilation.

External ingredient unloading sites – External food ingredient or commodity unloading sites must be designed to exclude stored-product insects such as red or confused flour beetles, sawtoothed grain beetles, foreign grain beetles, flat or rusty grain beetles, hairy fungus beetles, psocids, ants, flies and bees, or wasps. Other arthropods such as sowbugs and millipedes are attracted to moist food debris when it is allowed to accumulate around the unloading site. Surfaces adjoining railroad tracks or lots where unloading occurs should be paved and drain properly. These areas must be cleaned without using water because moist debris will decay and attract pests. Rail unloading areas should not be covered with gravel or rock, which makes cleaning spillage nearly impossible. Debris that sifts down through the gravel or rock attracts pests. Treating the track area with insecticides does not eliminate the underlying cause.

If exterior storage tanks or silos are covered with a protective head house, pest control and sanitation in these areas must be thorough. Hang insect pheromone traps for Indian meal moths, drugstore/cigarette beetles, and warehouse beetles. The traps are species-specific and effective for monitoring flying stored-product insects. Mark trap locations on a schematic map. Check traps weekly and log catches. Typically, head houses are not heated or airtight enough to be sealed easily from the inside and properly fumigated with labeled products.

Inadequate fumigation increases the likelihood of insect resistance. Resistance has already occurred in some cases. If the head house can be sealed to hold in hot air, heat can be used for insect control. The temperature should be maintained at 122 to125˚F for 18 to 24 hours, giving heat enough time to penetrate the cracks and crevices. Heat treatments stress insect populations and limit reproduction.

Windows are discouraged. Left open or unscreened they allow pests to enter. Broken windows can lead to product contamination. Secure top hatch openings to tanks or silos to keep foreign material from getting into the tank. Insects adapt and can survive during the cold months even outside in a head house. They will not reproduce below 50 to 55˚F, but they will survive.

Promptly remove food debris spilled during unloading. Unloading hoses should be clean, capped, and locked when not in use and stored off the ground in a sanitary location. Ideally, product protection devices such as magnets, sifters, filters, or strainers for products being unloaded should be installed before products enter the storage bin or silo. This prevents suppliers from unloading their problem into the bin. Inspect devices after each load and log observations. If contaminants are observed, act immediately to assure products do not become adulterated.

Plant Interior

Although the priority for food manufacturers should be keeping pests out of the plant, infestations inevitably occur. This section describes critical areas for pest control within the plant.

Docks and warehouses – Insect and other pest infestations often originate in warehouses. This is where food ingredients and finished products are stored, and they are located near receiving and shipping dock doors. Maximize rodent control in these areas by using nontoxic traps (i.e., snap, mechanical multiple catch, glue boards) on both sides of each door that opens to the outside. Place rodent bait stations outside along the building perimeter. Do not leave doors and windows open. If ventilation is needed, openings should be properly screened.

Seal wall openings for pipes and wiring to exclude pests. Caulking and copper wool works best. Copper wool does not rust like steel wool and prevents rodent chewing better than caulk. Do not allow birds to nest or roost near the plant. Promptly remove food spilled around docks so it does not attract pests.

Place insect light traps and pheromone traps (Mueller and Van Ryckeghem 2006) around dock and warehouse perimeters to catch flying insects. They are not a panacea because not all insects are highly attracted to them. Pheromone traps are available specifically for Indian meal moth, cigarette beetle, and warehouse beetle. Once in place, mark traps on a schematic location map and checked at least weekly. Log the catch for each trap to determine whether catches are increasing. Update maps as trap locations change.

Change insect trap light bulbs at least once a year. Their effectiveness in attracting insects decreases over time. Although it cannot be detected by humans, insects are sensitive to the drop-off in ultraviolet wavelength. Neither of these pest control devices should be used for control, but rather as a monitoring tool. Find sources of insect infestation close to to traps with high catches and eliminate them.

Keep pallet rack leg bases and I-beam bases clean and free of food in which insects can breed. Place these sites on the master sanitation schedule (MSS). These areas can be treated with a labeled residual insecticide, but debris may prevent insecticide from reaching insects. Sanitation is critical to pest prevention.

Floors – Warehouse floors should be designed for equipment and usage. Consider equipment and human traffic patterns. Will equipment be heavy? Will water or cleaning chemicals be used? Answers to these questions will determine what type of flooring will perform best and last the longest.

