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# PEST MANAGEMENT IN FOOD PROCESSING & HANDLING FACILITIES

*A Study Guide*



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## INTRODUCTION

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The National Pest Management Association (NPMA) is pleased to release the *Pest Management in Food Processing and Handling Facilities: A Study Guide*. This guide has been updated based on the *2016 Pest Management Standards for Food Processing and Handling Facilities* published by NPMA in November 2016. The publication of the 2016 revision coincides with the implementation of the Food Safety Modernization Act (FSMA). FSMA is reforming our food safety system by ensuring safe food supply based on prevention rather than reaction. The new FSMA standards is bringing increased scrutiny and oversight to the entire food industry which requires sanitation standards only achievable through proper pest management practices.

Food facility servicing requires extensive training and experience. This study guide was developed under the supervision of the NPMA Commercial Committee and is intended to be used as a basic training guide for servicing food facilities. The study guide provided by NPMA will help technicians prepare for the Pest Management in Food Processing and Handling Facilities Exam. Upon successful completion, a completion certificate will be earned demonstrating a technician's understanding of current food safety standards and regulations, helping to ensure a healthy food supply.

We hope you find this study guide to be a beneficial resource in preparing for the Pest Management in Food Processing and Handling Facilities Exam. We encourage all who work in food processing and handling facilities to use this study guide in conjunction with the *2016 Pest Management Standards for Food Processing and Handling Facilities* to keep current on food safety related to pest management in plants.

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# CHAPTER 1

## FOOD SAFETY IN FOOD PROCESSING AND HANDLING FACILITIES

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## 1.1 PERSONAL HYGIENE

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### BACKGROUND

1. **People working in food processing and handling facilities, including pest control technicians, can accidentally introduce disease, allergens and physical hazards into food.**
2. **People carry harmful and dangerous bacteria, viruses, and other pathogens, and allergens on and in their bodies and clothes, including their:**
  - a. Hands
  - b. Digestive system
  - c. Respiratory tract (including nose and mouth)
  - d. Hair
  - e. Skin
  - f. Clothes
  - g. Equipment (including scanners, cell phones, etc.)
3. **Bacteria, other microorganisms and allergens can contaminate processed food when the worker:**
  - a. Touches the food, food surfaces, or food-handling equipment.
  - b. Coughs or sneezes onto food, food surfaces, or food-handling equipment.
  - c. Contaminates food, food surfaces, or food-handling equipment with dirty clothing or equipment.
4. **These pathogens and allergens can cause serious food-borne illness in people who eat the food.**
5. **Workers can also contaminate food when they physically transfer pathogens and allergens from one area of a food plant to another, particularly when moving from a poor sanitation area to a processing area.**
6. **A sick worker in a food facility may pass his or her infection onto food which can then infect consumers. Common examples include Salmonella food poisoning, viral enteritis, and bacterial and fungal skin infections.**
7. **Workers in food facility, including pest control technicians, can carry potentially dangerous pathogens and allergens although they seem to be perfectly healthy.**
8. **Workers can also contaminate food product with foreign objects such as jewelry, buttons, clothing fibers, hair, and, in the case of pest control technicians, loose parts from their pest control equipment or equipment that may disperse broken parts if dropped, such as scanners, cell phones or flashlights; or materials containing pesticide residues.**
9. **Anyone working in a food facility, including outside contractors such as those performing pest control, must maintain a high degree of personal cleanliness, wear suitable clothing, and practice good hygiene and food safety practices.**

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## GUIDELINES FOR PERSONAL CLEANLINESS AND BEHAVIOR

- 10. Your hands and the contaminants under your fingernails are of primary importance in transmitting pathogens to food in a food facilities.**
  - a. Keep your hands clean (and your gloves, if you wear them).
  - b. Your fingernails should be clean and neatly trimmed.
  - c. Be aware that clean hands can be recontaminated with germs by touching your nose, mouth, or other body parts, or by touching other contaminated surfaces, such as door handles or pest management equipment
  
- 11. Regular and sufficient hand washing is the single most important way to prevent the spread of infection that causes foodborne illness.**
  
- 12. When in production areas, any activity that may recontaminate your hands must be followed by thorough handwashing. For example, wash your hands:**
  - a. Before entering a food production area.
  - b. After a visit to the restroom.
  - c. After sneezing, coughing, or using a tissue or handkerchief.
  - d. After using tobacco, drinking, or eating.
  - e. After handling garbage.
  - f. After handling raw or bulk food product.
  - g. After handling any equipment (including rodent traps and insect light traps).
  - h. And any other time your hands might have been contaminated, such as touching areas of your face
  - i. And per a client requirements
  
- 13. Proper handwashing is essential to adequately clean and sanitize your hands.**
  - a. Wet your hands under warm to hot, fast flowing water.
  - b. Apply a liberal amount of soap to develop a good lather, or use special hand sanitizing products.
  - c. Scrub your hands and wrists for at least 30 seconds; be sure to wash between your fingers.
  - d. Clean your nails with a fingernail brush.
  - e. Rinse your hands in warm to hot water.
  - f. Do a final rinse and dry your hands with disposable paper towels. (Towels are more preferred than air currents.)
  - g. Use sanitizers in accordance with client requirements.

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## 14. Avoid behavior which could contaminate food.

- a. Do not use any form of tobacco in food production areas. Tobacco use must be confined only to designated areas.
- b. Do not chew gum or eat in food production areas.
- c. Never spit in a food plant.
- d. Do not sneeze or cough over food or processing equipment.
- e. Do not put your fingers or hands in or about your mouth or nose.
- f. Do not wipe a sweaty brow with your hand; do not drip perspiration onto food or equipment.
- g. Do not dispose of food wrappers, drink bottles, etc. in the garbage located in food processing areas

## 15. Try to work in food production areas first before working in "dirtier" areas of the plant.

- a. If you must move from a "dirty" to a "clean" area, first wash your hands and change into clean protective clothing (coat, coveralls, gloves, boots or disposable shoe covers, etc.)
- b. Follow any client requirements regarding "clean rooms" which entry may be prohibited and follow all other client requirements when moving from one room/area to another
- c. If boot dips are available, be sure to use them to avoid tracking pathogens or contaminants into food areas on your shoes/boots.

## CLOTHING AND PERSONAL PROTECTIVE EQUIPMENT

### 16. Technicians must follow all facility rules regarding clothing and personal protective equipment (PPE).

- a. At a minimum, wear clean clothing and shoes appropriate for the site. (sleeved shirts, long pants and closed toe shoes)
- b. Many plants require that you wear dedicated outerwear and footwear (coveralls, hairnets, booties, etc. that are worn nowhere else) in processing areas.
- c. Plants may require special protective equipment. For example, steel toed boots.
- d. Plants may not allow shirts with upper pockets
- e. If you do have outside pockets, do not carry anything in them (such as pens, pencils, combs, etc.) in processing areas.

### 17. Wherever there is exposed food product, wear a hat, hairnet, snood (for facial hair) or other hair restraint to prevent hair getting into the food.

### 18. Make sure that protective clothing and personal protective equipment (PPE) are clean.

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- 19. Wash your gloves, use a glove dip, or change to new disposable gloves, with the same frequency and for the same reasons as for washing your hands.**
- Do not wear removable jewelry, watches, pins, earrings, fake fingernails, fingernail polish, or similar items in food processing or handling areas.
  - Some plants make exceptions and will allow you to wear removable jewelry and other objects if:
    - There is no risk that material will fall into food, equipment, or containers, and
    - The items can be adequately sanitized during periods in which food is handled.
  - If jewelry cannot be removed it may be covered with a sanitized material which protects against contamination, such as a glove.

## DISEASE PREVENTION

- 20. Workers in a food facility who are ill or injured can transmit a wide range of pathogens onto the food.**
- 21. Report any illness or infection to your supervisor immediately. Know the facilities policy illness and do not work in a food facility until you are given medical clearance if you have any internal symptoms that suggest a health risk around food such as the following:**
- |  |                  |
|--|------------------|
| a. Diarrhea                                    | d. Fever, chills |
| b. Vomiting                                    | e. Jaundice      |
| c. Any other signs of gastrointestinal illness | f. Sore throat   |
|  | g. Runny nose    |
- 22. Also report any of the following external symptoms and do not enter processing areas until you are given medical clearance:**
- Infected cuts or wounds
  - Boils
  - Discharges from the nose, ears, or eyes
- 23. In most food facilities you may work with non-infected cuts and other wounds as long as they are covered with a dry, waterproof and brightly-colored dressing.**
- A wound on the hand, besides being bandaged, should be covered by a glove.
  - Some plants require the wound dressing to be detectable by metal detectors in case the dressing falls into the food.
- 24. Anyone diagnosed with typhoid, paratyphoid, Shigella, E. coli O157:H7, or hepatitis A should not work in food processing areas until a physician determines that they are free of disease.**

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## 1.2 ALLERGENS

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1. **Food allergens are certain proteins in foods that can trigger an allergic reaction in a susceptible person or animal.**
  - a. Extremely small amounts, as little as 10 ppm or even less, can trigger an allergic reaction.
  - b. Reactions can range from mild rashes and hay-fever type reactions to severe life-threatening anaphylactic shock.
  - c. Scientists estimate that 5% of children and 2% of adults have some type of food allergy.
2. **Each year, food allergy reactions result in an estimated 200,000 emergency room visits, 9,500 hospitalizations, and 200 deaths.**
3. **Eight food allergens cause more than 90% of all food allergic reactions:**

a. Cow's milk	e. Soybean products
b. Eggs	f. Wheat
c. Peanuts	g. Fish
d. Tree nuts (such as almonds and walnuts)	h. Crustacean shellfish (such as shrimp and crab)
4. **To make it easier for allergic consumers to avoid foods that contain one of the eight major food allergens, Congress passed the Food Allergen Labeling and Consumer Protection Act (FALCPA)**
  - a. FALCPA applies to food products that are labeled on or after January 1, 2006.
  - b. Any food product that contains one of the eight allergens must clearly show the allergen on the label.
  - c. Any product that contains an undeclared allergen in violation of FALCPA may be subject to recall or seizure.
  - d. The manufacturer and plant management are subject to civil sanctions and criminal penalties for violations of the law.
  - e. Incorrectly or inadequately labeled allergens are one of the main reasons for food recalls.
5. **Pest control technicians must avoid introducing a food allergen into an "allergen-free" area of the food facility and should know the allergen control plan of the facility.**

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6. **Contamination of an allergen-free food product can happen if a technician brings a food allergen into a section of the plant on his or her equipment, supplies, clothing, or body. For example:**
  - a. Insect and rodent baits may contain a food allergen such as peanuts, wheat, or fish proteins. Know the allergens in the products used and the facility policy.
  - b. Technicians can pick up an allergen residue from one area of a facility and transfer it to another area of the facility that is manufacturing a product without that food allergen on its final label. High risk areas include:
    - i. Rework areas
    - ii. Damaged goods and returns
    - iii. Production areas in the same facility making product with one of the eight food allergens
  - c. Technicians can bring allergens into a facility from a previous service stop. If permitted by the food facility.
  
7. **Technicians need to become familiar with food facility rules regarding food allergy control. Rules vary, but some examples include:**
  - a. Service areas processing nonallergen-containing foods first.
    - i. Become familiar with any “allergen zoning map” or “hygienic zoning map” (showing allergen and nonallergen areas) developed by the plant.
  - b. When moving from a product area containing allergens into a nonallergen area, wash and change into fresh protective clothing (coveralls, hat, booties, etc.)
  - c. Consider your equipment and supplies as potential sources of allergens and take precautions to avoid cross-contaminating food products or processing equipment
  
8. **There are other allergens and materials of similar concern besides the “big eight” food allergens:**
  - a. Glutens
    - i. People with celiac disease are allergic to proteins (glutens) found in wheat, barley and rye grains.
    - ii. Some food plants manufacture foods that are “gluten-free.”
    - iii. In these plants, follow the same precautions to avoid cross-contamination as for the big eight food allergens.
  - b. Latex
    - i. Some people are allergic to latex and the dust from latex products.
    - ii. Avoid wearing latex gloves when working in food production areas.

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## 1.3 FOOD SECURITY

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- 1. Food is a compelling target for terrorists and criminals.**
  - a. Terrorists see sabotaging or contaminating a major food brand as a way to undermine consumer confidence in all commercial food.
  - b. The food system is considered one of the nation's eight critical infrastructures at risk of terrorist attack.
  - c. Mentally disturbed or angry individuals may maliciously poison or otherwise tamper with processed foods.
  - d. Be aware of the facilities Intentional Adulteration Plan
  
- 2. A number of federal laws address food security issues, including:**
  - a. The Public Health Security and Bioterrorism Response Act of 2002 (The Bioterrorism Act), which requires handlers and processors of food to take certain actions related to food security.
  - b. The Federal Anti-Tampering Act, which makes it a federal crime to tamper with or taint a consumer product.
  - c. The Food Safety Modernization Act, signed into law in 2011. FSMA is the most sweeping reform of food safety laws in 70 years. The law shifts the focus from responding to contamination to preventing it.
  
- 3. Security procedures at food facilities may affect pest control technicians working in those facilities. A pest control technician needs to comply with mandated security procedures established by the food facility. In addition, a technician may:**
  - a. Be required to go through special security training.
  - b. Be required to obtain additional security clearance, criminal background check, drug testing, etc. to work in the plant.
  - c. Need special identification.
  - d. Have to be accompanied by a plant staff member when working in certain sensitive areas of a facility.
  
- 4. Pest control technicians can have a beneficial role in food facility security as they work in the facility.**
  
- 5. Technicians should report any unusual occurrences or suspicious activity at the facility to a person in authority. For example:**
  - a. A person acting antagonistically, oddly, or otherwise out of the norm.
  - b. Glass breakage, broken doors, cut fences, etc.
  - c. Change in water color, taste, smell, or other indicators of water quality.
  - d. Packaging that appears to have been tampered with.
  - e. Anything else that seems out of the normal patterns of business.

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6. **By reporting conditions contributing to pests (conducive conditions) such as pest exclusion problems, technicians also improve food safety and security. For example:**
  - a. Open or damaged doors and security gates.
  - b. Torn screens, missing gratings, damaged windows.
  - c. Unscreened air vents, air flow problems.
  - d. Roof damage, wall damage, etc.
  - e. Chronically open loading dock doors, bulk storage bins, etc.
  - f. Damaged packaging.
  - g. Inadequately inspected incoming materials.
  - h. Inadequate product rotation.
  - i. Landscape designs that may hamper and prevent observation of criminal activity.
  
7. **Pesticides and other toxicants need to be stored off-site or, if on-site, then stored in a locked and secure structure.**
  - a. Labels, SDSs, and other documentation need to be up-to-date and accessible.
  - b. If stored on-site, then all proper storage safety procedures must be followed.
  - c. If stored on-site, then an up-to-date inventory must be maintained.
    - i. Any inventory discrepancies must be investigated.
    - ii. Obvious unauthorized use of application equipment, or missing application equipment, must be investigated.

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## 1.4 ORGANIC FACILITIES

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1. **Organic food is food produced according to organic standards, which means:**
  - a. Crops grown with a “non-chemical first” approach, artificial fertilizers or sewage sludge, irradiation or genetic engineering.
  - b. Animals managed without the routine use of antibiotics and without the use of growth hormones.
  - c. Food processed without conventional pesticides, ionizing radiation, and without the use of a wide range of food additives.
2. **The Organic Food Production Act of 1990 (OFPA) is the federal law that governs organic food production. The law:**
  - a. Establishes national standards governing the marketing of certain agricultural products as organically-produced products;
  - b. Assures consumers that organically produced products meet a consistent standard; and
  - c. Facilitates interstate commerce in fresh and processed food that is organically-produced.
3. **Organic food sales within the U.S. have grown at a 20 percent rate for the past few years while sales of conventional foods have stabilized at about 2 to 3 percent a year.**
  - a. More and more food facilities are producing organic foods. They may be dedicated plants or have areas (certified space) within the facility for processing or warehousing organic food.
  - b. Expect to service more organic food facilities in the future if you perform pest management.
4. **The National Organic Program (NOP) establishes national standards for the production and handling of organically-produced products, including a national list of substances approved for and prohibited from use in organic production and handling. Products marketed with the official NOP log must meet certain standards.**
  - a. Made law in October 2002.
  - b. Administered by the Department of Agriculture (USDA).
  - c. Covers all aspects of organic food production, processing, delivery and retail sale.
5. **Farmers and food processors who wish to use the word “organic” in reference to their businesses and products, must be certified organic. In general, they must:**
  - a. Avoid use of most synthetic chemicals (fertilizers, pesticides, antibiotics, food additives, etc.) and genetically modified organisms.
  - b. Grow crops on farms free of unauthorized chemicals for three or more years.
  - c. Establish an audit trail with detailed written production and sales records.
  - d. Avoid “commingling” by maintaining strict physical separation of organic products from non-certified products.
  - e. Undergo periodic on-site inspections.

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6. **The National List of Allowed and Prohibited Substances identifies synthetic substances that may be used, and the non-synthetic substances that cannot be used, in organic production and handling operations.**
  - a. The list includes insecticides, rodenticides, and other pesticides.
  - b. The list may specify precisely how or where the substance may be used.
  
7. **Food facilities processing organic foods must develop an Organic Handling System Plan. The plan:**
  - a. Must be approved by an authorized “certifying agent.” Note: certification standards may vary by auditing agency and may be more strict than NOP.
  - b. Describes the practices and procedures that will be used for producing and handling the organic foods, and how often they will be used.
  - c. Lists chemicals and other substances that will be used in production, including chemical composition, source, and where each will be used.
  - d. Describes monitoring practices and procedures.
  - e. Details the record-keeping system used to document compliance with organic food rules.
  - f. Describes the procedures to be used to avoid contact with prohibited substances.
  
