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Safe food guidelines for small meat and poultry processors

A Pest Control Program

EXPERT REVIEWED

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Outline

The common housefly is a known carrier of diseases and pathogens, including listeria and salmonella. The housefly vomits stomach fluid onto its food and sucks up the dissolved nutrients. Flyspecks are dried vomit and fecal material. It has been estimated that in a six-month period, a pair of houseflies and their descendants would total 191,000,000,000,000,000,000 if all the offspring survived. Actual numbers of surviving offspring are much less.

Introduction

Basic pest control in the food processing plant is an essential prerequisite food safety program. Unfortunately, many processors have never established a systematic, written pest control program. This fact sheet outlines the pests of concern and steps that the small processor can take to start a pest control program.

1. What is a pest control program?

All meat and poultry processing facilities, regardless of size, must have a written Sanitation program. One section of the Sanitation program (9 CFR 416.2(a), http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/janqtr/9cfr416.2.htm) is the control of pests: insects, rodents, and birds. GMPs (Good Manufacturing Practices) specified in the Code of Federal Regulations (CFR) clearly specify that pests cannot be present in the food-processing environment (CFR Title 21, Part 110.35 http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/aprqtr/21cfr110.35.htm). To prevent infestation, the processor must create a proactive program for stopping these pests from threatening the safety and quality of the product.

Table 1. To create a plan or contract with an outside pest controller?

	Processor-supported program	Contracted program
Upfront cost	Lower, usually	Higher
Processor time commitment	High	Virtually none
Pest control expertise	Low, usually	High
Recordkeeping	Processor supported	Contractor supported
Equipment and chemicals	Processor must obtain	Contractor supplies
Validation materials	Processor obtains	Contractor supplies
Overall benefits	Must be evaluated by the processor, taking into account all the factors necessary to develop and maintain the program	

The pest control program is a stand-alone program and is also a part of the plant's food safety system. Most small food plants must decide whether to maintain a pest control program themselves or contract the program to a pest control company. There are positive and negative aspects of each approach. Table 1 lists some things to consider.

Many small processing facilities hire a pest control company because the processor lacks the personnel and expertise to run such a program. Of course, a pest control contractor should be reputable and have proper training and experience. A pest control contractor must provide records and reports to the processor verifying that the program is effective and operating successfully. This verification is usually done through visual inspection for pests and/or evidence of pests in the plant or product. The processor must maintain these records with the plant's hazard analysis records to prove that the contracted pest control program is effective. The verification records should include evidence of contractor training and certification to apply pesticides in a food-manufacturing environment, and evidence that the pesticides are approved for such use.

Many processors choose to develop and maintain a pest control program themselves. An effective program can be developed in-house if the processor understands how to control pests. The program would consist of several written sections.

Purdue's Department of Entomology offers six self-study, online courses in pest management (https://www.continuinged.purdue.edu/media/pest/), including one on pest management in food plants.

> *The pest control program is considered a prerequisite program. It is necessary for a plant to implement a pest control program to prevent adulteration of product. It is a necessary part of the total plant food safety program.*

Items included in a pest control program

1. **Pest control procedures —** The activities performed to control each type of pest. The written procedures should be detailed and include frequency of action.
2. **Recordkeeping —** The documentation of each performed activity. These records must be accurate, up-to-date, and include inspection for evidence of pests in each plant area.
3. **Responsible individuals —** The person(s) who are charged with performing pest control procedures and recordkeeping. Also, the supervisor responsible for signing off on reviewed records.
4. **Deviation —** Evidence of a pest problem is a subjective determination that requires expertise. For example, periodically finding a cockroach under a trashcan may be acceptable, but finding many cockroaches would be a deviation. A deviation has occurred when an allowable limit has been exceeded.
5. **Corrective measures —** These are written action steps in the plan that will be performed if there is a deviation from the pest control program. Often, they may include increasing control procedures, retraining of employees, cleaning up the area, etc.

6. **Verification and validation —** Written scientific evidence that the procedures are effective at controlling pests. This material is often available from chemical, trap, and pest control equipment makers. Also, verification is documentation of visual inspection for evidence of pests.