Wood floors usually are not a good choice. Older facilities that have them must maintain them in good condition to prevent cracks and crevices that allow food debris to accumulate and insects to breed. Keep wood floors sealed with several coats of polyurethane sealer. Concrete floors are common. Joints need to be sealed, and floor sealers do not last indefinitely. Highly acidic foods can damage concrete floors, allowing food and water to accumulate. Stagnant water can lead to insect and microbiological issues.

Phorid flies (Phoridae), moth flies (Psychodidae), dung flies (Sphaeroceridae), and fruit flies (*Drosophila* spp.) are among many flies that breed in stagnant water. They also breed under loose sections of flooring that are not properly sealed. If floors are not repaired, flies will remain, and insecticide treatment is futile. Tile floors often are a poor choice because of their construction. Seams split over time, allowing food debris and water to accumulate. Water stagnates and can lead to serious insect and microbiological issues.

Ceilings – Periodically inspect and clean ceilings and overheads. Place overheads on the MSS. Fogging with synergized pyrethrins or other labeled insecticides will not be effective on dirty overheads because insects live under built-up debris where they are protected from insecticide. Fogging is most effective when droplets hit exposed insects.

Do not overlook overhead areas as potential runways for rodents, which are excellent climbers. Do not allow condensate to accumulate in overhead areas because it becomes a source of moisture for pests. Design HVAC systems to remove condensation. Avoid false ceilings. Stored-product insects and rodents can be found in false ceilings where flour and food debris accumulate. If personnel forget to clean and inspect them, pests can take over. Fogging is ineffective if these areas are dirty. False ceiling areas must be placed on the MSS, and a pest control

program (i.e., monitoring rodent and insect traps) should be implemented.

Floor drains – Floor drains can pose problems for the plant sanitarian. In dry environments, if food debris is allowed to accumulate, stored-product insects will take harborage in the drain. In wet environments, microbial concerns abound. In dry warehouses or production areas, clean and plug drains when not in use to ensure they stay clean and infestation free. Do not allow drains that are in use to dry out. Place drains on a schematic map and document cleaning dates based on an MSS.

Unplug drains while conducting a heat treatment (Chapter 15) in case a sprinkler head or two discharge. This keeps personnel from having to enter a hot room to unplug the drain while the sprinkler is on. Ideally, floor drains should be a minimum of four inches and equipped with a removable secondary strainer to prevent cockroaches, rodents, and other pests from entering the facility through the drainpipes. The strainer also prevents large accumulations of organic material from entering the drain and causing a backup. Drains should be constructed with smooth surfaces and rounded corners.

Trench drains are difficult to maintain in a sanitary manner. They should not be used except in operations where they are required because of the food being manufactured. Trench drains may deteriorate, causing the floor drain interface to separate. This allows water and food debris to get into the cracks and stagnate. Many fly species will breed in that environment and can only be eliminated by repairing the separation.

Closely monitor floor drains for pests and adequately clean and sanitize. It is important to have written drain-cleaning programs and procedures that require scrubbing the drain sides and piping into the drain. This is the only way to remove biofilms that accumulate in wet drains. Pouring sanitizing solutions into a drain will not remove biofilms. Insects will live under them and continue to breed. Utensils used for drain cleaning should be color coded and labeled ONLY for this purpose. Using drain-cleaning utensils to clean food contact surfaces will cause cross-contamination and violate good manufacturing practices. To verify that a drain is a source of an insect pest, place a plastic bag over the drain and tape it to the floor for 24 hours. Check the bag for insects. Then clean, scrub, and sanitize the drain.

High-pressure water or air should not be used in drains or anywhere else, including overheads. It can scatter debris (i.e., microbials and insects) into the general manufacturing environment and cause cross-contamination. Vacuuming is the preferred method for removing debris. In a wet environment, using a squeegee to corral large amounts of debris is preferred to using high-pressure water.

Electrical equipment – Electrical equipment and systems are extremely vulnerable to stored-product insects, especially sawtoothed grain beetles and confused or red flour beetles. If equipment is poorly designed so it does not remain dust- and water-free, it will become a pest harborage. Thousands of feet of conduit could become insect-breeding expressways. Even overhead light fixtures can become infested. They are warm, and ultraviolet light attracts several insect species. Pesticides are not recommended for use in such areas. Heat can be used to disinfest areas, but only if systems are designed to withstand high temperatures. Caution is advised in determining temperature specifications because "hot spots" can occur during a heat up. Installations must meet appropriate code requirements.