8. **Pest management service must be in conformance with the standards of the National Organics Program and with the food facilities’ Organic Handling System Plan.**
  - a. Emphasize non-chemical, IPM-based techniques for managing pests.
  - b. When a pesticide is required to control a pest, use a substance listed on the National List as acceptable for use in organic production and handling operations. Confirm with certification authority and facility policy.
  - c. If it is necessary to use a pesticide not listed as acceptable on the National List, follow the proper contingency procedures in conformance with the standards of the National Organics Program.
    - i. The producer or handler of the organic facility and the certifying agent must authorize use of the pesticide.
    - ii. Take effective measures to prevent the pesticide from contacting any organic products.
    - iii. Update the pest management portion of the food plant’s Organic Handling System Plan to reflect the use of the pesticide, and include a list of all measures taken to prevent the pesticide from contacting any organic products.

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9. **In emphasizing non-chemical, IPM-based techniques for managing pests, technicians should emphasize pest prevention by:**
  - a. Pest-proofing to prevent movement of pests into and through the facility.
  - b. Conducting thorough inspections to identify pest conducive conditions such as:
    - i. Sanitation problems that could provide pests with food, hiding places, and breeding sites.
    - ii. Environmental factors (temperature, light, humidity, atmosphere, and air circulation) that could increase the likelihood of pests.
  - c. Address the conditions conducive to pests.
  
10. **Control of existing pests should favor non-chemical tactics as a first choice. Examples include:**

a. Insect traps	f. Structural modification
b. Rodent traps	g. Vacuum fumigation and low-oxygen atmospheres
c. Vacuuming	h. Dessication/moisture reduction
d. Heat and cold treatments	i. Other mechanical and physical controls
e. Improved sanitation	
  
11. **Pests may also be controlled using lures and repellents consistent with the National List.**
  
12. **When a pesticide is required to control a pest, you should:**
  - a. Use a substance listed on the National List as acceptable for use in organic production and handling operations. Examples include:
    - i. Boric acid
    - ii. Certain botanicals
    - iii. Carbon dioxide
    - iv. Insecticidal soaps
    - v. Pheromones
    - vi. Sulfur dioxide – underground rodent control only (smoke bombs)
    - vii. Vitamin D3
  - b. Or, if it is necessary to use a pesticide not listed as acceptable on the National List, follow the proper contingency procedures in conformance with the standards of the National Organics Program.
  
13. **Your company's pest management plan should be submitted in writing and incorporated into the food plant's Organic Handling System Plan.**
  - a. Follow it to the letter.
  - b. Do not deviate from it without authorization and preapproval.
  - c. Communicate with food plant personnel and keep detailed and complete records of your work.

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## CHAPTER 2

# STANDARDS AND REGULATIONS

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## 2.1 INTRODUCTION TO FOOD PLANT STANDARDS AND REGULATIONS

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2

CHAPTER

1. **All pest management activities at a food plant must be compliant with all regulations, laws, standards, operating procedures, and food safety systems in place at that plant.**
2. **Food plants are regulated under a maze of federal and state laws (depending on the type of plant) and by many government agencies to ensure that food is safe and free from adulteration.**
  - a. Laws governing food plants include the following:
    - i. Federal Food Drug and Cosmetic Act (FFDCA)
    - ii. Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA)
    - iii. Occupational Safety and Health Act (OSHA)
    - iv. Federal Meat Inspection Act
    - v. Federal Poultry Inspection Act
    - vi. Food Safety Modernization Act (an amendment to FFDCA)
  - b. Pest control activities in food plants are also regulated under these laws.
3. **The primary U.S. federal law governing food safety in all food plants is the Federal Food Drug and Cosmetic Act (FFDCA), which is enforced by the Food and Drug Administration (FDA). The core of the law is this:**
  - a. A food product is considered unfit for consumption if:  
(see full definition at 21 USC 342 § 402)
    - i. It is contaminated with any filthy, putrid, or decomposed substance, or is otherwise unfit for food.
    - ii. It has been prepared or packaged in a way that MAY have contaminated it.
  - b. Even if the final food product appears free from contamination, it can still be considered “adulterated” if it has been processed or stored in a dirty or otherwise contaminated area.
  - c. Insect and insect parts, rodent droppings and rodent hair, bird feathers and bird droppings, and similar pests and pest debris are considered to be food contaminants and are not permissible in or near equipment, food ingredients, or packaged products.
  - d. Unless there is a food tolerance established by EPA, food contaminated with residue of a pesticide is considered adulterated and is a violation of FFDCA.
4. **The Food and Drug Administration (FDA) has developed Current Good Manufacturing Practices, or cGMPs, to help food plants maintain sanitary conditions and comply with FFDCA.**
  - a. These may be referred to as Current Good Manufacturing Practices (cGMP). This would be in reference to the regulations as updated regularly
  - b. Subsequent to updates annual training on current cGMPs is required

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5. **Where food plants are not following cGMPs and/or are not in compliance with FFDCA, FDA has the legal authority to:**
  - a. Issue warnings
  - b. Seize and condemn products
  - c. Shut down plants
  - d. Criminally prosecute those responsible
  
6. **Food plants producing meat, poultry and some egg products are regulated by the U.S. Department of Agriculture (USDA).**
  - a. The Food Safety and Inspection Service (FSIS) is the public health agency within USDA responsible for inspecting meat, poultry, and egg processing plants and insuring that they operate in accordance with laws and USDA regulations.
  - b. USDA regulations tend to be more stringent than FDA's.
  
7. **HACCP (pronounced hassip) is another system for ensuring safe food.**
  - a. HACCP is short for Hazard Analysis and Critical Control Point.
  - b. HACCP identifies critical control points in food production where food safety could be compromised.
  - c. HACCP is mandated in certain food plants (meat and poultry, fruit juice, seafood) and is voluntarily practiced in others.
  - d. HACCP is usually focused on process areas but is facility wide under FSMA.
  
8. **HARPC – HARPC is a newer system for ensuring safe food. HARPC stands for Hazard Analysis and Risk-Based Preventive Controls. While HACCP is mandated by the FDA in certain meat and poultry, fruit juice and seafood facilities, HARPC pursuant to FSMA is a U.S. standard required in almost all food processing facilities. Components of HARPC include:**
  - a. Identify hazards (biological, chemical, toxins, pesticides, naturally occurring, unintentional, intentional)
  - b. Develop risk-based preventative controls
  - c. Monitoring of effectiveness through regular evaluations
  - d. Corrective actions
  - e. Verification
  - f. Record keeping and documentation at a minimum for 2 years
  - g. Requirement to reanalyze when significant change at facility or every 3 years

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9. **Other standards to ensure food safety have been developed by various countries and by non-government organizations, such as:**
  - a. National Pest Management Association
  - b. American Institute of Baking (AIB)
  - c. International Organisation for Standardardisation (ISO)
  - d. Global Food Safety Initiative (GFSI)
  - e. SQF
  - f. BRC
  - g. FSSC 22000
  - h. NSF Cook & Thurber
  - i. Primus
  - j. Mérieux NutrSciences Certification LLC (formerly Silliker)
  - k. Many others
  
10. **In 2000, to harmonize food safety standards and reduce audit duplication throughout the supply chain, the Global Food Safety Initiative (GFSI) was developed. Today, GFSI is a bench marking organization that determines equivalency between exiting food safety schemes and promotes a harmonized approach to managing food safety across the industry worldwide.**

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## 2.2 CURRENT GOOD MANUFACTURING PRACTICES (CGMPs)

1. **Current Good Manufacturing Practices (cGMPs) describe the methods, equipment, facilities and controls for producing processed food. cGMPs contain requirements to ensure all human foods are free from adulteration (impurities).**
  - a. cGMPs are developed by the U.S. Food and Drug Administration.
  - b. cGMPs help food plants maintain sanitary conditions and comply with the Federal Food, Drug, and Cosmetic Act (FFDCA), which requires that all human foods be free from adulteration (impurities), and be prepared, packed and held under sanitary conditions.
  - c. cGMPs help ensure the production and preparation of safe food and include criteria for bacteria and contamination control, cleanliness (personal hygiene and dress codes), education, and training.
    - i. cGMPs define the minimum sanitary and processing practices that must be followed for production of safe food.
    - ii. cGMPs serve as one basis for FDA inspections
2. **There are two types of cGMPs from FDA:**
  - a. The primary cGMPs are called “umbrella” GMPs because they cover all types of food plants. Umbrella cGMPs:
    - i. Are broad in scope and subject to considerable interpretation.
    - ii. Use general statements and imprecise language.
  - b. There are also cGMPs specific for certain types of food plants. Though, these are being revised and additional areas added under FSMA.
 

i. Infant formulas	iii. Acidified foods
ii. Thermally processed low-acid canned foods	iv. Bottled drinking water
	v. Dietary supplements
3. **Processing failures due to a lack of the application of modern cGMP controls are a major cause of food product recalls.**
4. **Food cGMPs are quite detailed and cover material in five categories:**
  - a. General provisions, including definitions, rules for personal hygiene, education and training, and exclusion.
  - b. Buildings and facilities, including the plant itself and the grounds, sanitary operations, and sanitary facilities and controls.
  - c. Equipment, including plant equipment, instruments, and utensils.
  - d. Production and processing controls of the entire manufacturing process including raw materials, manufacturing operations, warehousing, and distribution.
  - e. Defect action levels.

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## 5. Requirements and practices described in the cGMPs:

- a. Mostly address procedures outside of the responsibility of pest management companies.
- b. Sometimes impact pest management operations, either directly or indirectly. These are discussed below.

## 6. Pest control technicians need to know how certain terms important to pest management are defined in the law (FFDCA) and in the cGMPs.

- a. The term “food” means:
  - i. Anything used for food (including chewing gum) or drink for humans or other animals.
  - ii. Components of food, including raw materials and ingredients.
- b. “Food contact surfaces” are those surfaces that contact human food, as well as:
  - i. Surfaces that may drain onto food.
  - ii. Surfaces which drain onto other surfaces that contact food during normal operations.
  - iii. Food contact surfaces of equipment.
  - iv. Utensils.
- c. “Pest” refers to any objectionable animals including insects and their larvae, birds, rodents, etc.
- d. “Critical control point” means a point in a food process at which control can be applied and is essential to prevent or eliminate a food safety hazard.
- e. “Rework” means clean, unadulterated food that has been removed from processing.
  - i. The food must have been removed for reasons other than insanitary conditions; or
  - ii. The food must have been successfully reconditioned by reprocessing to a state suitable for use as food.
- f. “Shall” is used for a mandatory requirement in the cGMPs; “should” is used to state recommendation or advice, and following the advice is optional. For example:
  - i. The cGMP guidance that “pesticide chemicals shall be identified, held, and stored in a manner that protects against contamination of food” is mandatory; it must be followed in order to be in compliance with GMPs.
  - ii. The cGMP guidance that “non-food-contact surfaces of equipment used in operation of food plants should be cleaned as frequently as necessary...” allows the plant to clean on a schedule that best suits their needs, while ensuring food safety standards.

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7. **Workers in a food facility, including pest control technicians, should not work in food areas where food could be contaminated if they may have:**
  - a. An illness
  - b. An open lesion including boils, sores, or open wounds
  - c. Any other abnormal source of microbial contamination
  - d. Have risk of allergen cross contamination
  
8. **Workers in food areas, including pest control technicians, should maintain cleanliness and practice good hygiene by:**
  - a. Wearing suitable outer garments.
  - b. Maintaining adequate personal cleanliness.
  - c. Washing hands thoroughly before entering food areas as well as whenever hands have become contaminated.
  - d. Removing all unsecured jewelry and similar objects that may fall into food or equipment.
    - i. If jewelry cannot be removed it must be covered adequately to protect food.
  - e. Maintaining gloves in sanitary condition.
  - f. Wearing (where appropriate) hair nets, head bands, caps, beard covers, or other hair restraints.
  - g. Not storing clothing where food is exposed or where equipment and utensils are washed.
  - h. Not eating, drinking, using tobacco, or chewing gum in exposed food areas.
  - i. And by taking any other precautions necessary to keep from contaminating food, food surfaces, or food packaging materials.
  
9. **cGMPs address maintenance of the grounds around the plant to deter pests by:**
  - a. Removing litter and waste, cutting weeds and grass, storing equipment properly so that pests are not attracted, and eliminating pest breeding and harborage sites.
  - b. Draining areas that are providing breeding sites for pests, including parking lots and rooftops.
  - c. Practicing good waste treatment and disposal practices.
  - d. Excluding pests from the site through pest extermination and exclusion on the border of the plant grounds.
  - e. Removing/remediating, when possible, all areas conducive for pest; including lots and grounds.
  
10. **Roads, yards, and parking must be maintained such that there is minimal chance of pest infestation.**

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**11. Certain cGMPs relating to facility construction and design relate to pests, including:**

- a. Bulk fermentation vessels need to be checked regularly for pests.
- b. Adequate aisles are required between equipment and walls.
- c. Proper screening is needed to protect against pest entry.

**12. Insecticides and rodenticides in a food facility:**

- a. Must be identified, held, and stored to avoid contamination of food, food contact surfaces, and food packaging materials.
- b. Can be stored onsite if identified and secured.
- c. Can only be used while following the necessary precautions and restrictions that will protect against contamination of food, food contact surfaces, and food packaging materials; and if permitted as per the plant's Food Safety Plan.

**13. No pests shall be allowed in any area of a food facility; effective measures are needed to:**

- a. Exclude pests from processing areas.
- b. Protect food from contamination by pests.

**14. Food contact surfaces shall be cleaned and sanitized after any interruptions where the surfaces may have become contaminated, including contamination by pests or pesticides.**

**15. Procedures for waste disposal (rubbish and offal) must minimize the potential for the waste to become an attractant, harborage, or breeding site for pests.**

- a. Trash receptacles must be designed and maintained to reduce the risk of pest infestation and odor.

**16. Equipment in a plant needs to be maintained and kept sanitary to prevent food contamination from any source, from pathogens to pesticides to pests.**

**17. Guard dogs are allowed in food facilities as long as no contamination of food occurs.**

**18. There are two outcomes under the cGMPs if food has become contaminated:**

- a. The food is rejected.
- b. The food is treated or processed to eliminate the contamination, if possible.

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- 19. The cGMPs sometimes allow natural or unavoidable defects in food (such as insects, insect parts, and filth) at certain levels as long as they present no health hazard.**
  - a. The defect action level is a level of defect at or above which food cannot be considered acceptable and below which a food presents no hazard.
  - b. Defect action levels have been set for many food products and specific defects (such as insect fragments). A few examples are:
    - i. Wheat flour: 75 insect fragments per 50g
    - ii. Ground paprika: 75 insect fragments per 25g
    - iii. Canned mushrooms: 20 maggots per 100g
    - iv. Cornmeal: 1 insect per 50g
  - c. If a food product exceeds the defect limits allowed, the FDA regards the product as “adulterated,” and subject to removal from the marketplace and other enforcement action under the Food, Drug and Cosmetics Act.
  - d. Lots cannot be mixed or commingled to bring a batch mix under DAL.
- 20. A pest control technician working in a food plant must take no action that violates FDA's good manufacturing practices.**
- 21. GMPS may be found in the Appendix section of the Pest Management Standards for Food Plants as well as on line. They are currently included in 21 CFR Part 110, but will be moving to 21 CFR Part 117 under FSMA.**

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## 2.3 NPMA PEST MANAGEMENT STANDARDS FOR FOOD PLANTS

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2

CHAPTER

1. **The National Pest Management Association has standards for conducting pest management in food plants.**
  - a. The NPMA standards are the minimum compliance level when servicing a food plant (under this standard).
  - b. The standards do not preempt local, state, provincial, or federal regulations.
  - c. Service in food plants must also comply with government regulations governing pest management, safety, and food protection.
  - d. Some food plants will have standards that are more stringent than the NPMA standards.
  
2. **All pest management employees entering the grounds of a food facility shall wear photo identification.**
  - a. The ID shall include the employee's name, ID number (if issued), and photo, as well as the company name, phone number and date of issue.
  - b. The ID shall be worn at all times on site unless the plant prohibits such badges.
  - c. Some food plants may require other identification and badges.
  
3. **Pest management workers must comply at all times with the visitor/contractor policies of the facility.**
  
4. **All employees who perform service work in a food facility shall wear uniforms meeting the facility's current requirements for uniforms.**
  - a. The uniform shall include at least the following:
    - i. Slip-resistant sole shoes (with steel tips if required by plant).
    - ii. Socks.
    - iii. Long pants.
    - iv. Shirt with sleeves (short or long) with company logo or name.
    - v. Uniform closures shall comply with the rules of the food plant.
  - b. Coveralls and a change of clothes should be available in the service vehicle.
  - c. A clean set of clothing shall be used in plants if a previous account exposed the technician's clothes to possible contaminants (including allergens, chemicals, or microbes).
  - d. Plant uniform rules must be followed if they are more stringent than the NPMA standards.
  - e. Plant required PPE in addition to Pest Management Company PPE requirements.

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5. **Any newly hired employee entering a food facility shall have a criminal background check covering the previous five years from date of hire.**
  - a. The checks shall be part of the records of the company and shall include all states or provinces in which the employee has lived or worked during the previous five years.
  - b. Resulting action from the background check will be at the discretion of the company management.
  
6. **Pest management workers must have reviewed and signed off on the personnel practices standards of the facility.**
  - a. If a special set of standards is in place for facility contractors, then the employee must comply with the standards.
  - b. If any questions or conflicts arise, the employee must either notify a supervisor or the facility contact person.
  - c. A copy of the reviewed and signed document shall be maintained in the facility files.
  
7. **All vehicles used for pest management service at a food facility must:**
  - a. Be clearly marked with company name.
  - b. Be properly licensed.
  - c. Have a current inspection if required by the state.
  - d. Have adequate insurance of at least \$1 million aggregate bodily injury and property damage;
  - e. If plant requires more, then the plant requirement must be met.
  - f. Be parked in a properly assigned area.
  - g. Have materials and equipment secured when unattended.
  
8. **All vehicles used for pest management service at a food facility must contain at least the following supplies:**
  - a. First aid kit.
  - b. Fire extinguisher.
  - c. Spill control materials to cover all products on the vehicle.
  - d. Current labels and Safety Data Sheets.
  - e. Service Kit (carrying kit for small quantities of products and equipment).
  - f. Change of clothing and coveralls.
  - g. Bump cap and other special equipment required by the plant
  - h. Safety glasses.