2. Common pests in the processing plant and ways to control them

2.1 Cockroaches

There is no insect, other than the housefly, that is more easily recognized and detested than the cockroach. Cockroaches have been shown to transmit diseases including pathogenic foodborne bacteria such as *salmonella, Vibrio cholerae, Staphylococcus aureus*, and others both in the insect's gut and on its exterior surface.

Detection: Each species has specific habitat preferences, although any species could be found in a food plant building. A good way to detect cockroaches is to enter a darkened production or storage area, turn on the lights, and quickly look for roaches scurrying back into hiding. Cockroaches also may be found by inspecting inside electrical junction boxes, receptacles, and control panels, or by looking behind objects and in floor drains. Glue traps often are a good monitoring device; some come equipped with a pheromone attractant. The use of flushing gases (a number of pyrethroid aerosol products are very good for this purpose) is a common method of driving them out in the open. These materials are so highly repellant that a single squirt into a suspect crack or crevice can cause the roaches to come boiling out into the light. Also, look for droppings and egg cases that indicate their presence.

Control of cockroaches starts with elimination of harborage (especially cardboard boxes that could harbor the insects or their eggs cases). This is done by sealing and filling cracks and crevices and maintaining a sealed, smooth surface throughout the plant in production and nonproduction areas. Seal junction boxes, receptacles, and control panels. Seal openings around conduits and pipes where they pass through walls and ceilings. Inspect incoming shipments (packaging, ingredients, etc.) and reject infested shipments. Chemical control requires that EPA-permitted insecticides be used in the food plant. These products are generally formulated as sprays, aerosols, or dusts. Dry powders and dusts, such as boric acid and insecticide powders, take advantage of the cockroaches' habit of preening themselves. It is important to understand that no pesticide can be used in a food processing plant unless EPA has approved such use.

2.2 Flying insects

The most common flying insects are the housefly and fruit fly. A single housefly has been estimated to carry up to 3.6 million bacteria. Flies transmit disease by spending part of their life in direct contact with or in close contact to fecal matter or decaying material. Flies must liquefy their food before ingestion, so they secrete salvia (often called vomitus) on surfaces. The movement of flies from unwholesome food sources to fresh food products, processing equipment, and other surfaces provides many opportunities to transmit disease-causing bacteria.

Removal and elimination of breeding sites is a key to fly control. This primarily involves the availability of garbage. Garbage must be located away from doors and removed frequently, and waste disposal areas must be properly maintained. Next, flies must be excluded from entering the food processing facility. This includes using air curtains (air screens) and/or doors that close automatically.

Electrocution traps with blue fluorescent light traps are effective in reducing flying insects, including flies. One drawback to these electrocution traps is that they literally cause the fly to explode, throwing aerosolized fly matter into the air. Because those particles can drift down some distance from the trap, it is best to place these traps away from food-handling areas, or well removed from food-handling surfaces in those areas. Blue-lighted sticky traps, baited jug traps and strips, or sticky ribbons are a safer alternative in these areas. Dead flies should be removed from traps at regular

intervals. Catch basins of electrocution traps or jug traps and strips should be cleaned daily. Sticky devices should be replaced at least once a week. Other commercial methods utilize insecticidal sprays or fogs to suppress flies, but exclusion should be the main line of defense.

Air curtains prevent flying insects from entering the processing building through receiving, shipping, or employee entrances. Photos courtesy of Mars Air Doors (Gardena, Calif.).

2.3 Pests of stored products

These primarily include insects that use the food as both nourishment and a habitat. They are usually small insects that infest and destroy foods during all stages of their life cycles. This group includes beetles, weevils, borers, and moths. Stored product pests are not generally associated with disease, as are cockroaches and flies, but they are considered a major food contaminant. As a group, they prefer dry products such as cereal grains and flours, but other foods such as nuts and dried fruits may be infested, as well.

Weevils infest stored grain and cause economic losses worldwide. The life cycle for most weevils is four to five months, and they can infest nearly every cereal grain. Flour moths lay their eggs in flour or meal where the larva destroys the product, and they are important grain pests. A variety of beetles can infest foods and food ingredients. These include grain beetles, flour beetles, and others.

Prevention: The purchase of quality, pest-free grain and food ingredients is the first step to prevention. Regular cleaning of storage areas and processing equipment to remove ingredient spills and accumulated dust is also important. Fumigation of empty storage bins with phosphine, ethylene oxide, or carbonyl sulfide are effective control options for stored product pests. Similarly, fumigation may be used in facilities when processing operations are over for the day.