Switch gear and control centers should be installed in well-lit, pressurized rooms. They should be filled with filtered and air-conditioned air and be able to be cleaned easily without high-pressure air. No small voids should be allowed between equipment and wall, or wall and floor interfaces. Dust can accumulate and provide a breeding ground for stored-product insects. Installations should allow adequate inspection space under and around equipment. There should be no hollow areas for materials to enter and accumulate.

Control panels installed in manufacturing areas should be dust-free and watertight. Panels can be pressurized with clean, filtered air. Supporting leg bases should be designed so there are no hollow voids that could allow debris to enter from the sides or where they attach to the floor. Be cautious when using caulk as a sealant. It can become loose and create a harborage. If caulking is used, inspect it periodically to ensure it is intact.

Motor and equipment leg bases – Motor and equipment leg bases often are overlooked during cleaning. There are numerous cracks and crevices and ledges in motors where debris accumulates. They are warm, which favors breeding of stored-product

insects. Clean motors at least monthly and include them on GMP inspection routes.

Equipment leg bases that sit firmly on floors also accumulate debris that can create harborage for insects if bases are not sealed to the floor. Sites are sometimes painted over and over, so crusty paint appears to be part of the equipment. Once loosened and scraped away, flour beetles or sawtoothed grain beetles might be found living there.

Windows – Making sure windows and doors are kept closed or properly screened in a food plant or warehouse can be a struggle, especially during off shifts. Because of the problems they create, it is a good idea not to have windows. Even with the most advanced HVAC units, invariably someone feels too hot and opens a window. Open windows require screens that become separate maintenance issues.

If windows or glass block windows that let light in but cannot be opened are used, do not allow any type of glass in or near food production or packaging because of the potential for breakage and contamination. Window screens used for exclusion, should be constructed of 16 mesh with 14 × 12 wires per inch. Screens should be designed for easy removal and cleaning. Reinforce those within five feet of ground level with a heavy-gauge wire and ¼-inch mesh screen to exclude rodents that can chew through conventional screening. Promptly repair holes for maximum pest exclusion.

Windows can be tinted to reduce the amount of insect-attracting light showing through. When inspecting the plant, look for dead or live insects on windowsills. Identify them to locate and eliminate the source.

Cost of Sanitation and Pest Prevention

The cost of pest control is minor compared to the cost of poor sanitation, which could easily be millions of dollars from negative publicity, brand damage, and worst of all, personal injuries to consumers. For food processors faced with a market recall, the dollars can add up quickly. Production time may be lost to do excellent work in critical sanitation and pest prevention areas, but cutting these two programs can prove more costly.

The goal should be a sanitation and pest prevention program in which prevention, rather than control, is the objective. Preventing pests from becoming an issue is the key to success. Legal requirements, such as FDA current good food and manufacturing practice, also must be met. (Code of Federal Regulations, Title 21, Pt. 110, 2006).

Over the past decade, the FDA's role in the design of new meat and poultry processing plants or remodeling of existing facilities has changed. Previously, the USDA Food Safety and Inspection Service (FSIS) required food processors to obtain prior approval of proposed drawings and equipment. Now, under the Federal Meat and Poultry Products Inspection Acts, food manufacturers are responsible for designing plants and equipment that can be maintained in a sanitary manner (CFR, Title 21, Pt. 110, 2006).

Sanitary design may cost more, but food adulterated with physical, chemical, or biological contaminants that could harm consumers is unacceptable. Adulterated food cannot be sold or shipped across state lines because FDA has jurisdiction to oversee interstate commerce. (FDA, 2007.)

Food manufacturers must design plants and equipment so they can be monitored and cleaned, not only because it is required by law, but also to protect consumers, their brands, and ultimately their business. The consequences of not doing so were illustrated by Peanut Corporation of America, a peanut processing company that was forced out of business after being found to be the source of a massive *Salmonella* Typhimurium outbreak in the United States during 2008 and 2009. Nine people died and at least 691 people in 46 states fell ill due to food poisoning from eating the company's products, according to the Centers for Disease Control and Prevention (CDC). In 2009, Peanut Corporation of America filed for Chapter 7 bankruptcy liquidation. At least a dozen civil lawsuits have been filed, and the federal criminal investigation continues.