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**9. Drivers of pest management service vehicles must:**

- a. Get a five year motor vehicle background check.
- b. View the NPMA Safe Driving Video or participate in an insurance industry-approved program annually.
- c. Have any driver training records required by the insurance company on file.
- d. Never use their vehicle to block loading docks, plant employee entrances, or sidings without approval by plant management.

**10. Each company must have a Safety Plan.**

- a. Safety training must be documented for all employees working in food plants.
- b. Each company must also provide verification that food plant-specific safety training has been completed.
- c. The NPMA standards specify a long list of safety training topics that must be covered.

**11. Any technician performing pest management services in food facilities must be trained in food facility pest management.**

- a. Proof of training must be available to the food facility contact.
- b. The standards require both of the following:
  - i. Pesticide enforcement regulatory agency certification or registration.
  - ii. Verifiable training specific to food facility pest management including an exam administered by NPMA.
- c. Documentation of such training should be in the PC logbook section of records

**12. All pest management programs must comply with Current Good Manufacturing Practices (cGMPs).**

- a. All technicians working in food facilities must be trained in requirements of cGMPs.
- b. Food facilities may have cGMP-related requirements beyond cGMPs and technicians must be trained in these plant policies as well.
- c. May use facility cGMP training manual.
- d. Written training verification must be on file in the facility and in the company office.
- e. Annual retraining is suggested.

**13. The NPMA standards include detailed pest management standards for these specific pest groups:**

- a. Rodents
- b. Insects
- c. Birds and Wildlife
- d. Weed control

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- 14. All areas of the facility interior shall be surveyed for rodents and conditions which may lead to rodent infestation.**
  - a. The NPMA standards specify the areas that should be checked.
  - b. Findings should be documented.
  - c. All rodent control devices should be mapped. If at any time temporary devices are used they must also be mapped showing location, date installed and date(s) removed.
  - d. Maintenance and sanitation issues such as, but not limited to, holes in walls, pipe chases, bulk feed lines, spilled food items, or open doors/windows shall be noted consistently on service records.
  - e. Recommendations shall be made and documented to the facility to reduce chances of future infestation.
  
- 15. Prior to designing and implementing a rodent control program, a company representative shall interview facility contacts and review all available rodent history information.**
  
- 16. If rodent control program history is available the program should be designed based on that data, if no history is available the NPMA standards include a way to determine the frequency of service and the spacing for rodent control equipment indoors and out, such as bait stations, traps inside stations, or multi-catch mouse traps.**
  
- 17. Rodenticides shall not be used inside food facilities in any area unless approved by the facility contact and permitted by the label.**
  - a. If approved, any action and reasoning must be documented, and rodenticides should be used only temporarily in tamper resistant stations and when there is no exposed food product.
  - b. Monitoring blocks may be used if permitted by plant contact.
  
- 18. Facilities should have an inspection aisle of at least 18 inches along walls.**
  - a. Commonly, this area is painted white in order to contrast with droppings or insects.
  - b. Traps may be placed along these areas.
  
- 19. Due to concerns about allergens, no peanut butter or nut-based attractants may be used inside a facility unless approved by plant contact.**
  
- 20. A rodent monitoring program must be in place.**
  - a. Minimum requirements for rodent monitoring are provided in the NPMA standards.
  - b. A thorough audit of the monitoring program should be conducted quarterly.
  - c. Audit documentation, including trend reports should be maintained at the plant.

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- 21. The NPMA standards include a standard for an insect program.**
  - a. A thorough inspection is required no less than monthly.
  - b. The standard specifies:
    - i. Areas of inspection.
    - ii. Acceptable insect controls.
    - iii. Installation and maintenance of insect traps.
  
- 22. The NPMA standards also include a standard for managing birds and wildlife.**
  - a. Birds and wildlife can enter facilities and create contamination or potential contamination hazards.
  - b. Maintenance issues such as, but not limited to, holes in walls, pipe chases, doors/windows shall be reported.
  - c. The standard provides guidelines for preventing and controlling birds and wildlife.
  - d. Facilities should be encouraged to eliminate favorable conditions for wildlife infestation, including rooftop
  
- 23. The NPMA standards also include a standard for weed control.**
  - a. Vegetation should not be planted against a building's exterior.
  - b. An inspection band and clear zone adjacent to the building should be encouraged as part of the periodic audit.
  - c. Weed problems should be checked as part of the normal audit process during pest management service regardless of whether the pest management company performs weed control.
  
- 24. At least monthly, the pest management company surveys the facility for infestation by pests and the potential for infestation.**
  - a. Building maintenance, employee practices, physical conditions of the plant, incoming materials, processing, and shipping are also evaluated.
  - b. Documentation of all surveys with recommendations shall be maintained at the facility.
  
- 25. The NPMA standards require that the pest management program be audited at least once per year.**
  - a. A supervisor, quality assurance staff person, or a manager reviews the entire program on site.
  - b. The quality assurance (QA) audit evaluates the program, records, and frequency, as well as the monthly surveys to make sure that all documentation is in order.
  - c. Documentation of the audit along with recommendations for any changes to the program should be maintained at the facility.

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- 26. At least once per year, the pest management company shall offer to conduct an educational program for plant personnel.**
- The standards specify what should be included in the training and who should be encouraged to attend.
  - Date, content, trainers name, and list of those who attend is kept in the facility pest management records.
- 27. The standards require that all pesticides be stored off site or in a locked and secured storage area.**
- Any on-site storage must provide adequate spill control and safety equipment for all materials stored.
  - All storage must be in compliance with government regulations, policies of the food plant, storage requirements listed on the label, and cGMPs.
  - If storage is in a locked cabinet, all room requirements must be met.
  - Fumigants shall not be stored onsite unless storage requirements of the label are met.
  - Records must be stored in a secured area.
- 28. The NPMA standards include a standard for working in USDA certified National Organic Program (NOP) facilities. These facilities produce food certified as produced without conventional pesticides, artificial fertilizers, and other artificial inputs.**
- Procedures to ensure that the food will not be contaminated by any pest management method must be in place prior to beginning any service in an NOP facility.
  - NOP requires that pest prevention be limited to mechanical or physical controls and/or natural or approved traps and repellents when possible.
  - If these measures fail to control the pests, the facility may use a natural substance approved on the National List.
  - If the natural (approved) substance fails, then a synthetic substance may be used:
    - "Provided that the handler and the certifying agent agree on the substance, method of application, and measures to be taken to prevent contact of the organically produced products or ingredients with the substance used."
  - The NOP requires adherence to IPM methods.
  - There may be additional organic requirements beyond NOP in some plants.
- 29. The NPMA standards include details on communications, data collection, reporting, and recordkeeping.**
- This information is covered in the next chapter, Communications and Recordkeeping.

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## 2.4 COMMUNICATIONS AND RECORDKEEPING

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1. **NPMA's Pest Management Standards for Food Plants provide guidance for communications with the plant, recording data, reports, and recordkeeping.**
2. **Pest management surveys, inspections and risk assessments of food facilities should be recorded.**
  - a. The NPMA standards provide a sample "risk assessment" as a comprehensive checklist of typical pest problems and conducive conditions found on the interior and exterior of a food facility.
  - b. Risk assessments should be conducted to identify current or problems.
  - c. The sample risk assessment is meant to be used as a tool to assist in analyzing, creating and maintaining a successful plan.
  - d. Risk assessments are only one component of a successful integrated pest management which also includes proper implementation, management and communication.
3. **The NPMA standards require documentation of the annual Quality Assurance audit.**
  - a. The written results of the QA audits must be filed at the facility with a copy in the pest management company office.
  - b. SDS and labels for all pesticides and other pest management products used at the facility must be filed at the facility either in hard copy or electronic versions, or be accessible via the web.
4. **The following general personnel records for pest management workers must be on file and be available to the food facility contact:**
  - a. A 5-year criminal background check.
  - b. A 5-year motor vehicle background check.
  - c. Safe-driver training records.
  - d. A sign-off that the employee has reviewed the plant personnel practices.
5. **Any technician servicing a food facility must be trained and proof of that training must be available to the food facility contact. The following is required:**
  - a. Food-facility specific training.
  - b. Exam results from NPMA food facility pest management testing.
  - c. Regulatory agency certification or registration records.
  - d. Safety training.
  - e. Training in cGMPs and plant-specific cGMP-related requirements. (This training should be repeated annually.)

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6. **Annual pest management training records for facility personnel should be kept in the facility pest management files. At a minimum, records shall include:**
  - a. Date of training course.
  - b. A description of the content of the training presentations.
  - c. A list of attendees, and the trainers name
  
7. **All records and documents for the pest management program may be in hard copy or filed electronically.**
  - a. The pest management company must keep a backup copy of all documents at the pest management company office.
  - b. The pest management company cannot surrender any copies of documents to any official without the express written consent of the plant contact or substitute.
  - c. However, if there is a regulatory audit of pest management (such as by a pesticide enforcement agency), records may be surrendered if required.
  - d. Always be sure to keep copies of any surrendered documents.
  
8. **Official documentation and reporting required by the standards shall be retained as follows:**
  - a. On-site data may be collected: 1) by handheld electronic devices, 2) manually, or 3) by a combination of methods.
  - b. There shall be access to all service data.
  - c. Record recovery will be available on demand.
  - d. Records will be sortable by product used, area, pest, date, time, and shift.
  - e. Trends shall be determined at the interval of service.
  - f. All inspection reports can be made available online.
  - g. All documents in the pest management filing system must be available to the facility in a reasonable time. Prior to completing any work in a food facility, a signed contract and scope of service must be in place (unless specifically waived by the food facility) and must include data specified in the NPMA standards.
  
9. **The pest management company shall provide a Pest Sighting Log.**
  - a. The log should be maintained in a plant office, which may be the pest management area.
  - b. The log shall include dates, times, locations, type of pest, name of reporting employee, and actions taken by the pest management company.
  - c. The log shall be reviewed by the technician at each visit and data shall be included to aid in adjusting the pest management program as necessary.
  - d. Use of the log shall be discussed at the training sessions for plant personnel conducted by the pest management company.

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**10. Credentials to be maintained at the facility along with the pest management records must include:**

- a. Copy of the certification or registration document, if issued in the facility jurisdiction, for each person who will perform pest management services in the plant.
- b. Copy of the pest management company license to operate issued by the state or provincial lead pesticide enforcement agency. (where applicable)
- c. Copy of current insurance certificate.
- d. Copy of proof of successful completion of verifiable training and exam for each technician servicing the plant.

**11. Standard Operating Procedures (SOPs) shall be developed for the facility.**

- a. SOPs should be developed in partnership between the pest management company and the food facility.
- b. All scope of service information, including methods of inspection and treatment, must be documented and approved by the food facility. Emergency response policy and after hours contact information must be included in the scope of service.
- c. Protocols and procedures shall include at least the following:
  - i. Procedures and timetable for all current or anticipated pest management activities including inspections and audits
  - ii. Pest sighting log
  - iii. Pest activity records
  - iv. Treatment records
  - v. Trend reports
  - vi. Dated floor plan/plant layout with pest management activity information listed such as rodent stations, monitoring devices, etc.

**12. All service records for service including applications and/or monitoring shall include the following information:**

- a. EPA or PMRA registration number
- b. Product brand name
- c. Lot number of product
- d. Target pest
- e. Rate of application or % concentration
- f. Date and time of application
- g. Location or site of application
- h. Amount of finished product used
- i. Signatures of technician AND plant contact
- j. Certification or registration number of technician
- k. Emergency phone number
- l. Notes and observations and any other records required by the state pest management enforcement agency

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## CHAPTER 3

# IPM INSPECTIONS OF FOOD PROCESSING & HANDLING FACILITIES

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## 3.1 INTRODUCTION TO IPM IN FOOD PROCESSING & HANDLING FACILITIES

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1. **The acronym IPM stands for Integrated Pest Management.**
  - a. IPM is a systems approach to pest management, focused on prevention.
  - b. IPM is based on science.
2. **Four themes run through IPM:**
  - a. Prevent pests before they become a problem.
  - b. Use action thresholds to determine when management with pesticides is necessary.
  - c. When pests do become a problem, choose control methods and materials that pose a low hazard to people and the environment while providing long-term, effective control.
  - d. IPM is a partnership between the pest management vendor and client.
3. **IPM is well suited to pest management in food processing and handling facilities.**
  - a. IPM achieves long-term control of pests using many different tools and practices and uses pesticides only when necessary.
  - b. IPM is consistent with Good Manufacturing Practices (GMPs), Hazard Analysis and Critical Control Point (HACCP), Hazard Analysis and Risk-Based Preventive Controls (HARPC) and the NPMA Pest Management Standards for Food Processing and Handling Facilities.
  - c. IPM is the recommended pest management approach for National Organic Program (NOP) facilities.
4. **IPM is a process for achieving long-term management of pests using many different tools and practices, and using pesticides only when necessary.**
  - a. IPM differs most from most forms of traditional pest management in that it does not depend on automatic or calendar-based applications of pesticides.
  - b. IPM is primarily prevention of pests before they become a problem. This is accomplished through pest proofing (excluding pests), habitat modification (removing food, water and shelter of the pest), conducting thorough inspections, continually monitoring, and addressing sanitation problems.
  - c. When possible, nonchemical techniques should be used as the first choice to control existing pest issues. Traps, vacuums, and moisture management are some of the most commonly used nonchemical control methods.
  - d. When pesticides are required to control a pest population, technicians choose products and application methods that minimize risks to people and the environment.

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- e. IPM often uses “action thresholds,” a pest population label at which an IPM technician takes action to reduce and/or control the pest population. In general, populations below the “action threshold” indicate that no direct control action is necessary
  - f. The client and the pest management company should work together to establish “action thresholds.” This process ensures concerned parties know when action will be taken.
  - g. IPM clients need to take nonchemical recommendations seriously (e.g., installing door sweeps, fixing torn screens, etc.). If for some reason the client cannot implement IPM recommendations, the pest management company and the client should work to find viable solutions.
  - h. IPM may initially be more labor intensive and require up front resources to implement than non-IPM pest management programs. However, costs are can be lower over time due to the long term benefits of better structural and environmental maintenance.
  - i. IPM practices may also provide financial benefits unrelated to pests. For example, weatherization of buildings can help exclude pests, but it also can save energy and reduce moisture problems.
  - j. Using IPM in food facilities is important because of the focus on exclusion and prevention of pests that could contaminate food products.
- 5. Different people may define IPM in different ways.**
- a. The details of IPM programs can vary widely depending on the site and the philosophy of the parties involved.
  - b. IPM requires a new “mindset” on the part of both technicians and staff that is consistent with FSMA regulations.
  - c. IPM is proactive (acting to prevent pest problems).
  - d. IPM requires food facilities coordination and staff cooperation.
  - e. IPM may require additional training and supplies.
- 6. The Environmental Protection Agency (EPA) states that IPM is not a single pest control method, but rather involves integrating multiple control methods based on site information obtained through:**
- a. Inspection
  - b. Monitoring
  - c. Reports
  - d. Evaluation

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7. **Although many different approaches to IPM exist, every IPM program should be designed based on the pest prevention goals and eradication needs of the facility. At a minimum, IPM programs should incorporate this four-tiered implementation approach recommended by the EPA:**
  - a. Identify pests and monitor activity.
  - b. Set action thresholds.
  - c. Prevent
  - d. Control
  
8. **IPM is not a “pesticide-free” option for controlling pests; situations arise when pesticides are necessary and are a legitimate tool in food facilities IPM.**
  - a. When pesticide use does become necessary, selecting materials is not as simple as using whatever pesticide the technician chooses. Most food facilities have approved product lists that detail which products may be used in the plant. Only those products can be considered unless a written exception is made by plant personnel.
  - b. The pesticide application methods must follow the label directions and safety precautions to minimize risk from toxicity.
  
9. **IPM programs place a different emphasis on the various actions and tactics used in pest control than do outdated “traditional” pest control programs.**
  - a. Inspecting and monitoring for pests and conditions contributing to pests is of critical importance in IPM.
  - b. Far more time may be spent by an IPM technician in inspecting than applying control materials.
  - c. Technicians are often decision-makers in IPM programs; they work with the facility to determine what to do and to effectively implement corrective actions.
  - d. Communications are typically more detailed and more time-consuming than in traditional pest control, meaning detailed record-keeping, various types of reports and logs, and education of plant personnel.
  
10. **There are three general ways to control pests in an IPM program: pest prevention, physical (or nonchemical) pest control, and pesticides.**
  - a. In IPM, technicians give preference to those tactics and tools that do not include pesticides.
  - b. The best long-term solution is to prevent pests in the first place by:
    - i. Limiting their food, water, and harborage sites.
    - ii. Physically blocking them from entering a building.
    - iii. Eliminating conditions that attract them.

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- 11. The following couplets illustrate the differences between IPM and other pest management programs:**
  - a. In IPM, non-chemical control measures are prioritized. The application of pesticides most often takes place after nonchemical efforts have been deemed to be insufficient. Even when pesticide applications are made, non-chemical methods should continue to be used where possible. Non-IPM pest management programs allow pesticides to be used as the first line of defense without trying non-chemical tactics.
  - b. IPM requires that clients implement technician recommendations in order to solve or prevent pest problems. Non-IPM pest control may not emphasize client cooperation as heavily as IPM programs do.
  - c. IPM is dependent on the client being an active partner in the program. Traditional pest management is often less focused on the client making changes to aid in pest management.
  - d. Education and training are important and necessary for implementing IPM. IPM paperwork requirements can be extensive (logbooks, service reports, trending reports, etc.); while more traditional pest control paperwork requirements can be limited to a basic service ticket.
  