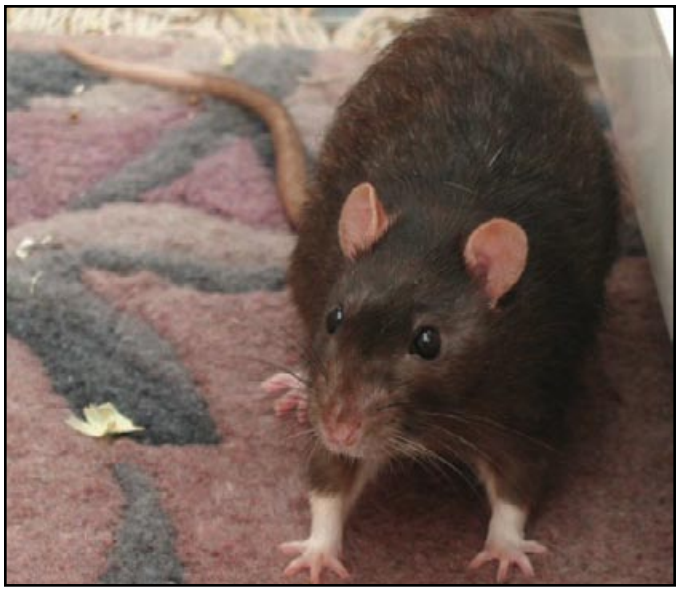
2.4 Rodents

Rodents include rats and mice. They must be controlled in and around a food plant because rats and mice carry and transmit disease, and they can cause significant economic losses by damaging food containers, contaminating food with rodent droppings, and consuming food. Two major species of rats are found in and around human habitation: the Norway rat and the roof rat. The common mouse species prevalent around human population in the U.S. is the house mouse.

Both rats and mice reproduce rapidly, rats having 20 offspring per year and mice up to 35 young per year. Both mammals are primarily nocturnal, but they leave behind several signs of infestation.

Signs of rodents

1. **Droppings —** Fecal matter is a sign of rodent presence, and the amount of it can indicate the extent of the infestation.
2. **Visual sightings —** Seeing rats or mice often indicates a serious and probably well-established infestation, but most experts believe that visual sightings are the least reliable indicators.
3. **Noises —** Shrill squeaks, gnawing sounds, and scurrying sounds could be caused by rodents.
4. **Smudge marks —** Rodents emit oily lipid material from their fur and leave greasy smudges at entry points and frequent travel paths. Rat smudge marks are often more noticeable than those left by mice.
5. **Tracks —** Coating the area around suspected entry points and travel ways with talc, chalk, or flour can detect tracks and tail marks to identify locations for bait station or trap placement.
6. **Gnawing —** Both rats and mice chew and gnaw materials, which is a sure sign of rodent presence. Rats and mice are known to gnaw the insulation of electrical wires, causing fire hazards. Mice are known to cause extensive damage to insulation materials.



7. **Urine stains —** Both rats and mice leave urine stains that can be detected with long wavelength UV light as a yellow to blue fluorescent spot.

Elimination of harborage is the most effective way to control rodents. This includes removing all general clutter from the food plant and storage areas to eliminate rodent hiding places. Maintain an open, well-kept perimeter around the processing plant to discourage rodent activity. Next, food and water sources must be eliminated. This would include environmental management to reduce or eliminate free water and food sources. Third, rodents must be denied entry into the food plant. This would include filling all structural cracks, screening fan and vent openings, and installing drain covers to prevent rodent entry. It has been shown that a mouse can squeeze through a 1/4-inch hole. Mice and rats are also exceptional climbers, which means openings should be located and closed at all levels in the facility. Next, a physical control system should be included. Physical control systems would include strategically placed poisons, glueboards, bait boxes, ultrasonic devices, and traps.

Toxic baits and concentrates

Primary types are the anticoagulant baits; they are relatively safe to use, inexpensive, and effective. Single- and multi-dose anticoagulant products are available, as are products with active ingredients other than anticoagulants. Prebaiting with similar nonpoisonous bait may be effective if the rodents exhibit bait shyness. Regular rotation of brands and formulations of baits may also deter bait shyness. Poisons may be administered in bait blocks, liquid baits, pelletized baits, or treated grain.