Implementation of food safety measures — GMPs, HACCP (Hazard Analysis and Critical Control Point), integrated pest management (IPM), clean-in-place (CIP) systems, metal detectors, magnets, sifters, strainers, filters, sanitary design of floors, walls, ceilings, and drains, and audits — are costly. The return on investment is preventing the manufacture of adulterated food.

A sanitation program that relies solely on the periodic use of chemicals (i.e., fumigants) to manage pests is not feasible. Fumigations can cost tens of thousands of dollars each, yet they offer no long-term residual protection. If doors or windows are left open after fumigation, the facility can be reinfested. The goal must be to prevent infestations.

Food manufacturers must address structural defects instead of relying solely on pesticides. A 2010 survey of pest management industry personnel (Grasso 2010) reported a 6% increase in net revenue from managing stored product insects from 2008 to 2010. The number of pest management jobs for rodents, ants, and cockroaches were projected to increase from 10 to 13% during the same time period. The top four rodent pests (mice, rats, voles, and squirrels) were expected to increase revenue 13% with the average price of a rodent job at $250 in 2010.

Adhering to a Master Sanitation Schedule

Master sanitation schedules do not need to be complex. Many facilities post them so all personnel can see them and comment as appropriate. Something as simple as a grid listing periodic sanitation tasks down the left side and the months across the top will work. Initial and date tasks when completed. Do not leave blank spaces that could lead auditors to believe a task was neglected. Note the reason for the blank (i.e., plant or line down, no production). MSS are not static and should be updated as equipment and processes change in the facility or suggestions from internal or external audits are implemented. Do not include pest control records on a MSS. These should be kept separate for audit reasons.

With food manufacturing facilities becoming more automated, and fewer employees hired just to clean, production personnel are being assigned to clean the production equipment they run, as well as surrounding areas. Some plants (i.e., USDA-regulated) have designated sanitation crews because regulations require more frequent sanitation cycles. Non-USDA plants may shut down for sanitation and run for several weeks before another cycle, based on the food safety risk profile of the products manufactured. This operating procedure includes the cost of sanitation combined with the cost of production, overhead, salaries, and benefits. Many MSS tasks, such as silo or bin cleaning, can be contracted to a third party.

Once an MSS is established, it should be monitored for effectiveness. Audits, conducted by internal or external personnel, cost time and money. Some plants have an employee designated to work with external auditors to carry out inspections. If a facility supplies several customers, each will probably want one of its auditors to visit or have an outside auditing company visit the plant.

Audits take several days and can be an annual or semiannual event. For example, if a facility quality assurance (QA) manager has to accompany an auditor for two days, at a salary of $100,000 with 250 work days per year, it costs $400/day. This does not include preparation time. Most external third party audits cost at least $1,000 per day. In-house personnel need ongoing training to conduct audits. Cleaning personnel should not be assigned to audit their own areas. Independent investigators are needed to ensure there are no conflicts of interest. Fortunately, online training for conducting audits is available at nominal cost. Employees do not have to leave the plant to participate, and it is available 24 hours a day, seven days a week in most cases.

Poor sanitation and pest prevention cause poor audit scores, which will reflect negatively on the company and its business. Facilities must be inspection- or audit-ready at all times.

Most food production facilities require basic preventive food safety programs such as HACCP and environmental microbiology. Each proactive program has an implementation cost, plus periodic sampling and analysis costs. MSS support these programs to make them effective.

Future of Food Safety

Protecting the food supply is a continual challenge for food manufacturers. Widely publicized cases of foodborne illness over the last decade prompted new regulations, which shifted the focus of federal regulators from responding to contamination to preventing it.

The FDA Food Safety Modernization Act, signed into law in January 2011, authorized the FDA to require comprehensive, prevention-based controls

across the food supply. As a result of this new approach, FDA is requiring food facilities to evaluate the hazards in their operations, implement and monitor effective measures to prevent contamination, and have a plan in place to take any corrective actions that are necessary.

The law also gives the FDA a new ability to hold food companies accountable for preventing contamination. In the future, food manufacturers can expect the FDA and USDA to request records (i.e., sanitation and pest control) that have not been required in the past. Companies should be prepared to produce documentation showing sanitation tasks and how they have been carried out.

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