- 12. One of the main roles of an IPM technician is to identify conducive conditions at the facility, and track implementation of recommendations so problems are corrected.**

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## 3.2 INSPECTIONS AND MONITORING

1. **The goal of a food facility pest management inspection is to identify any conditions that may cause or permit contamination or adulteration of food by pests.**
2. **A technician should not just look for pests, but, rather, seek a wide range of information including the following:**
  - a. Identity and location of pests.
  - b. Areas of critical sensitivity (processing equipment, food storage, etc.).
  - c. Size of pest populations.
  - d. Conducive conditions that are contributing to the pest problems. Conducive conditions are factors that attracts pests, provides them food, water, harborage or breeding sites, or that permits their entry into the facility such as:
    - i. Poor sanitation.
    - ii. Improper storage.
    - iii. Pest entryways (holes in walls, etc.).
    - iv. Sources of food, water and harborage.
  - e. Management practices that could affect pest populations or pest management activities (trash pickup, inspection aisles, lighting, construction, etc.).
  - f. Environmental conditions (temperature, moisture problems, weather or seasonal changes).
3. **Proper identification of pests is essential.**
  - a. Different pests have different habits and food requirements.
  - b. What works to manage one pest may not work against another similar pest. For example:
    - i. One stored product moth may be attracted to a pheromone trap while another similar moth is not.
    - ii. "Gnats" may be fruit flies, drain flies, or phorid flies, each requiring different action.
    - iii. If there is any doubt as to the proper identification of a pest, specimens should be submitted to a qualified individual for identification.
4. **The frequency of regular monitoring inspections will vary with the specific conditions at the food facilities but should be conducted at a minimum once a month unless otherwise specified by regulation or the customer requirements.**
5. **There are various ways to collect information during your inspection, including:**
  - a. Speaking with plant personnel, or reading their comments in the IPM logbook.
  - b. Walk-through visual inspections of all areas of the facility, including the grounds and the roof.
  - c. Use of various types of monitoring devices.

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6. **Do not look just for the pests themselves, but also look for other evidence of pests such as:**
  - a. Droppings and frass from insects, rodents, and other pests.
  - b. Gnawing, tracks, and sebum trails (an oily secretion of the sebaceous glands) from rodents.
  - c. Damage (such as exit holes in packaging).
  - d. Shed insect skins or webbing.
  
7. **Inspections should include safely accessible sections of the building's interior (both food and nonfood areas), the building's exterior (including, on occasion, the roof), and the grounds.**
  
8. **Develop a profile of the top problem sites.**
  - a. Often, the majority of pest activity is not found in all areas of the facility. Inspections should be focused on areas of highest risk for pests.
  - b. Higher risk areas include the following:
    - i. Cracks and crevices.
    - ii. Corners, ledges, and hollows.
    - iii. Equipment voids and structural voids.
    - iv. Dark zones, shadow areas.
  - c. Ask staff to identify hard-to-clean areas; these will be the sites most likely to have pest problems
  - d. Ask about any recent equipment malfunctions that might have resulted in food spills.
  
9. **Pests can reinfest the same sites year after year. Always record sites of infestation and refer to past records.**
  
10. **Pests tend to follow structural lines. Look for pests, droppings, and other signs along safely accessible:**
  - a. Utility lines (electric, plumbing, computer cables, etc.).
  - b. Heating ducts/pipes.
  - c. Expansion joints/stress cracks.
  - d. Wall/floor intersection.
  - e. Pallet/shelf edges.
  - f. Equipment edges.
  - g. Rows of stored materials.
  
11. **High-risk areas that need to be inspected on every service visit include the following:**
  - a. Any area infested at the previous inspection.
  - b. Rework areas/returned goods.
  - c. Receiving.
  - d. Processing areas.
  - e. Food storage.
  - f. Exterior perimeter of building.
  - g. Loading docks.
  - h. Rail tracks at entry
  - i. Dumpster/compactor areas, and other trash areas.
  - j. Any exterior processing equipment or exterior bulk food storage.
  - k. Outdoor lunch areas.

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**12. Raw and packaged food areas need to be inspected regularly for stored product pests.**

- a. Inspect packaging for pests and evidence of pests (webbing, frass, fragments, etc.) in seams and corners, and look for pest entry/exit holes in packaging.
  - i. Check products with damaged packaging.
  - ii. Check the oldest products.
- b. Spot check cereal products by examining a sample for pests and evidence of pests.
  - i. A hand lens or small microscope will help you identify mites and small insects and insect fragments.
  - ii. For flour and other fine-milled product, sift the material through a fine screen.
  - iii. Bioassays can be conducted by the facility to test incoming product for contamination.
- c. Some pests can produce a noticeable odor. Inspect closely where odors appear to be associated with pests.
- d. Look for staining of the food or label, along with insect body parts and frass.
- e. Check for food debris spilled under stored food, and any food debris that has accumulated in nearby cracks and crevices.

**13. The roof of a food facilities should be inspected occasionally during the year, if safely accessible. Food byproducts and organic debris can accumulate onto roofs and ferment, attracting rodents, wildlife, birds and insects, which can then find their way inside through ventilation shafts, utility lines, or damaged flashing.**

**14. Inspection checklists are valuable for ensuring that critical food facilities areas are inspected and not overlooked, and can also serve as documentation and reminders of problem areas**

**15. Consider the condition of adjacent properties and whether you should establish special inspections to intercept pests from high-risk sites.**

**16. Once a food facilities inspection is completed, it should immediately be reviewed with the plant sanitarian or other designated facility contact.**

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## 3.3 KEY FACTORS WHEN INSPECTING FOR RODENTS

1. **Droppings, or fecal pellets, are a key indicator of rodent activity. By analyzing droppings you can do the following:**
  - a. Identify the kinds of rodents present at an account.
  - b. Pinpoint infested areas.
  - c. Estimate the population size.
  - d. Determine what they are feeding on.
  - e. Always be careful around any kind of fecal material. Droppings may harbor disease spores. A technician should wear appropriate PPE which may include a respirator and gloves when inspecting/treating areas with droppings.
2. **A single rat may produce >50 droppings daily, a mouse up to 100.**
3. **The droppings of pest rats and mice are distinct:**
  - a. Roof rat droppings are up to one-half inch long and tend to be pointed at both ends and curved.
  - b. Norway rat droppings are up to three-quarter inches long with one end blunt and are mostly straight.
  - c. House mouse pellets are much smaller:  $\frac{1}{8}$  -  $\frac{1}{4}$  inch.
  - d. Deer mouse and house mouse pellets look very much alike; but deer mouse pellets are slightly smaller.
  - e. Very young rats produce droppings similar in size to mature mice.
4. **Do not confuse the droppings of other animals with rodent droppings:**
  - a. Bat droppings are easy to identify since they are comprised almost entirely of insect parts and crumble when pressed.
  - b. Squirrel droppings are slightly larger than rat droppings, up to one inch long, blunt.
    - i. Squirrel droppings are sometimes twisted in the middle so one dropping can appear like two connected together with a narrow waist.
    - ii. Sometimes, multiple squirrel droppings will be connected.
5. **American and certain other large cockroach droppings are sometimes confused with mouse droppings, being about  $\frac{1}{8}$  inch long, but they are rectangular, blunt on both ends, and have ridges.**
6. **The highest number of droppings will be found in locations where rodents rest or feed. Heavily used runways will have droppings scattered along their lengths.**
7. **Fresh droppings are often soft, putty-like, and moist, but can harden and dry out after a few hours or days, depending on the relative humidity and other factors.**

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- 8. To determine if a rodent population is active, sweep up old droppings and reinspect a week later for new droppings.**
  - a. If large numbers of fresh droppings appear, there may be a large and active rodent problem.
  
- 9. Rats and mice urinate regularly during their waking hours. They urinate in feeding areas, they urinate in travel areas.**
  - a. Portable ultraviolet lights are often used in the food industry to identify rodent urine on food items.
  - b. Blacklight inspections work best at night and in dark rooms.
  - c. Both wet and dry urine stains will glow under an ultraviolet light (blacklight).
  - d. Rodent urine glows bluish-white when new and turns yellowish as it ages. Many other materials glow with a different hue.
  - e. Certain solvents, cleaners, and lubricants may also fluoresce bluish-white or yellow-white.
  - f. Rodent urine typically is deposited in droplets in a straight line, with large droplets leading to smaller ones.
  
- 10. Rodent sebum marks or rub marks may be found:**
  - a. Along wall/floor junctions.
  - b. On pipes and ceiling joists.
  - c. On sill plates where rats swing around obstacles (often called swing marks).
  - d. Grease marks are also found at regularly used openings in walls, floors, and ceilings.
  
- 11. Rodent tracks show up in dust, snow, or soft, moist soil.**
  - a. A rat's foot print is about three-quarters inch long, and may show four or five toes.
  - b. Mouse tracks are much smaller, usually less than  $\frac{3}{8}$  inch long.
  - c. Some rats and mice may also leave a "tail drag" line in the middle of their tracks.
  - d. Rodent tracks typically do not last long so their presence is usually a positive indicator of an active infestation.
  
- 12. Gnawing damage is evidence of a rodent infestation.**
  - a. New gnawing damage is a positive indicator of active rodents.
  - b. Gnawed holes may be two inches or more in diameter for rats, but often nearly as large for mice.
  
- 13. The size of the gnawing marks can tell who did the gnawing: roughly  $\frac{1}{16}$  inch space between tooth marks for mice and  $\frac{1}{8}$  inch for rats.**

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- 14. Norway rats are usually responsible for any burrows you find, although roof rats and deer mice will sometimes burrow around buildings.**
  - a. Norway rat burrows may be found singly or in groups along foundation walls, under slabs and dumpster pads, in overgrown weedy areas, beneath debris, and in embankments.
  - b. The main opening of an active burrow will be free of dirt, leaves, and debris, and often smooth with hard-packed soil pushed out in a fan-shaped pattern.
  - c. To determine activity, fill the opening with a ball of wadded-up newspaper or a few leaves and cover it with loose soil. Any active rats will reopen and clear the hole overnight.
  
- 15. Always inspect the structure for routes of entry for rodents.**
  - a. A young mouse can squeeze through a slotted opening about  $\frac{3}{8}$  inch wide, just slightly larger than the thickness of the average pencil.
  - b. A young rat needs about one-half inch slot.

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## 3.4 TOOLS USED FOR INSPECTIONS AND MONITORING

1. **Food facilities inspection tools include the following:**
  - a. Floor plan (food facilities can be complex and confusing).
  - b. Clipboard/pen, electronic tablet or phone, hand-held service device, or other digital recorder.
  - c. A quality flashlight (explosion-proof required in some plants).
  - d. A small set of tools including screwdrivers, pliers, and adjustable wrenches.
  - e. Knife or multi-tool.
  - f. Mechanic's mirror (metal, not glass) with extendable handle.
  - g. Collection materials (plastic vials, tweezers, swabs, plastic bags, plastic putty knife).
  - h. Hand lens or magnifier.
  
2. **Optional or supplemental inspection equipment can include the following:**
  - a. Blacklight (UV) to detect rodent urine.
  - b. Moisture meter.
  - c. Barcode scanner (for servicing devices).
  
3. **Monitoring tools and devices are left on site between inspections. They have certain advantages over visual inspections:**
  - a. Monitoring tools work 24 hours per day, seven days a week.
  - b. Monitoring tools pinpoint precise areas of pest activity, even if pests are only active late at night.
  - c. Some monitoring tools capture pests, making accurate identification easier.
  - d. Monitoring tools help assess the size, location and level of development (whether it is increasing or decreasing through time) of infestations.
  - e. Monitoring tools gauge the program's success by comparing trap results before and after pest management action.
  - f. Monitoring tools can be used to collect numerical data as part of IPM recordkeeping requirements.
  
4. **The types of monitoring tools available include the following:**
  - a. Sticky traps, which use an adhesive to capture insects.
  - b. Pheromone traps, which use chemical attractants to draw certain species of pests into the trap
  - c. Food attractant traps (pitfall, fruit fly, etc.).
  - d. Grain probe traps.
  - e. Insect light traps (ILTs), which use ultraviolet light to lure and capture certain flying insects.
  - f. Nontoxic rodent bait.
  - g. Tracking patches.
  - h. Electronic detecting devices using technology such as heat, motion or pressure sensors

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5. **Sticky traps are simply plastic, cardboard, or other materials with one or more surfaces covered with glue.**
  - a. Sticky traps can be flat, triangular, box-like, or hanging tapes (for flying insects).
  - b. Sticky traps are a simple and inexpensive way to monitor cockroaches, ants, flies, and other pests.
  - c. Some sticky traps are available with lures to attract pests, such as cockroaches, beetles, stored product pests and flies.
  
6. **Sticky traps are good positive indicators of an infestation, but are not a guarantee that the area is pest-free.**
  - a. Capturing cockroaches or other pests in a sticky trap confirms pests and identifies the species.
  - b. If sticky traps are empty, the area may be pest-free.
    - i. On the other hand, the traps could be in the wrong place, or the infestation could be in an unusual place.
    - ii. For example, there could be an isolated heavy infestation 15 feet away, but if there is no sticky trap there, you may miss it.
  
7. **By placing traps in various locations, a technician can locate focus areas (sites of high pest populations) or pest entry points.**
  
8. **The distribution of pests on the trap can also help determine a site of infestation and other information about the pest population. With cockroaches, for example:**
  - a. A bunch of cockroaches on one side of the trap tells you they are likely coming from that direction.
  - b. If all stages of the cockroach are captured, it's likely a large, long-standing population.
  - c. If only adults or large nymphs are captured, it may be a new infestation that has moved in from a cockroach focus nearby.
  - d. If mostly small nymphs have been captured, there will be a pocket of infestation within a few feet.
  
9. **Sticky traps are good tools to evaluate the success or failure of the program.**
  - a. Are the trap catches decreasing?  
This suggests control actions are successful.
  - b. Are they increasing or remaining the same?  
Perhaps some changes are necessary.
  
10. **To be sure that the trapping trends are reflecting actual pest populations, use the same brand of trap in the same places over the same time periods.**
  - a. Otherwise, trap catches may be affected more by differences between traps than by changes in pest populations.
  
11. **Sticky traps are generally poor tools for controlling pests.**

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- 12. Place sticky traps in the most likely areas of infestation (pest vulnerable areas), in pest travel ways.**
  - a. Prioritize sticky trap locations based on knowledge of the pest and the site.
  - b. Emphasize sites where there is food available, or with potential pest entry point
  
- 13. Avoid placing sticky traps in the open if possible. Cockroaches and other crawling pests do not often travel in the open if they do not have to. Proper placement will help prevent damage and displacement of the device by equipment and employees.**
  
- 14. Think about where you normally find your key pests, and place the sticky traps nearby.**
  - a. Put traps inside cabinets, on food storage shelves, under sinks and stoves, under equipment, in drawers, and next to trash cans.
  - b. Whenever possible, place traps horizontally against the edges of a wall or other vertical surface, near corners and sites where there has been cockroach aggregation.
  - c. In food storage areas, place sticky traps on or under shelves and approximately ten feet apart.
    - i. Place traps on different levels.
    - ii. Install traps on the floor in the corners of the room.
    - iii. Try to create a matrix in the storage area that will pinpoint a new infestation and help identify the infested goods.
  
- 15. Traps should be checked at every regular service visit, monthly if possible.**
  
- 16. Number and date the traps.**
  
- 17. Replace traps as needed, don't just leave them in place permanently.**
  - a. Replace traps that have already captured a pest, and record the capture information.
  - b. Replace any trap whose glue has become dusty or dirty.
  - c. Follow the manufacturer's recommended replacement schedule.
    - i. Three months is probably a maximum effective life for a sticky trap.
    - ii. Even though it can appear sound, the glue may have lost its holding power.
  
- 18. Pheromone traps are valuable tools for monitoring stored product pests, such as cigarette beetles and Indianmeal moths, which are major pests of food facilities and food warehouses.**
  - a. Pheromones are the natural scents that insects produce to communicate with each other.
  - b. Some pheromones are incorporated into lures that can be used in traps to attract certain insect pests.
  - c. Most traps use sex attractant pheromones that draw only the male insect.
  - d. Other pheromone traps use aggregation pheromones that attract both males and females of the same species.

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- 19. A pheromone will attract only one species of pest, or sometimes a few closely-related species.**
- 20. Pheromone traps are most often used in food facilities for monitoring certain moths and beetles.**
- 21. Depending on the food product at the plant, the moths most commonly monitored with pheromone traps include the following:**
- |                              |                  |
|------------------------------|------------------|
| a. Indianmeal moth.          | d. Raisin moth.  |
| b. Mediterranean flour moth. | e. Tobacco moth. |
| c. Angoumois grain moth.     | f. Almond moth.  |
- 22. Depending on the food product at the plant, some of the beetles that can be detected with pheromone traps include the following:**
- |                            |                          |
|----------------------------|--------------------------|
| a. Cigarette beetle        | e. Merchant grain beetle |
| b. Red flour beetle        | f. Lesser grain borer    |
| c. Confused flour beetle   | g. Warehouse beetle      |
| d. Sawtoothed grain beetle |                          |
- 23. There are many different styles of pheromone traps:**
- Hanging traps to attract certain flying insect pests have a sticky surface and a small lure that contains the pheromone.
  - Pitfall traps lure crawling insects into a container filled with oil.
  - The German cockroach pheromone trap combines a sticky trap with an aggregation pheromone.
- 24. Where you place pheromone traps is determined by the label, insect, style of trap, and the site. In general:**
- Place traps in a grid pattern, 20 to 60 feet apart.
  - Place traps in areas where there have been pest problems and in hard-to-clean areas where there could be product spillage.
  - Place traps to avoid air currents and moisture.
  - Consider the insects' habits.
    - Traps will catch more moths near the ceiling and more beetles near the ground.
    - Use hanging traps only for flying insects.
    - Cockroach pheromone traps should be placed as you would cockroach sticky traps.
  - Don't place traps near doors, windows, vents, or loading docks where they could attract insects from outside.
  - If trapped insects might be entering from outdoors, place traps around the outside of the facility (but not near doors or windows) to check outdoor populations. This will also intercept migrating insects before they enter.

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- g. Once insects have been captured in a trap, tighten the grid to pinpoint the source of the infestation. For example, place traps every five feet around the one with the catch.
- h. Number each trap and mark on a map of the room where you have placed the traps.
- i. Keep a monitoring record of each trap's location in the grid, the date it was placed, and its catch at each inspection.

**25. Check traps on a regular basis, more often if you suspect an infestation.**

- a. Avoid letting a pheromone trap go unchecked for longer than a month.
- b. Replace traps when they are dusty, dirty, or loaded with insects.
- c. Remove and discard used traps.