Toxic tracking powders

Tracking powders are designed to kill the rodents when they groom themselves. These powders are placed along rodent travel ways or in burrows.

Trapping

Traps are a safe and effective method of eradication, especially for mice and roof rats. Rodents, especially rats, can become trap shy. Glue traps can also effective, and they may trap roaches as well.

Ultrasonic devices

There is controversy about the effectiveness of using ultrasounds (above 30,000 Hz) to repel rodents. Some devices alter the wavelength and direction of sound, and most are somewhat effective when placed at openings to food plants. Most rodents become used to ultrasonic devices after exposure.

Rodenticides

Rodenticides can be used in food processing plants when placed in secure/tamper-proof stations and restricted to areas where food is not processed (warehouse, storage and service spaces, utility rooms/closet, offices, etc.). Normally three perimeters are established for physical control measures. First, bait stations are positioned at the perimeter of the processing plant fence. Second, the outside wall of the plant should be spotted with bait boxes placed directly against the wall, with entry holes to the boxes parallel to the wall. Boxes should be locked and chained to prevent tampering. Finally, a third perimeter of traps inside the plant should be concentrated at areas of high rodent density and near entrances to the plant. All bait stations should be numbered and inspected once each week. Traps should be inspected daily. Density of bait placements may need to be adjusted upward during the fall when large numbers of rodents seek winter harborage inside buildings. Norway rats most often build their nests in ground burrows. They may be effectively controlled by baits placed directly in their burrows, if that can be done without risk of exposure to non-target animals or tampering. Roof rats present special control problems since they typically nest in overhead areas. Solid and liquid baits should be placed in attics or above drop ceilings. Block baits or traps should be attached to rafters, joists, and sills in open overhead spaces.

2.5. Bird pests

Several species of birds harbor disease and pose a risk to food plant sanitation. The most common species involved are pigeons, sparrows, and starlings.

Birds pose a threat to the food processor by carrying disease-causing microorganisms, contaminating product areas with excreta, feathers, or external parasites such as mites. The most common microorganism spread by birds is *Salmonella*. Up to 50 percent of house sparrows were found to contain this microorganism. *Campylobacter jejuni* has also been readily isolated from wild birds.

The best and most effective means of controlling birds is to eliminate nesting and feeding sites on the building(s) and in the vicinity. This includes initial construction of window, door, and ledge areas to prevent roosting and nesting.

> *Birds are difficult to eradicate once they frequent a food processing facility.*

Bird repellent systems work to scare and deter birds from roosting areas.

Scaring devices

Decoys of natural predators, such as owls and hawks, have been used to scare birds, but often become ineffective after birds learn to ignore them.

Sticky pastes

Pastes can be applied to roosting areas to entangle birds and frighten them away.

Electrical wires

Wires that emit a shock to roosting birds can be effective but are difficult to maintain and costly to operate.

Netting

Placing netting or chicken wire over nesting sites such as trusses on a loading dock can be very effective. This has been used extensively to prevent pigeons from roosting on monuments and federal buildings in Washington, D.C.

Entry barriers

Devices designed to block entry to a building, such as automatic doors, vertical plastic strips, even high-velocity air curtains, are available.

Needle strips

Needle strips are applied to ledges, rooflines, and other roosting points. They have been shown to be very effective if installed correctly.

Traps

Traps can effectively remove bird pests. Starlings are the most easily trapped bird pests. Traps can become expensive, because they must be examined regularly so that accidentally trapped nontarget species are not destroyed.

Poisons

Baiting and poisoning of birds is debatable, and this method is usually a last resort when other means of control have failed. Poisons are indiscriminate, having the potential to harm desirable species of birds as well as pest birds. Usually it is recommended that only professional pest control applicators use toxicants for bird pests. Several chemical control agents are commercially available; Avitrol is one of the most commonly used. A fumigant formulation is available for use in warehouse areas.

3. Integrated pest management (IPM)

Integrated pest management (IPM) is a strategy to safely and economically manage pest populations through a well-balanced combination of control practices. The small processor should begin a pest control program by determining which activities will best control each pest most effectively.