**26. Replace pheromone lures according to the manufacturer's directions.**

**27. Probe traps can be used to monitor for pests in bulk-stored grain.**

- a. Probe traps are inserted into bulk grain (as well as bulk peanuts, almonds, and tobacco) so that the top is 3–6 inches below the surface.
- b. Probe traps are about 15 inches long and 1 inch in diameter and made of clear plastic.
- c. The top half is perforated with slanted holes that insects enter and then drop into a collecting tube.
- d. Probe traps capture a wide range of stored grain pests including the warehouse beetle, Khapra beetle, red and confused flour beetle, rusty grain beetle, sawtoothed grain beetle, and lesser grain borer.
- e. There are also automated probe traps that electronically record grain insects entering the trap.

**28. An insect light trap (ILT) not only kills flies and other insects, it is an effective pest monitoring tool and "early warning system" to identify a breakdown in sanitation or control procedures before a pest problem gets out of control.**

**29. Collecting trays and glue boards should be checked regularly.**

- a. When outdoor insect activity is high, check traps every week.
  - i. Traps can be checked less often during periods of low insect activity, say an unheated warehouse in winter.
  - ii. Sticky-type ILTs must be checked at least monthly.
- b. While servicing the trap, also brush out the dead insects from behind the tray/board and from cracks and crevices.
  - i. Insects in the tray must be examined.
  - ii. Insects should be identified and categorized at least as stored product insects, flies, or occasional invaders. Document captures by pest and number.

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## 30. Evaluate the catch to try and determine trends. For example:

- a. If large numbers of house flies suddenly are found in the trap, there is likely a nearby breeding source either inside, or if outside, then a window or door is being left open.
- b. If the trap contains dermestid beetles in the winter, there is probably an infested site inside the building.
  - i. Pinpoint the infested location by using pheromone traps.
- c. If the trap contains winged ants, there is a nearby nest.
- d. If the trap suddenly captures mosquitoes, someone is probably leaving a door open, and probably at dusk or at night.

## 31. ILTs must have the same level of recordkeeping as other types of traps.

## 32. Use insect light traps indoors only. When placed outdoors, they mostly capture non-pest insects.

## 33. There are other monitoring tools besides traps.

## 34. Rodent monitoring blocks look like rodenticide bait blocks but are nontoxic.

- a. The blocks are very attractive to both rats and mice.
- b. The blocks can be placed in bait stations in and around a building and checked at each service visit.
- c. If a monitoring block is gnawed on or eaten by a rat or mouse, further management action should be taken.

## 35. Rodent monitoring blocks can be useful monitoring tools.

- a. They confirm rodent activity before toxic bait application (“bait and switch”).
- b. They can be used inside stations just like a rodenticide, or out in the open and in other locations where rodenticides can’t be used.
- c. They identify the species feeding (through gnaw marks and droppings) before you place a toxic bait, thereby protecting non-target wildlife in a baiting area.
- d. They can overcome a rat’s hesitancy to enter a bait station, and accustom rodents to feeding at preselected locations, improving kill when rodenticide or traps are then used.

## 36. A tracking patch is a light coating of nontoxic dust (such as talc) that is spread near suspected rodent activity areas and shows the tracks of any rodents (or other animals) that walk through it.

- a. Tracks in a tracking patch can identify the species and the direction of movement.
- b. A flashlight shined across the patch at a low angle gives the best view of the tracks.
- c. Tracking patches should not be used where there is a risk of contamination of food, even though the patch material is typically nontoxic.

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## CHAPTER 4

# PEST PREVENTION

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## 4.1 PEST PREVENTION OVERVIEW

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1. **Good manufacturing practices mandate that no pests be allowed in any area of a food processing and handling facility.**
2. **Rather than control a population of pests once it becomes established in a facility, food facilities want to:**
  - a. Exclude pests from processing areas.
  - b. Protect food from contamination by pests.
3. **Food facility IPM emphasizes prevention of pests in the first place, rather than controlling them once they become established. There are two main strategies for pest prevention:**
  - a. Correcting sanitation problems that are providing pests with food, water, and shelter. Sanitation includes:
    - i. General housekeeping, including sanitation inside and around processing equipment.
    - ii. Pest proofing.
    - iii. Landscape management.
    - iv. Habitat modification.
  - b. Pest proofing to exclude pests from the facility, or to make it more difficult for them to move within the facility.
4. **Periodic monitoring of pest preventive measures, due to changes and modifications at the food facility.**

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## 4.2 PEST PREVENTION THROUGH SANITATION

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1. **Poor sanitation makes life easy for cockroaches, flies, stored product pests, mice, rats, and other pests that need little more than spilled food, a good hiding place, and sometimes a little water to establish an infestation in a facility.**
2. **Removing readily available food for pests is an important way to prevent and reduce pests.**
  - a. Cleaning up clutter is important, too.
    - i. Clutter and debris provide harborage (living and hiding places) for pests.
    - ii. Continually check for clutter in all storage processing areas and make clean-up recommendations to the facility.
3. **While it is the responsibility of the food facility to correct sanitation problems that are attracting or contributing to pests, it is the IPM technician's responsibility to:**
  - a. Identify and document sanitation problems that may lead to pest problems.
  - b. Provide information on how the specific sanitation problem may lead to pests.
  - c. Provide recommendations to the plant on how to correct those sanitation problems.
  - d. Document all sanitation problems and recommendations (keep records).
  - e. Follow-up on the completion of recommendations
4. **Identifying sanitation problems is one of the main goals when servicing a food facility or conducting an inspection.**
  - a. Sanitation problems that contribute to pests can occur inside the facility, on the exterior perimeter, and even on the grounds.
5. **Compost piles, leaf piles, debris piles, stacked wood, pipes, or building materials should be located away from the foundation and away from mulched areas.**
  - a. Clutter and debris provide harboring for pest population.
6. **Minimize moisture around the building.**
  - a. Make sure that drainpipes, downspouts, or spigots are not emptying against the building.
  - b. Splash blocks should be in place and downspouts should extend beyond the perimeter.
  - c. Roof gutters should be cleaned, and stagnant water in containers and equipment should be emptied.
  - d. Drainage of all wet areas must be adequate to prevent standing water.

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- 7. Trash piles, construction materials, empty containers, old machinery (bone yard), and other debris must not accumulate around the plant.**
  - a. Trash and food debris on the grounds, especially trash that accumulates around the foundation and under shrubbery, must be picked up.
  - b. Spilled food debris must be cleaned up regularly:
    - i. Along railroad tracks.
    - ii. Around exterior processing equipment.
    - iii. At loading dock entrance.
    - iv. In dock leveler pits.
  
- 8. Loading sites for liquid sweet foods, such as corn syrup, need drains and an adequate cleanup schedule to avoid attracting large numbers of flies, bees, yellowjackets, ants, and other sugar-feeding pests.**
  
- 9. Sanitation problems on the roof can contribute to problems at the facility from rodents, birds, flies, stored product pests, and other pests.**
  - a. Standing water can attract pests and contribute to roof-level termite infestations.
  - b. Roof vent blow-outs can dump food debris on the roof that can attract pests.
  
- 10. Inside, all facilities need sanitation and inspection aisles in processing and storage areas so that staff can inspect and clean and the pest control contractor install traps and other devices in critical areas.**
  - a. An unobstructed lane 18-24 inches wide, painted white (sometimes yellow), should be established completely around the inside of the exterior walls in processing and storage areas.
  - b. There also should be a space 18-24 inches wide between rows of stacked product.
  
- 11. Food products should be stored in accord with good warehousing practices.**
  - a. Stored packaged foods should be stacked on industrial grade, steel wire shelves that allow spilled foods to fall to the floor and make clean-up easier.
  - b. Food stored on pallets should be at least 18 inches away from the wall to allow inspection and cleaning.
  - c. The policy of FIFO or "first in, first out" ensures that foods do not remain in storage for too long. Older food products are more likely to become infested.
  
- 12. Storage areas need to be free from clutter.**
  - a. Clutter in disorganized warehouse areas can lead to large cockroach and mouse populations.
  - b. Cardboard boxes are a particular problem because they provide hiding and nesting sites for many kinds of pests.
  - c. Facilities should not store old cardboard but recycle or dispose of it quickly.
  - d. Be alert to clutter on the top of walk-in coolers.

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- 13. Food debris is a potential breeding site for stored product pests wherever you find it. Some problem areas that commonly accumulate food debris and food dust, and which need to be inspected (and sometimes disassembled) and cleaned regularly, include:**
- a. Beneath pallets and storage shelves, and on horizontal crossbeams on racking.
  - b. Wall/floor intersections, expansion joints in floor, openings around pipes.
  - c. Rework area and returns area.
  - d. Cracks and pits in the floor (concrete, brick, tile, etc.).
  - e. Nooks, crannies and voids inside processing equipment and conveyors.
  - f. Control panels, automation boxes, lockers.
  - g. Subfloor conduits for refrigeration lines, pipes, etc.
  - h. The tops of machinery, electrical panels, and equipment.
  - i. Dock plate levelers.
  - j. The bases of steel support columns.
- 14. Catch trays in insect light traps should be emptied regularly.**
- a. Dermestid beetles and other stored product pests can breed in decaying insect parts.
- 15. Pests can occur anywhere in a facility so good housekeeping is important in other areas besides production and storage areas.**
- 16. Leaks and condensation can provide conducive conditions for moisture-loving pests.**
- a. Leaky plumbing anywhere.
  - b. Excessive condensation from refrigeration.
  - c. Leaks in the roof.
- 17. Floor drains can become breeding sites for many pests, from drain flies to cockroaches.**
- a. Floor drains need to be inspected and cleaned regularly.
  - b. Also check floor drains in non-food areas such as rest rooms, locker rooms, and janitorial closets.
  - c. Be alert to floor drains that are hidden under/behind equipment or that may not be frequently used.
- 18. Mop buckets should be emptied after use. Wet mops and rags cleaned and hung to dry.**
- 19. The facility must have an effective procedure for inspecting all incoming goods and materials.**
- a. No products should be accepted that are obviously damaged or infested.
  - b. Rail cars and trucks delivering product must be clean.
- 20. Damaged and returned goods areas need to be isolated from clean items and processing areas of the facility.**

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## 4.3 TRASH MANAGEMENT

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1. **Good trash management greatly reduces the number of pests in and around a facility.**
  - a. Garbage cans and recycling containers should have lids that close and should be emptied and cleaned out regularly.
  - b. The trash room should have a concrete floor with a floor drain so that it can be hosed down or power-washed.
  - c. Trash compactors should be washed out regularly using high pressure and a degreasing solution.
  - d. Trash cans should be emptied daily and cleaned regularly.
2. **Trash cans should be lined with heavy plastic trash bags.**
  - a. Bags should be taken out regularly to be stored in closed containers outside until trash pickup.
  - b. The inside of the trash can underneath the plastic liner should no be allowed to accumulate spilled trash or liquids and should be inspected and cleaned regularly.
3. **Recycling areas for bottles and cans need to be inspected and cleaned regularly to remove sugary residues and other food debris.**
4. **Dumpsters are a prime attractant for rodents, flies, birds, cockroaches, and other pests.**
  - a. Poor dumpster management is the number one cause of rat problems around a building.
  - b. Flies inside a facility are often traced to flies attracted to and breeding around dumpsters outside.
  - c. Insect light traps should be used in areas commonly infested with flies where appropriate, especially when dumpsters are located in interior areas.
  - d. All possible entryways should be sealed around areas near dumpsters.
5. **Dumpsters and compactors placed near doors, loading docks, and windows attract pests and bring them near natural points of entry into the facility.**
  - a. Dumpsters should be located 75 feet or more from outside doors.
  - b. Dumpsters should be situated on a thick concrete pad that has foundation toes on the outside to keep rodents from burrowing under the pad.
  - c. If not installed on a pad, small dumpsters can be on wheels to keep them up off the ground.
  - d. Ideally, the dumpster area should slope to a sanitary sewer drain to handle runoff from cleaning.

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- 6. Limit the use of shrubbery around dumpster enclosures.**
  - a. Thick foundation plants might help conceal the dumpster from view, but they also conceal rodent burrows and accumulated garbage, and make inspection difficult.
  - b. Especially avoid thorny shrubs like barberry or pyracantha, or dense low plants like English Ivy or arborvitae.
  - c. Make sure weeds or grass around a dumpster are trimmed close.
- 7. Dumpster lids should be kept closed.**
  - a. If there's so much trash that the lid can't close, then a bigger container is required or the trash service needs to schedule more frequent pickups.
  - b. Users need to close the doors after they've deposited trash.
- 8. Dumpsters should be cleaned out regularly using high pressure washers and a degreasing solution.**
  - a. Drain holes should never be left open (except during cleaning).
  - b. Drain hole plugs should be used or the opening should be screened.
- 9. Dumpsters should not be damaged, leaking, or rusted through, and the lids should close properly. Otherwise, they should be replaced.**
- 10. Dumpsters should be checked by staff twice daily, and any trash around the area should be removed that didn't end up inside the dumpster.**
  - a. Staff should also police the area immediately after the dumpster has been emptied or removed.
  - b. Spilled trash should never be allowed to remain overnight.
  - c. Cardboard boxes should be broken down or crushed and placed inside the dumpster or special cardboard recycling containers, not left on the ground.

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## 4.4 LANDSCAPE MANAGEMENT

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1. **Certain types of plants and design favor rodents and other pests.**
2. **Trees and shrubbery are best kept back 30-50 feet from the food plant perimeter.**
3. **Trees should not be close enough to touch a building since ants, squirrels, and rats (roof rats especially), often follow branches to enter a building.**
  - a. Trim tree branches that touch the building.
  - b. Ivy, esplaniered bushes, or other plants against walls should be avoided because ants, rodents, and other pests use them to find entry into buildings.
4. **Fruit and nut trees and berry bushes provide rodent food and attract other pests and should not be located within three hundred feet of a building.**
5. **Thick low-growing ground covers such as juniper hide burrows and provide ideal rodent hiding places and runways.**
  - a. When the plants fill in, the ground becomes impossible to inspect.
  - b. These types of plants also capture food debris and other trash, which is difficult or impossible to remove.
  - c. Thin or remove dense shrubbery and ground covers around the building's foundation.
6. **Landscapers should avoid mound-shaped, ground-hugging shrubs and instead use plants that have a wineglass shape or that are otherwise open at the base.**
7. **When rodents are living in large numbers under dense shrubs or ground covers, the plants may need to be removed and replaced by plants less attractive to rodents.**
8. **Thorny shrubs should also be avoided as they are difficult to inspect and prone to capturing wind-blown trash.**
9. **Large rocks, railroad ties, and similar landscape structures are attractive as rodent burrow sites and should be avoided.**
10. **Blooming plants should not be located near the building to minimize bee and wasp activity.**

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**11. High grass and weeds provide cover and are attractive nest areas for rodents.**

- a. High grass and weeds provide cover and are attractive nest areas for rodents.
- b. Make sure that the facility has no weedy areas that are being ignored by grounds personnel.
- c. Weeds along fence lines or around abandoned equipment or debris are particularly attractive to rodents.
- d. String trimmers should be used to mechanically manage weeds on a regular basis.

**12. Organic mulch near the building can be the source of many different pest problems:**

- a. Because organic mulches are made of plant material that gradually decomposes, they attract millipedes, sowbugs or pillbugs, cockroaches, slugs, earwigs, and crickets and other pests that feed on decaying material.
- b. Mulch also draws pests that are attracted to the moisture and heat, pests that simply like the protected harborage that mulch provides, and pests that are there to feed on other pests.
- c. Pests use a well-mulched foundation as a stepping stone to enter the structure.
  - i. During temperature extremes or if the mulch becomes too dry or too wet, these perimeter invaders may try to move inside.

**13. A heavy layer of wood mulch that is right up against the building can also enable subterranean termites to bypass a termiticide soil barrier.**

- a. Termites can travel through the protective mulch above ground and enter the building through foundation cracks, conduits, or weep holes in brick.

**14. Food plants should have a 2-3 foot wide inspection strip around the perimeter of the structure.**

- a. Place landscape cloth over this strip to keep weeds and grass from coming up, then leave the strip bare or cover with dirt, crushed stone, gravel, or sand.
- b. As an alternative, regular herbicide applications can be used to keep the inspection strip clear of weeds.

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## 4.5 LIGHT MANAGEMENT

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1. **Bright outdoor lights attract insects of many types, both flying and crawling.**
  - a. Even a small light can be seen for miles and may be attractive to insects.
  - b. Food facilities often have bright security lighting.
  - c. Food facilities often become beacons that attract insects, with high intensity lights at loading docks, doorways, and parking lots, and lights shining brightly on white exterior walls.
2. **Insects can accumulate in large numbers under lights, and at doorways and windows.**
  - a. Insects attracted to lights at the building perimeter often find their way inside.
  - b. Insects at lights may also attract spiders and bats that feed on them.
3. **If a food facilities' lights are causing pest problems, an IPM technician's job is to discuss with facility staff how to change the lighting to prevent pest problems, while still retaining security and visibility.**
4. **Insects and lighting is a complex issue.**
  - a. Many insects are attracted to high UV (ultraviolet) light, such as in fluorescent bulbs.
  - b. An insect may be attracted to a particular wavelength of light, but may only be attracted at a certain time of the night or at a certain time of the year or at a certain temperature.
  - c. Male insects may be attracted but not females.
  - d. Brightness is also important. All else being equal, a 200 watt bulb will attract more insects from a longer distance than a 100 watt bulb.
  - e. Certain insects are attracted to heat and so also to lights that put out heat, such as standard incandescent bulbs, halogen bulbs, floodlights, and others using a glowing filament.
  - f. Another factor is competition from other lights. If the only bright light in the area is the one shining on the loading dock, every light-attracted insect in the area will zero in on that entrance.
5. **Insect behavior is complex, and lighting recommendations will depend, to some extent, on the specific types of insects causing trouble.**
  - a. Midges, for example, mostly fly to lights in early evening.

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6. **There are many lighting alternatives that are less attractive to pests.**
  - a. Replace high wattage bulbs with lower wattage (less bright) bulbs.
  - b. Lights with a yellowish, pinkish, or orange tint are less likely to attract insects.
  - c. Substitute sodium vapor lamps or others with low UV output for mercury vapor lamps and fluorescent lamps in high-risk areas.
    - i. Use sodium vapor lights around loading areas and entrances.
  - d. Replace bulbs that put out a high amount of heat (such as halogen lamps and incandescent floodlights) where they are causing pest problems.
  - e. Direct or shield outside lights so that the light shines only where it's needed.
    - i. Indirect lighting is less attractive to insects than direct lighting.
    - ii. When possible, install lights 15 to 20 feet away from the entryway, but facing toward it, rather than placing lights directly above doorways.
  - f. Avoid bright flood lights shining on a white wall, particularly if near water, since the lights can attract swarms of midges and mayflies.
  - g. Use curtains on windows or make sure lights are turned off in unoccupied rooms. Bright lights shining through windows can bring insects directly inside.
  - h. Create a perimeter of bright decoy lights every 100 feet at a distance of 250 feet or so from the building.
  
7. **Meet with the facility safety officer and discuss security concerns before recommending changes in lights.**
  - a. Lighting strategies that reduce insect problems almost always come with trade-offs.
  - b. Lights that are less attractive to insects may also be dimmer and less attractive to people.
  - c. Low-pressure sodium lamps wash out most colors, for example, making them appear yellow or gray, and should be used only where color rendition is not important.
  - d. High-pressure sodium lights are better at color rendition, but cause reds to appear brown.
  - e. Color-balanced, high-pressure sodium lights are better for people but may be more attractive to insects.
  - f. Lighting alternatives can often reduce the insect risk without seriously affecting security.

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## 4.6 PEST-PROOFING

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1. **Pest-proofing keeps pests from entering buildings, or moving from room to room within buildings.**
  - a. Pest-proofing can be as simple as repairing screens and caulking cracks, or as complex as major building repair.
  - b. Physical alterations can be expensive and time-consuming but they usually are permanent solutions, and they often provide other benefits: improving heat or cool air retention, preventing water damage, and otherwise complementing building maintenance programs.
2. **Pest-proofing can be done by custodial or maintenance staff or by the IPM technician, depending on the requirements of the IPM contract.**
  - a. Extensive pest-proofing is usually done by the facility itself, although it may be contracted to the pest control company.
  - b. Caulking and minor screening may be done by the IPM technician as part of regular service.
3. **The three goals of pest-proofing are exclusion, isolation, and harborage elimination.**
4. **All exterior doors need to be kept closed and should not be kept open for ventilation unless protected by screens or air doors.**
  - a. Shipping and receiving dock doors should be tight-fitting and closed when not in use.
  - b. Metal doors are best; if exterior doors are made of wood, they should have metal flashing at the bottom of the door and on sills and jambs to prevent rodents from gnawing their way inside.
  - c. Railroad tracks going under shed doors can be fitted with rubberized plugs so rodents can be kept from following the tracks into the plant.
5. **Caulking, screening, repairing or stuffing holes, and other methods of manual exclusion on the perimeter can keep pests out of a building.**
  - a. Pest exclusion is most effective against rodents, bats, flying insects, and the larger crawling arthropods such as large cockroaches, millipedes, and crickets.
  - b. In general, openings larger than ¼ inch wide will allow mice to squeeze through.
  - c. Exclusion is less effective against small crawling insects because there are so many small openings under siding, around windows, and at soffits that small pests, ants, for example, might find and use for entry.
  - d. Yet even for the smallest pests, caulking and sealing the obvious openings provides a measure of control. Some pests may find their way in, but many will not.

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6. **Old buildings have many opportunities for pest-proofing, and its use in such buildings can often have remarkable success.**
  - a. Doors leading out of these buildings, for example, are often poorly sealed.
    - i. Stand on one side of the door in the dark and look to the other side in the light. More often than not you will be surprised at the number and size of the openings you'll see.
  - b. Windows should be kept closed or should be screened.
    - i. 16 mesh screens will keep out most insects.
  
7. **Doors to the outside need door sweeps, brush seals, thresholds, or weatherseals to keep pests out.**
  - a. Door sweeps, brush seals, thresholds, and weatherseals are typically easy to install.
  - b. Compression seals can eliminate the space under roll-down bay doors.
  - c. The benefits of door sealers are not only related to pest exclusion.
    - i. Door sweeps, thresholds, and weatherseals reduce heating and air conditioning costs, and result in less sound and light infiltration.
    - ii. Often, a plant's utility savings may offset the cost of the installations.
  
8. **Make other exterior pest-proofing recommendations as needed:**
  - a. Repair screens on windows and doors and make sure they fit tightly.
  - b. Screen outside vent openings and air handlers to prevent outside insects from entering the plant.
  - c. Install air curtains over loading docks and other open doorways.
  - d. Seal cracks and crevices in exterior walls.
  - e. Caulk, stuff, or seal openings around pipes and conduits where they enter the building.
    - i. Use appropriate sealants. Foam sealants, for example, are usually not appropriate for rodents because they can easily chew through them.
    - ii. Don't limit this pest-proofing to ground level; pests can enter around utility lines entering on upper floors or at roof level.
  - f. Install bird exclusion devices to keep birds from roosting on window ledges and other building surfaces.
  - g. A building may need bird netting installed to keep pest birds from roosting or nesting on the building.
  - h. Fill or drain low spots to eliminate standing water that breeds mosquitoes and other flies. Adjust downspouts so that water drains away from the building.
  - i. Remove piles of wood, stone, or other materials or stack them off the ground and away from building foundations.
  - j. Maintain a positive indoor air pressure.

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9. **Do not ignore the roof. Rodents, insects, and birds can find their way inside at roof level. Look for the following:**
  - a. Damaged or poorly fitted soffits and fascia boards.
  - b. Unscreened vents and air intakes.
  - c. Damaged flashing.
  - d. Missing bricks, damaged mortar, siding, shingles, etc.
  - e. Holes around utility wires, pipes, conduit.
  
10. **Pest-proofing within a building results in “pest isolation.”**
  - a. Pestproofing inside a building can create separate compartments, like waterproof doors do in a ship.
  - b. Installing caulk, mesh, and other sealants around pipes, utility lines, and other entries into the voids between rooms can isolate infestations in one area and keep them from spreading.
    - i. Pest isolation prevents pests from spreading throughout a facility, and makes them easier to control.
  - c. High pest risk areas, such as the loading dock, receiving, and damaged-goods storage, should be physically isolated from the rest of the facility by installing caulk, mesh, and other sealants.
  - d. All conduits must be sealed or plugged to keep mice from using them as highways throughout the building.
    - i. Plugging conduits also keeps mice from chewing on wires, including computer lines.
  
11. **Make other recommendations to isolate pests as needed:**
  - a. Repair or screen floor drains.
  - b. Screen interior vent openings.
  - c. Caulk crevices around doors, windows, vents, plumbing fixtures, equipment, cabinets, and counter tops.
  - d. Repair grout around wall and floor tiles in food processing areas, as well as restrooms, locker rooms, and other sites.
  - e. Reattach loose floor tiles/quarry tiles.
  - f. Repair cracks and pits in flooring, and damaged or deteriorated expansion joint liners.

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12. **Installing caulk, mesh, and other sealants can also eliminate pest harborage, in some cases reducing pest levels or making them easier to manage by other means.**
  - a. Eliminating pest hiding and living areas has always been the most controversial objective of pest-proofing.
    - i. Many buildings simply have too many cracks and crevices, many behind cabinets and inaccessible, for a technician to be able to seal enough of them to make a difference.
    - ii. Harborage elimination in food processing areas can work, however, against crawling insects and rodents since processing areas should already be fairly tightly sealed.
  - b. Grout and ceramic tiles must be maintained with no cracks or broken pieces.
  - c. Repair seals around floor drains to prevent food debris accumulation and fly breeding.
  - d. Harborage elimination by sealing and caulking also works to prevent stored product pests from feeding on spilled food debris in cracks and crevices in the floor and around equipment.
  
13. **Bird netting is sometimes spread under horizontal ceiling beams in food warehouses to eliminate bird roosting sites.**

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## CHAPTER 5

# TRAPS AND OTHER PHYSICAL CONTROLS

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## 5.1 TYPES OF PHYSICAL CONTROLS

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1. **When prevention fails, and pests have been detected inside the facility or on the grounds, some sort of control action is required to eliminate the pests.**
2. **In food facility IPM, mechanical control of pests is preferred over chemical control. The primary mechanical controls are traps, including**
  - a. Rodent traps
  - b. Live traps for other vertebrates
  - c. Insect traps
3. **Other mechanical controls used in certain instances include the following**
  - a. Vacuuming
  - b. Moisture reduction
  - c. Temperature control
    - i. Freezing
    - ii. Heating
    - iii. Steam
  - d. Low-oxygen chambers
  - e. Microwave
  - f. Mist nets
  - g. Shooting

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## 5.2 TRAPPING RODENTS AND OTHER VERTEBRATES

1. **Most technicians are already familiar with traps for rodent control, and there is nothing special about their use in food facility IPM except that they are typically used more often.**
2. **The most common traps used to catch mice and rats are glue boards, snap traps, and multiple-catch mouse traps (repeating mouse traps).**
  - a. There are other kinds of traps that are less commonly used.
    - i. There are several types of small “live traps” that will capture single mice alive to be disposed of or relocated.
    - ii. There are also electronic shock traps that use batteries and an electrocuting plate to kill mice or rats that enter the trap.
3. **There are several advantages to using rodent traps:**
  - a. There is no risk of contamination from chemicals.
  - b. Trapping is a good option inside sensitive sites where the use of pesticides must be kept to a minimum.
  - c. Traps are effective against both large and small populations of rodents.
  - d. Unlike rodenticide baits, traps indicate immediately whether the control has been successful.
  - e. Traps hold the rodent carcass so that you can dispose of it, avoiding odor and insect problems that occur when rodents die in hidden locations.
  - f. With traps, there is no rodenticide bait for rodents to carry away or translocate to potentially contaminate other sites.
  - g. Unlike rodenticide baits that can take many days to kill (allowing the rodent to continue feeding and contaminating foods) a trap captures a rodent immediately.
4. **There are some disadvantages to rodent traps.**
  - a. Traps are sometimes moved, stolen, damaged or discarded by facility workers.
  - b. For large rodent populations, many traps are required which means considerable expense to purchase and set up the traps.
  - c. Technicians must remove dead rodents, rebait (in some cases) and reset traps.
  - d. Health inspectors may cite the facility if they find rodents in traps, dead rodents are auditable.
  - e. Traps can be damaged by fork lifts and other mobile equipment or used as door props leading to damage.
  - f. Glue traps can become ineffective in dusty or greasy locations.
  - g. All traps have capacity limitations.
5. **Inside food facilities the most commonly used rodent trap is the multiple-catch trap.**

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6. **Multiple-catch or automatic repeating mouse traps are large, metal or plastic traps that are capable of catching up to 30 mice without having to be reset.**
  - a. Multiple-catch traps are used for mice not for rats.
  - b. There are “wind-up” traps that “kick” the mouse into the trap.
  - c. Other traps use a double treadle door to channel the mouse into the trap.
  - d. Mice are usually captured alive but can also be caught on a glue board placed inside the trap.
  - e. Multiple-catch traps installed indoors do not have to be anchored.
  - f. Use of heavy-duty steel trap covers is recommended where forklifts and other equipment may damage non-covered traps.
  
7. **Multiple-catch traps work because mice are curious and will investigate new things in their territories.**
  - a. Mice will usually enter the small entrance hole without hesitation.
  - b. “Mousy-smelling” traps generally improve trap catch.
  - c. Mice will usually enter the trap with or without a food attractant.
  
8. **Snap traps in stations or glue traps in stations or concealed inside PVC pipes may be useful in these situations:**
  - a. On mezzanines where equipment is stored.
  - b. In areas where using large traps may be cumbersome.
  - c. In dense storage areas.
  - d. In areas of high mouse activity.
  - e. In areas multi-catch traps are ineffective
  
9. **The rodent snap trap has been around for over a hundred years.**
  - a. The original professional mouse trap is the wooden base, spring-operated snap trap everyone is familiar with.
    - i. Snap traps also may be made of plastic or metal.
  - b. The killing bar on a snap trap is powered by a spring and is released when a rodent steps on the bait pan.
    - i. When it works properly, the rodent is killed quickly when its neck, skull, or back is broken.
    - ii. When it doesn’t work properly, the rodent may escape or be trapped but remain alive.
  - c. Mouse snap traps will not kill rats; larger, more powerful traps are required for rats.
  - d. Snap traps can be baited with a food bait or nest material, or left unbaited.
    - i. Due to food allergen concerns, no peanut butter or nut-based baits can be used.
    - ii. Bait should be placed on top of trigger and not under the notch.
    - iii. Professional lures are available, but not required.

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- 10. In addition to the traditional snap trap, for mice there are also “clam shell” snap traps.**
  - a. Clam shell snap traps can be set with one hand and are easily cleaned.
  - b. Some clam shell traps suffocate the mouse, instead of killing it quickly.
- 11. Glue traps for rodents are similar to sticky traps used for insects.**
  - a. They consist of a cardboard or plastic tray base covered with a sticky material.
  - b. Some models are covered or can be folded into a tent shape; others are perforated so they can be torn down to fit specific areas.
  - c. Some traps are “prescented” with a food odor.
- 12. Glue traps are less effective in extreme temperatures or if they become dusty or covered with debris.**
  - a. In dusty, greasy, or damp areas, place glue traps inside rodent bait stations.
  - b. In some environments (e.g. flour blending) glue traps are ineffective
- 13. Glue traps are also often used inside multiple-catch traps to hold captured mice.**
- 14. Glue traps are most often used for mice.**
  - a. Larger glue traps with more sticky surface can be used for rats.
  - b. Rats generally do not die quietly or easily on a glue trap and may carry the trap away if it is not securely anchored.
- 15. Many food facility and independent food facility standards require that snap traps or glue traps be “enclosed.”**
  - a. Snap traps can be placed inside a rodent bait station.
  - b. Glue traps can be placed inside bait stations, multiple-catch traps, or PVC pipe.
- 16. Good trap placement greatly increases the effectiveness of a rodent monitoring program.**
  - a. The inside of any exterior wall should have multiple-catch traps or glue boards in stations.
  - b. Place traps at the rate of one per 20–40 feet if historical data does not indicate more effective placement
  - c. Place more traps in high risk areas, less in low risk, including along interior walls.
  - d. In areas of high traffic, stations should be placed directly against the wall and protected to prevent forklift damage.
  - e. Be sure to utilize trap placement near exterior doors.

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**17. Traps may also be placed along interior walls.**

- a. Concentrate traps where there is rodent activity, rather than evenly spacing them along a wall.
- b. Put more traps in high-risk areas, less in low-risk areas.

**18. When trapping a confirmed infestation:**

- a. Place more traps in areas of high activity and fewer traps in other areas, including along interior walls.
- b. Place traps along the route between the rodent's nest and its food source.
- c. Place traps where there are large numbers of droppings since that is where the rodents are spending most of their time.
  - i. Place traps along baseboards or edges of walls or other objects where there are obvious signs of rodent activity.
  - ii. Other good trapping sites are behind objects, and in dark corners, particularly where runways funnel rodents into a small place.
  - iii. Consider trap placement not just on the ground, but think three-dimensionally and consider placement on other planes.
- d. Use historical data to help determine how close or how far traps should be from one another. If there is no historical data available use suggested measurements for the specific rodent until a baseline is established.

**19. If there is not obvious rodent activity, set traps along possible runways.**

- a. For mice, place snap traps or glue traps 5 to 10 feet apart, and even closer if the population is large.
- b. For rats, trap placement should be 10 to 20 feet apart, and even closer if you are dealing with a large population.

**20. For mice, place snap traps perpendicular to the wall or object with the trigger next to the wall.**

**21. For rats, place snap traps perpendicular to the wall or object with the trigger away from the wall.**

**22. Glue traps should be placed in the same locations that you would place snap traps, with the following exceptions:**

- a. Place glue traps lengthwise, parallel to the wall or other object that lines a runway.
- b. Do not place glue traps in corners because mice slow down to explore corners and their whiskers may touch the glue alerting them to danger.
- c. Do not place glue traps in direct sunlight.
- d. Don't place glue traps in extremely cold conditions (below 20 degrees F.), or near open flames or on hot pipes, or areas with heavy dust/debris in the air regularly. (e.g. flour blend rooms)

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- 23. To increase effectiveness, set two or three snap or glue traps side by side, about an inch apart, so that a rodent leaping over one will be caught in the second or third.**
- 24. Traps can also be set overhead along pipes, beams, rafters, etc.**
- Set snap traps on overhead surfaces, especially where you see rub marks.
  - Fasten the traps to pipes or beams with, wire, heavy rubber bands, velcro straps, or hose clamps, when necessary.
  - Glue traps can also be fastened to pipes (but not hot pipes) and beams that are overhead runways.
    - Tape, wire, or nail or thumbtack glue traps in place.
  - Do not place traps above food processing areas.
- 25. Traps for roof rats should be placed in somewhat different locations.**
- Set traps along branches, beams, ledges, and sills.
  - Traps can be attached to chain link fence poles or tree branches using cup hooks and rubber bands or bungee cords.
    - Outdoor traps should be set only from dusk to dawn to avoid trapping nontarget animals like birds and squirrels.
  - Indoors, set traps in dark corners inside suspended ceilings, in attics, or in overhangs and soffits.
- 26. Rats and mice react differently to traps and baits.**
- Rats are wary of anything new in their territory and will initially avoid it, while mice are very curious and will usually explore new things.
    - At the beginning of a trapping program for rats, place baited traps unset for a few days or a week so that the rats will get used to them.
  - Because mice are curious, you can improve your trapping results by moving boxes, pallets, shelves, or other objects in their territories to create new runways that lead to your traps.
    - Mice will investigate the changed territory thoroughly.
    - While getting rats used to traps can take some time, a mouse trapping program can be very successful very early.
    - Rats might not consume baits right away: it is typical for rats to avoid consuming new foods for several days.
    - Mouse consumption of bait is highest in the initial days after discovery.
- 27. Probably the biggest mistake in trapping rodents is not using enough traps.**
- A large number of snap traps or glue traps set for a short time will be more effective than a small number of traps set for a long time.
  - If one model is not working try another.