1. **Inspection (monitoring) —** Thorough inspection of the entire plant by an expert to objectively identify pest problems is recommended. A written analysis should be provided, with details on problem areas within the plant. Inspections should be conducted at a predetermined frequency. For a small processor, it may be cost-effective to hire a pest management specialist.
2. **Physical control —** A standard of cleanliness must be established, with direct accountability for cleaning. This includes all areas inside and around the outside of the facility. Exclusion practices combined with routine inspection and repair restrict the ability of pests to enter and move from place to place in the plant. Some examples of these practices would be proper landscaping, adequate door seals, no entrances from outside directly into the processing area, and proper placement of dumpsters.
3. **Mechanical control —**These are nonchemical means that stop pests or prevent infestations. We have covered several means, such as sticky traps, electronic fly traps, needle strips, etc. Storage insects can often be controlled by temporarily raising or lowering ingredient temperature or reducing moisture content to levels at which insects cannot grow.
4. **Chemical control —** IPM does not eliminate the need for pesticides, and they should be used when necessary. Only trained personnel should apply pesticides. Application of restricted-use pesticides requires certification, and it may be practical to hire a professional exterminator.

Once the methods of control have been chosen, they must be written down in a concise program with specific instructions, frequency of monitoring, responsible persons, monitoring activities, and reassessment. The program must be available for viewing by FSIS inspectors. Many small processors completely contract out the pest control program to private exterminators who provide all procedures, monitoring, and documentation.

4. Verification of the pest control program

All food safety programs (HACCP, recall, sanitation, pest) must have validation documentation that ensures the instituted procedures are effective. For example, if the pest control program calls for air curtains on the loading dock door, is this measure effective at preventing incoming insects? Often, manufacturers of pest control products provide documentation of the effectiveness of their products. This is evidence that the procedures in the program are effective. The pest controls must also be verified by evaluating data collected on pest numbers and frequencies and by visual checks of the processing plant.

5. Action steps for the small processor

- ✓ Obtain and read a copy of theses regulations pertaining to pest control:
  - CFR Title 21, Part 110.35 http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/aprqtr/21cfr110.35.htm
  - CFR Title 21, Part 110.20 http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/aprqtr/21cfr110.20.htm
  - CFR Title 9, Part 416.2 http://a257.g.akamaitech.net/7/257/2422/14mar20010800/edocket.access.gpo.gov/cfr_2002/janqtr/9cfr416.2.htm
- ✓ Decide whether to create a program or hire a private company.
- ✓ Assess current pest control procedures and define areas that need correction or addition.
- ✓ Document the pest control program in concise form with required procedures, recordkeeping materials, verification materials, frequency, etc.
- ✓ List the individuals responsible for each aspect of the program.
- ✓ If needed, contact pest control experts who can evaluate your plan for completeness and effectiveness.

Disclaimer

Reference to products in this publication is not intended to be an endorsement to the exclusion of others that may be similar. Persons using such products assume responsibility for their use in accordance with current directions of the manufacturer.

Other publications in this series

FS-20-W, Small Meat Processing Plants: Overview of HACCP (Hazard Analysis Critical Control Point)
- www.ces.purdue.edu/extmedia/FS/FS-20-W.pdf

FS-21-W, Small Meat Processing Plants: SSOP and GMP Practices and Programs (Sanitation Standard Operating Procedures and Good Manufacturing Practices)
- www.ces.purdue.edu/extmedia/FS/FS-21-W.pdf

FS-23-W, Small Meat Processing Plants: A Recall and Traceability Program
- www.ces.purdue.edu/extmedia/FS/FS-23-W.pdf

FS-24-W, Small Meat Processing Plants: Verification Programs
- www.ces.purdue.edu/extmedia/FS/FS-24-W.pdf

FS-25-W, Small Meat Processing Plants: Selection and Maintenance of Temperature Measurement Devices
- www.ces.purdue.edu/extmedia/FS/FS-25-W.pdf

Additional resources

Purdue Department of Food Science,
- www.foodsci.purdue.edu/outreach

Food Safety and Inspection Service of the USDA,
- www.fsis.usda.gov

Purdue Department of Entomology self-study courses in pest management
- https://www.continuinged.purdue.edu/media/pest/

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