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- 28. Two tactics can help improve long-term trapping success against mice:**
  - a. After a week of trapping success, leave your traps unset for a week.
  - b. When you restart the trapping, move the traps several feet to new locations to take advantage of the mouse's natural instinct to investigate new things.
  
- 29. Traps should be monitored weekly.**
  - a. Wear disposable gloves when handling dead rodents.
  - b. Dispose of the rodents in a sealed plastic bag and remove in enclosed bags from facility.
  
- 30. All rodent trapping stations must be recorded and numbered and records must accurately map their locations.**
  
- 31. Live traps are often used to trap wildlife inside a food facility or on the grounds.**
  - a. Use a properly sized and designed trap for the specific animal.
  - b. Stake down or otherwise secure the trap.
  - c. Allow the animal to get used to the trap by baiting it and locking it open for a few days.
  - d. Leave a short bait trail to the trap.
  - e. If possible, set the trap at the mouth of the target animal's burrow, otherwise set it along a regular travel path.
  - f. If the animal is entering the building, place a trap at the entrance point, for example, next to a crawlspace vent.
  
- 32. Treat trapped animals gently and humanely.**
  - a. Keep a trapped animal calm by keeping it in the dark; cover the cage with a tarp, sheet, burlap, box, etc.
  - b. Know local regulations regarding release or euthanasia.
  - c. Animals that are to be released should be released in accordance with state/local regulations.
  
- 33. Never release sick or lethargic animals. Take them to the humane society or local animal control.**
  
- 34. Wear heavy-duty leather gloves when handling a cage with a live animal inside.**

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## 5.3 TRAPPING INSECTS

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1. **The traps commonly used to capture pest insects are sticky traps, pheromone traps, fly traps, jar traps, and insect light traps.**
2. **While primarily used for monitoring insects rather than controlling them, traps can be considered a viable control tool when placed in large enough numbers.**
  - a. Insect light traps can control low levels of flying insects that occasionally enter the facility from outside.
  - b. Certain stored product pests will be suppressed when enough pheromone traps (designed for that pest) are placed in a tight grid throughout the room.
  - c. Fly traps can suppress populations when placed in large enough numbers but are best used as a supplemental control tool to capture occasional fly invaders.
3. **Fly traps come in a wide range of styles, in addition to insect light traps.**
  - a. Flypaper comes in sheets and rolls.
  - b. Window-mounted traps are small and relatively inconspicuous.
  - c. Large wall-mounted traps use chemicals to attract the flies and glue to hold them.
  - d. Traps are also designed specifically for *Drosophila* flies (fruit flies).
4. **Jar traps capture yellowjackets primarily, but also flies.**
  - a. Jar traps are useful in the fall when yellowjackets are foraging around food and garbage.
  - b. Sunny locations tend to be better trap sites but of course the sunniest locations may change through the day.
  - c. Can cause odors; place in a location where odor is not going to be a problem.
5. **Insect light traps (ILTs) kill flies and other flying pests that have entered the facility or storage area from outside or that have emerged from infested materials.**
6. **There are many types of ILT traps including ceiling-hung, two-sided models, wall-mounts, cornermounts, window-mounts, and decorative wall sconce ILTs for use in cafeterias and other public areas.**
7. **ILTs must be installed and maintained properly to be effective.**
  - a. Most flying insects, such as moths, won't respond to lights more than 100 feet away.
  - b. Flies rarely respond if the light is more than 25 feet away.
  - c. Greatly increase the effectiveness of the traps by placing the right trap in the right location. (i.e. away from competing light sources)

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- 8. Shatter protection must be in place where food or packaging could become contaminated if one of the bulbs shattered. (explosion proof bulbs may be required)**
- 9. Entryways are key locations for ILTs.**
  - a. A good first line of defense is large ceiling-hung traps mounted 15-25 feet inside of the loading dock and food delivery doors. (but not closer than 15 feet)
  - b. The traps should be mounted perpendicular to the door.
  - c. Make sure that the light won't be seen from outside and won't attract insects into the facility.
- 10. Most ILTs, however, should not be ceiling-hung, but placed low.**
  - a. ILTs installed within five feet of the floor will capture many more flies than ceiling-hung traps.
  - b. Install ILTs at key points along the flyways (paths) to stored or processed food; that's where the flies will be heading.
  - c. ILT's should be spaced at about 50 foot intervals in suspected flyways.
  - d. A narrow hallway is one of the best sites for a trap.
  - e. In food prep areas, place the traps to draw the insects away from the food.
- 11. You can't tell by looking at a glowing UV bulb whether it's working at full strength.**
  - a. The phosphor inside loses 50% of its effectiveness after a year of continuous use.
  - b. Bulbs in ILTS must be changed according to manufacture's recommendations or, in the absence of recommendations annually, at a minimum.
  - c. There are commercial UVA meters that are available to measure bulb output.
- 12. Make sure nothing is placed in front of an ILT, which will render it ineffective.**
- 13. Collection trays for ILTs should be emptied often and glue boards replaced before they become dusty or loaded up with dead insects.**
  - a. Dead insects in an ILT can attract dermestid beetles and other scavengers.
  - b. If traps are not serviced often enough, scavenger pests may lay their eggs right in the trap, making the trap the cause of an infestation rather than the cure.
  - c. Contents should be identified and documented for future trend analysis.

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## 5.4 OTHER PHYSICAL CONTROL METHODS

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1. **Vacuumping can be used to control many pests.**
  - a. IPM technicians are increasingly using specialty vacuums to suck up cockroaches, flies, ants, spiders, and other pests.
  - b. For many pest problems, a vacuum may be all that is needed.
  - c. For other pest problems, a vacuum may be the only control method that is acceptable.
    - i. Examples include ants or cockroaches living inside an oven.
2. **Vacuumping is the quickest way to quickly knock down populations of aggregating pests such as boxelder bugs, cluster flies, clover mites, even yellowjackets.**
3. **Vacuumping with a crevice tool can eliminate large pockets of cockroaches in heavy infestations.**
  - a. As an added benefit, vacuumping also removes roach droppings, body parts, egg capsules, and other cockroach allergens, as well as food particles debris and insect fragments that may render food adulterated.
  - b. The use of heat gun directed into the cracks and crevices can act as a non-pesticide flushing agent.
4. **Special vacuum attachments allow vacuumping under appliances and around sensitive equipment like computers.**
5. **After vacuumping, the vacuum bag and contents should be placed into a sealable plastic bag and discarded outside the facility.**
  - a. To ensure that all insects are dead, vacuum up talc or corn starch at the end of every service to kill any pests that might have remained alive inside the vacuum bag. This abrades and desiccates any pests that might have remained alive.
  - b. Do not change or empty bags in the food facility.
6. **Vacuumps should be equipped with HEPA filters to capture cockroach, mouse, or other allergens that otherwise could become airborne.**
7. **Pests inside some infested materials can be controlled with heat or cold. It is important to know the limits of what you are heating or cooling.**
8. **Most pests can be killed by freezing infested materials in a large commercial freezer that can quickly reach temperatures of 0° F (18°C) or lower for at least 48 hours for smaller items. Six to ten days may be needed for larger items (greater than 25 pounds).**
9. **Low, but above-freezing temperatures, usually 40-42 degrees F, can be used to protect items in storage. This may not kill eggs or larvae or pupae.**

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**10. Heat will also kill insects.**

- a. Holding a specimen at a temperature of 130 degrees F for three hours will kill any insect.
- b. Small items can be heated in an oven to kill infesting pests.
- c. Larger items may require a commercial kiln.
- d. Items can also be placed under tarps and portable forced-air heaters used to raise the temperature to the desired level.

**11. Heat sterilization of equipment, an individual room, or an entire facility is done occasionally for flour beetles and similar stored product pests in cereal mills and other facilities.**

- a. Various types of heaters – steam, gas, oil – are used.
- b. Care must be taken not to damage wood floors or heat sensitive equipment.
- c. Sprinklers and other fire suppression systems may have to be modified to prevent damage or activation.

**12. Infested items can also be treated in a chamber using a low-oxygen atmosphere.**

- a. The item is encased in plastic and the air is removed.
- b. Nitrogen or carbon dioxide replaces the oxygen, suffocating the pests.

**13. Moisture reduction can prevent and sometimes even suppress or eliminate certain insect and mite populations.**

- a. Examples include millipedes, springtails, and psocids, which require relatively high levels of moisture to survive.
- b. In some cases simply reducing moisture levels through structural changes, ventilation, or using dehumidifiers will eventually desiccate and kill the pests.
- c. Even when reduced moisture does not kill the pests directly, it may make it impossible for them to reproduce and eliminate their food source.

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## CHAPTER 6

# PESTICIDES IN FOOD PROCESSING & HANDLING FACILITIES

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## 6.1 GENERAL GUIDELINES FOR USING PESTICIDES IN FOOD PROCESSING & HANDLING FACILITIES

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1. **Pesticides are used when needed to control rodents, insects, and other pests in and around food processing & handling facilities.**
  - a. Pesticide use is considered necessary when nonchemical control measures are unavailable, impractical, ineffective, or likely to fail to reduce pests below action thresholds.
  - b. The use of a pesticide must be in compliance with:
    - i. Current Good Manufacturing Practices (CGMPs) and other applicable standards.
    - ii. EPA (product label directions), FDA, and other regulations.
    - iii. Policy of food plant management.
    - iv. Document non-chemical options.
2. **The most common uses of pesticides in a food facilities include the following:**
  - a. Rodenticides, primarily used as a protective barrier outside of the facility for monitoring.
  - b. Targeted insecticide applications to infested sites, primarily in cracks and crevices and voids.
  - c. Space treatments (ULV, fogging) with contact insecticides that kill insects on contact.
  - d. Fumigation of infested food product (either finished or raw materials) and/or equipment.
  - e. Surface treatment of stored grain, nuts, and other bulk products.
  - f. Treating exterior sources of pests, such as dumpsters.
3. **Inside food processing and storage areas, a major consideration for technicians must be to ensure that there is no pesticide contamination of food products or equipment.**
  - a. This requires collaboration with facility operations to prepare for treatments.
4. **Some pesticide formulations cannot be used in specific areas of the facility. For example, dusts cannot be used in any type of flour or grain mill and peanut based baits cannot be used in allergen free areas. Check with the plant contact that each formulation to be used is acceptable for its intended area.**
  - a. Be certain that products proposed for use are labeled for use in food facilities.

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## 6.2 INSECTICIDES

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1. **Since insecticides applied in food plants must not come in contact with food or otherwise possibly contaminate food products, it is important to distinguish between food and nonfood areas:**
  - a. Nonfood areas may include locker rooms, trash rooms, lavatories, machine rooms, boiler rooms, and garages—areas where food is not normally present.
  - b. Food areas include any location where food is stored, prepared, processed, or served.
2. **Certain restrictions apply to the types of insecticides and treatments that can be used in food or nonfood areas.**
  - a. To be used in the food area of a food plant, an insecticide must be labeled “for use in food-handling establishments.”
  - b. Even if the product is labeled for use in food establishments, you may be restricted in the site of the application and the type of application.
3. **Residual insecticides are those applied to obtain insecticidal effect lasting several hours or longer.**
  - a. There are four types of residual applications: crack and crevice, spot, general, and broadcast/barrier.
  - b. Each may be used in certain areas of food-handling establishments as directed by the product label.
4. **A contact insecticide is one that kills on contact.**
  - a. Contact insecticides are nonresidual products and do not leave an insecticide residue behind.
  - b. Contact insecticides are used in aerosols, ULV applications, space treatments and fumigants.
5. **The directions for use section of the label of any pesticide for use in food areas will have a heading that says something like APPLICATIONS IN FOOD-HANDLING ESTABLISHMENTS.**
  - a. There will then be a subheading for FOOD AREAS which may say something like “limited to crack and crevice treatment only.”
  - b. There will be a second subhead for pesticide use in NONFOOD AREAS. You must know the difference between a food area and a nonfood area (see above).

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- 6. Insecticide applications in food areas are often limited by the label to crack and crevice treatment.**
  - a. This means small amounts of insecticide spray, dust, or bait can be applied into cracks and crevices, or voids where insects hide.
  - b. Apply insecticide as deeply as possible into the crack or void.
  - c. Typical crack and crevice application sites would be inside hollow legs of equipment, undersides of shelves and racks, behind countertop splash guards, in cracks or missing grout in ceramic tile, around conduits and the flange where pipes enter walls, floor or ceiling, inside motor housings, and around drip trays under refrigeration units.
  - d. A “crack and crevice only” labeling does not allow treatment of exposed surfaces in food areas. Food should be covered or removed before application.
- 7. Liquid application is best done with a crack and crevice extension tip. Use a pressure of 8-15 psi and avoid any splashback.**
- 8. Treatment of electrical panels and boxes must be done with extreme care according to the label, and liquids should not be used. Such applications should be in accordance with plant policies and according to OSHA requirements.**
- 9. Dusts are applied into cracks and crevices and wall and cabinet inaccessible voids using a hand duster. Never dust into ceiling voids that are above food-handling areas.**
- 10. Avoid using gel baits on surfaces that could get hotter than 130° F. or on surfaces that are frequently washed.**
  - a. Wipe up any excess bait or drips.
  - b. Use containerized baits instead of gel baits for areas that are wet, greasy, dusty, or frequently cleaned since the station protects the bait.
    - i. Do not use insect bait stations in areas prone to heavy traffic or excessive water accumulation.
  - c. Both gel baits and bait stations can be used in cold storage area where the temperature is above -10°F.
  - d. Should not be used if possibility of contaminating food.
- 11. Residual crack and crevice applications can usually be applied in food establishments while they are in operation unless the pesticide label specifically says otherwise.**

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- 12. Spot treatment is a limited application to areas where insects may occur.**
  - a. Spot treatments are usually done with a flat fan nozzle.
  - b. Treated sites may be on floors, walls, or bases of equipment but should not be areas that may come in contact with food or utensils.
  - c. Individual spot treatments cannot exceed two square feet or as directed by the label.
  - d. Until recently, EPA only permitted spot treatments in nonfood areas of food-handling establishments. Recently, however, some insecticides have received EPA approval for spot applications in food areas.
  
- 13. General treatments are applications to large surfaces such as walls, floors, or ceilings and are allowed only in nonfood areas.**
  - a. General treatments include space treatments such as ULV applications
  - b. General treatments may also include the use of insect growth regulators (IGRs).
  - c. General treatments may only be used if the application will not contaminate the food product.
  
- 14. It is best to apply an insecticide only when the area is not in operation.**
  - a. This is the rule in USDA inspected plants.
  - b. There may be exceptions for certain applications, but only with plant approval.
  
- 15. Before application of nonresidual insecticides by fogging or space spray, exposed foods must be removed or covered.**
  - a. Glassware, serving, and cooking containers, and utensils must be removed from the treatment area and covered with plastic.
  - b. After application, all food-handling contact surfaces should be cleaned before use, according to label directions.
  
- 16. Where a residual insecticide is applied in a food production area, it is always good practice, and may be required, to wash all food-contacting surfaces to prevent food contamination.**
  
- 17. Barrier treatment is the application of pesticides to thresholds and other entrances, the foundation, and the soil adjacent to the foundation.**
  - a. A barrier treatment may be made with residual sprays, dusts, or granules according to label instructions.
  - b. Barrier treatments are primarily targeted to outdoor pests that may become invaders or nuisances when their populations build up.
  
- 18. Non-regulated products (including but not limited to essential oil products, limestone dusts, etc.) may be used according to the instructions and as crack and crevice and spot treatment only.**

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## 6.3 RODENTICIDES

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1. **Rodenticides are pesticides that kill rodents.**
  - a. Rodenticides are not generally used for routine maintenance inside a food facility.
  - b. Rodenticides are commonly used as a rodent control tool outside and around a food facility to eliminate rodents before they find their way inside.
  
2. **There are many reasons to avoid rodenticides inside a food facility, using them only as a last resort:**
  - a. When rodents are poisoned, they may:
    - i. Crawl off and die elsewhere possibly contaminating food.
    - ii. Create foul odors in the plant.
    - iii. Attract scavenger insects such as dermestid beetles.
  - b. The baits themselves can become infested by stored product pests.
  - c. Rodenticide can be “translocated” – that is, carried by rodents into food areas to contaminate food product.
  - d. Bait stations can be damaged by heavy equipment such as fork lifts, spilling rodenticide onto floors in food storage or food processing areas.
  - e. Rodent proofing and exterior control can keep most rodents from entering the facility.
  - f. There are good alternative control methods available that pose no food contamination risk.
  
3. **Federal laws and regulations do not prohibit the use of rodenticides inside a food facility.**
  - a. Food facility management may prohibit or restrict the use of rodenticides, but that is policy and not law.
  - b. Should be considered as a last resort.
  
4. **A rodenticide shall not be used inside food facilities in any area unless:**
  - a. Its use is approved by the facility contact.
  - b. The rodenticide label permits such use.
  - c. Rodenticide use and reasoning is documented.
  - d. The rodenticide is used only temporarily.
  - e. There is no exposed food product present.
  - f. Note: nontoxic monitoring blocks may be used if permitted by plant contact.
  
5. **Choose a rodenticide based on three factors:**
  - a. Active ingredient.
  - b. Formulation.
  - c. Allergen concerns, if product will be used in an allergen free area.

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6. **Active ingredients in rodenticides are classified in two ways:**
  - a. Mode of action (how they kill rodents):
    - i. Anticoagulants.
    - ii. Non-anticoagulants.
  - b. Feeding characteristics.
    - i. Can kill after a single feeding.
    - ii. Requires multiple feedings.
  
7. **Anticoagulants are the largest group of rodenticide active ingredients. They work by preventing normal blood clotting.**
  - a. An animal that consumes a lethal dose will die from uncontrolled internal bleeding.
  - b. Most anticoagulants are relatively low in hazard to people, livestock, pets, and other animals when compared with other rodenticides.
  - c. Anticoagulants work slowly.
    - i. Death is delayed anywhere from 3 days to 3 weeks after feeding begins.
    - ii. Because of this delay, rodents generally do not associate their illness with their food, so “bait shyness” is rare.
  - d. Vitamin K1 is a readily available antidote in case of an accidental poisoning.
  
8. **So-called “second-generation” anticoagulants are able to kill rodents after just one feeding.**
  - a. Second-generation anticoagulants work at a lower dose than first generation products.
  - b. While the rodents may only feed one time, it still takes three or more days for poisoned rodents to begin dying.
  - c. Vitamin K1 is also the antidote.
  
9. **There are currently three rodenticides that are not anticoagulants.**
  - a. Bromethalin is categorized as a “stop-feed” because rodents that eat a toxic dose stop feeding even though death may not occur for 1–4 days.
    - i. A toxic dose can be consumed in a single night’s feeding.
    - ii. Bait shyness is not a problem.
    - iii. Poisoned rodents typically die with their back legs stretched out behind them.
    - iv. There is no specific antidote to an accidental poisoning (although treatments are available).
  - b. Cholecalciferol is vitamin D3.
    - i. In small doses, this vitamin is beneficial.
    - ii. In large doses it is poisonous, especially to rodents, dogs, and cats.
    - iii. Also a “stop-feed” rodenticide, but multiple feedings for several days are usually necessary before feeding stops.
    - iv. There is no bait shyness.
    - v. Calcitonin is the antidote (primarily for dogs).

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- c. Zinc phosphide is an acute, single dose rodenticide.
  - i. When zinc phosphide comes in contact with stomach acids it releases toxic phosphine gas.
  - ii. Poisoned rodents usually die from heart failure, and are often found on their stomach with tail and legs extended behind them.
  - iii. Fast-acting: known to kill rats in under an hour, although death in a few hours or overnight is more common.
  - iv. Rodents that survive often develop bait shyness and will avoid feeding on zinc phosphide again.
  - v. There is no antidote.

**10. There are three common formulations of rodenticide used against rodents:**

- a. Food baits.
- b. Liquid baits.
- c. Tracking powders.

**11. Fumigants are occasionally used to control rodents.**

- a. Fumigation of outdoor rat burrows is done with aluminum phosphide, chloropicrin (tear gas), and a variety of "smoke bombs" that asphyxiate rodents in their burrows.
- b. Rarely, a rodent-infested building will be fumigated with sulfurlyl fluoride.

**12. Rodenticide food baits come in many forms:**

- a. Bait blocks.
- b. Pellets.
- c. Meal.
- d. Seeds.
- e. Place packs.
- f. Soft baits.

**13. Baits used in food facilities should be colored to distinguish them from food product.**

**14. Bait blocks are the most common rodenticide formulation for a number of reasons.**

- a. Most should be secured by rods and wires so that they cannot be carried by rodents to a different location (translocation).
- b. Blocks hold up well in damp sites but should be checked regularly for condition.
- c. Blocks are attractive to rodents not only as a food but for gnawing.

**15. Blocks are often the best formulation to use in the following situations:**

- a. Inside bait stations for perimeter and long-term baiting programs.
- b. Inside sewers, storm drains, utility tunnels, and similar below-ground sites.
- c. Up in trees and on roofs and structures for roof rats.

**16. Bait blocks are not an acceptable choice for unsecured use or inside burrows.**

**This is a poor tactic as rodents will almost always remove blocks and deposit them on the ground outside the burrow's entrance. Thus, making the bait available to non target species. In addition, unsecured bait is typically a violation of product label.**

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## 17. Advantages of pellets include:

- a. Easy to use, particularly in “place packs,” which can be used in damp locations.
- b. Rodents like pellets because of their size, since they can hold them in their paws and store them in their cheeks.
- c. Loose pellets are usually the best choice for direct burrow baiting since they are not as easy to kick out of a burrow as are bait blocks or place packs.

## 18. The biggest disadvantage to pellets is the ease with which rodents can carry them in their cheeks for hoarding in a cache somewhere else (translocation).

- a. Rats and mice hoard pellets, especially inside voids.
- b. Hoarded pellets are not only a safety hazard, but a potential source of stored product pests.

## 19. The main advantage to meal baits is that they cannot easily be translocated by rodents. Their disadvantages are as follows:

- a. Meal baits absorb moisture.
- b. They spoil quickly in damp areas.
- c. They attract many stored product pests.

## 20. Seed baits are very attractive to mice, which will often feed on seed baits aggressively when other formulations fail.

- a. The big disadvantage to seed baits is that mice translocate the seeds and store them in hidden areas.
- b. Seed baits can become infested with insect seed pests.
- c. These products may not be allowed due to potential contamination of food product.

## 21. Tracking powder is simply a rodenticide combined with talc or powdery clay.

- a. Tracking powder is applied into inaccessible areas where rats and mice live and travel.
- b. The powder sticks to their feet and fur, and is swallowed when the animals groom themselves.

## 22. Because of the risks of food contamination, avoid using tracking powders inside food facilities.

- a. All tracking powders are classified as restricted-use because of their toxicity and the risk of inhalation when misapplied or disturbed.
- b. The rodenticide active ingredient in tracking powders is generally 5 to 40 times more concentrated than that in baits.
- c. A major risk factor for tracking powder is that the powder can become airborne and drift into nontarget areas.
- d. Tracking powder can also be translocated to other areas on the fur or paws of rodents.
- e. Never use tracking powders in suspended ceilings or around air ventilators or anywhere it could contaminate food.

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- 23. Note that it is illegal to use some tracking powders in burrows in certain situations. Always read and follow the label and labeling.**
- 24. Zinc phosphide tracking powder is labeled only for mouse control indoors.**
- 25. The major advantages to tracking powders are:**
- Tracking powder can kill rodents even when food and water are plentiful.
  - Tracking powder may be the only rodenticide formulation that will be effective if rodents have become bait or trap-shy.
- 26. Liquid bait is a special rodenticide formulation that is mixed with water.**
- Where water is scarce, liquid baits can be effective against rats, which require daily water.
  - Liquid baits are less effective against mice, which don't have to drink daily but will if water is placed in their path.
  - Liquid baits are most useful in grain storage structures, flour mills, and other dry food facilities.
- 27. The disadvantages to liquid baits are as follows:**
- The time to install and service the liquid bait dispensers.
  - Risk of spillage and subsequent contamination.
  - Drinking by nontarget animals
- 28. An exterior rodent baiting program is a common strategy for protecting food facilities from rodents.**
- Rodenticide bait blocks should be placed inside tamper-resistant bait stations:
    - In areas of high rodent activity.
    - Along fence lines, according to label instructions.
    - Around the outside perimeter of buildings.
  - Number and spacing of stations is dependent on:
    - The history of rodent pressure at the site.
    - The potential for infestation.
    - Likelihood of entrance.
  - Always read and follow label instructions with regard to the use and placement of rodenticides.
  - Consider placing light colored stations if darker bait boxes will absorb too much heat. This is typically where the temperature exceeds 90° F for long periods of time.
    - May require baits to be checked/changed more frequent with wet and hot weather
- 29. Rodenticide baits must be applied in tamper resistant bait stations at food facilities.**
- Tamper-resistant stations significantly reduce the risk of accidental poisoning.
  - Secure exterior stations.

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- 30. All rodenticides have warnings on the label telling the applicator to place the bait “in locations not accessible to children, pets, wildlife, and domestic animals, or in tamper-resistant bait stations.”**
- A tamper-resistant bait station is designed so that a child or pet cannot get to the bait inside, but a rodent can.
  - A tamper-resistant station is also resistant to destruction by dogs and by children under six years of age.
  - A bait station should also be used in a manner that prevents children from reaching into bait compartments to get at the bait.
  - Tamper-resistant stations differ in the type and quality of construction, but they are usually metal or heavy plastic with a locking lid.
  - A bait tray is NOT a tamper-resistant station.
- 31. Rodenticides at food facilities are typically used only inside tamper-resistant stations. There are occasional exceptions, when approved by the facility, such as:**
- Baits or tracking powder inside exterior rodent burrows.
  - Bait blocks suspended from wires inside sewer vaults and similar sites.
- 32. Bait stations must be secured.**
- To attach a bait station to the ground, use a rod anchor or a Duckbill® earth anchor.
  - To secure a bait station to wood, concrete, or masonry, use bolts, screws, industrial strength glue, or nails.
  - For attachment to a fence, use chain, wire, or plastic cable ties.
    - Attach the station in two places.
    - As an alternative, make sure that the chain or wire is short enough that the station can't be lifted and tilted.
- 33. It is also good practice to anchor your bait inside the station.**
- Most rodent bait stations come equipped with either vertical or horizontal rods designed to hold block baits.
  - There are good reasons to anchor bait blocks inside a rodent bait station.
    - Anchoring bait keeps rodents (or other animals or children) from dragging or shaking the bait out of the station and scattering it.
    - Anchoring also keeps the bait fresher and drier since it is up off of the bait station floor.
  - Rodenticide place packs also thread onto the anchoring rods.
- 34. Carry adequate supplies when servicing bait stations, including the following:**
- Station keys and wrenches.
  - Putty knife/scrapper and brush.
  - Punch for plastic log cards
  - Bait bucket, a plastic bag for old bait, and rags.
  - Markers/pens.
  - Multi-tool, such as a Leatherman®.
  - Disposable gloves.
  - Zip-lock plastic bags for dead rodents.
  - Disinfecting solution.

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## 35. Follow good maintenance procedures when servicing baits stations:

- a. Inspect the bait (or monitoring blocks).
  - i. Look for evidence of feeding.
  - ii. Identify the feeder, whether mice, rats, crickets, slugs, etc.
- b. Clean the station.
  - i. Brush and scrape droppings, crumbs, leaves and other debris out of the bait stations.
  - ii. At the next inspection, any new droppings will indicate that the station is still active.
- c. Replace bait as needed.
  - i. Two months is about the maximum life of a bait before it becomes unpalatable to rodents.
  - ii. Replace bait periodically to detect evidence of new feeding.
  - iii. Remove spent rodenticide from facility for proper disposal.
- d. Record information.
  - i. Note on the bait station's service record every time you check the station and every time you replace bait.
  - ii. Replace log cards/labels when full.

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## 6.4 TOXICITY AND HAZARD OF PESTICIDES

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- 1. A pesticide is a chemical that is used to manage pests.**
  - a. A pesticide may be called an insecticide, or a rodenticide, or an herbicide, depending on the target pest.
  - b. Not all pesticides kill pests: some repel pests (repellents) and some affect the growth or development of pests (growth regulators).
  
- 2. Toxicity is the degree to which a chemical is poisonous.**
  - a. It is a physical characteristic of a material just like its boiling point.
  - b. The more toxic a chemical is, the less of it is required to kill the target pest.
  
- 3. Every pesticide is toxic to some degree and may pose some risk to people and the environment.**
  - a. The risk can range from negligible to severe, depending on the toxicity of the pesticide and the degree of exposure.
  - b. People exposed to excessive levels of a pesticide may suffer short-term or long-term health effects.
  - c. All pesticides should be used with care in areas where children or pets could be exposed.
  - d. Pesticides in the environment, when used improperly, can damage nontarget plants and animals, contaminate water, cause fish kills, etc.
  
- 4. The potential hazard from a pesticide is a function of both the toxicity of the pesticide and the risk of exposure and sensitivity of non-target populations.**
  - a. The potential hazard from an insecticide applied into a hidden void is much less than the hazard of the same product when applied as a fan spray to an accessible surface.
  - b. The potential hazard to children and pets of a rodenticide secured inside a tamper-resistant bait station is much less than the same rodenticide placed on the ground in an unsecured manner.
  
- 5. People can be exposed to pesticides in food facilities in several ways.**
  - a. Applicators face the greatest risk of exposure, especially during mixing and application.
  - b. People can also be exposed by entering treated areas too soon after application, before sprays have dried, dusts have settled out, or airborne residues or fumigants have dissipated.
  - c. People may be exposed to small doses if the food they eat was contaminated by a pesticide.
  - d. Spills caused by accident or carelessness can cause dangerous pesticide exposures.

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- 6. Pesticides can damage the environment if misused.**
  - a. Runoff of pesticides can contaminate surface water (streams, ponds, estuaries, etc.) or ground water (for drinking or irrigation).
  - b. Drift can carry airborne residues into nontarget areas such as a neighboring property or a nearby body of water.
  - c. Misapplication can damage plants and kill nontarget organisms.
  
- 7. Two documents supply information on handling and use of a particular pesticide product, on storage and disposal, and on hazards to people and the environment:**
  - a. Pesticide label.
  - b. Safety data sheet (SDS), formally called MSDS.
  
- 8. The pesticide label provides instructions telling how to correctly use the product.**
  - a. Where it can be used.
  - b. What pests are controlled by the product.
  - c. Directions for mixing and application.
  - d. It briefly highlights how toxic the pesticide is to people, and discusses ways to reduce risks (precautions).
  - e. The label is the law regarding the use of the product and should be read each and every time a pesticide is used.
  
- 9. The safety data sheet, called an SDS for short, is a guide to the hazards of a pesticide.**
  - a. An SDS has some of the same information found on a pesticide label.
  - b. But it provides more technical details on (1) identification and ingredients, (2) potential hazards, and (3) safety recommendations.
  - c. If the SDS is in conflict with pesticide label, follow the label and reference Section 15 of the SDS.
  - d. SDS should be on hand for emergency personnel in case of emergency.
  
- 10. Pesticides are grouped into categories based on how toxic they are to people, animals, and the environment.**
  - a. Special identifying words--called "signal words"--are printed in large letters on every pesticide label to show how toxic the product is.
  - b. The signal words are DANGER, WARNING, and CAUTION.
  - c. The signal words refer to the toxicity of the concentrated material inside the original container; if the material is diluted the toxicity may be reduced significantly.

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- 11. Pesticide products labeled DANGER are highly toxic.**
  - a. If the concentrate was swallowed, as little as a taste to a teaspoonful could kill the average person.
  - b. All highly toxic pesticides that are very likely to cause acute illness through oral, dermal, or inhalation exposure, also will carry the word POISON printed in red and the skull and crossbones symbol.
  - c. Products that have the signal word DANGER due to skin and eye irritation potential will not carry the word POISON or the skull and crossbones symbol.
  
- 12. Pesticide products labeled WARNING are moderately toxic.**
  - a. They may cause acute illness from oral, dermal, or inhalation exposure, or they are likely to cause moderate skin or eye irritation.
  - b. The fatal oral dose for the concentrate is estimated to be between one and three teaspoonfuls.
  
- 13. Pesticide products labeled CAUTION are slightly toxic or relatively nontoxic and have only slight potential to cause illness or skin or eye irritation.**
  - a. The vast majority of pesticides used by pest management professionals in our industry carry caution labels and so are classified as slightly toxic or relatively nontoxic.
  
- 14. The toxicity of the end-use product (for example, the spray applied to a surface after being diluted) is often much less than the packaged pesticide product.**
  - a. Two pesticide products with the same signal word may pose different risks to people in the treated area if, for example, one is designed to be used full strength and the other to be mixed with water and diluted to a 1 percent solution.
  - b. When choosing between similar effective pesticide products, choose the one whose end-use product (the material that is actually applied) is the least toxic to people, and whose potential risks of exposure is lowest (reminder: hazard = toxicity x exposure).

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## 6.5 APPLICATOR EXPOSURE TO PESTICIDES

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1. **Applicators of pesticides typically face the highest risk of exposure to themselves and therefore the greatest potential hazard.**
2. **The Occupational Safety and Health Administration, commonly called OSHA, has a set of rules called the Hazard Communication Standard that gives a worker the right to information about hazardous chemicals in the workplace, including pesticides.**
  - a. The purpose of the Hazard Communication Standard is to reduce the incidence of chemically-caused illnesses and injuries in the workplace.
  - b. You have the right to know the hazards and identities of the chemicals, such as pesticides, that you might be exposed to when working.
  - c. It gives you the right to know what protective measures are available to prevent any illness and injury from these hazardous chemicals.
3. **OSHA requires that workers be informed about certain legal requirements of the Hazard Communication Standard:**
  - a. A company must have a written list of all hazardous chemicals in the workplace.
  - b. Technicians must have ready access to the SDS for each pesticide or chemical used.
  - c. Containers of hazardous materials must be labeled, tagged, or marked with the identity of the chemical and appropriate hazard warnings.
  - d. If a chemical is transferred to another container, the new container must be labeled.
  - e. Workers must be provided information and training prior to working with any hazardous material.
  - f. Every company must have a Hazard Communication Program in writing.
4. **Pesticide exposure can occur through the skin (dermal), mouth (oral), lungs (inhalation), or through the eyes.**
5. **Ninety-seven percent of all pesticide exposure during treatment is by contact with the skin.**
  - a. Emulsifiable concentrates and oil-based sprays are absorbed most readily through skin.
  - b. Dusts and granules are the least absorptive.
  - c. Water-based sprays such as wettable powders are somewhere in the middle.
  - d. Health risks from skin exposure are higher when skin is exposed to a pesticide concentrate rather than a dilution.
6. **The area of the body exposed and the condition of the skin will make a difference in the amount of pesticide absorbed.**
  - a. The genital area, the scalp, ear canal and forehead absorb pesticide very rapidly.
  - b. Cuts, scrapes, and skin rashes absorb pesticide more quickly than unbroken skin.
  - c. Hot, sweaty skin also absorbs more pesticide than cool, dry skin.

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- 7. Skin exposure is caused by poor pesticide safety practices, such as:**
  - a. Splashing, dripping, or spraying pesticides on unprotected skin.
  - b. Wearing inadequate personal protective equipment or wearing clothing gloves, or shoes that are already contaminated with pesticide.
  - c. Applying pesticides outdoors in windy weather.
  - d. Touching pesticide-treated surfaces.
  - e. Not washing hands after handling pesticides or pesticide containers.
  
- 8. Before handling a pesticide, check for a Precautionary Statement on the label that gives an alert about the need for skin protection:**
  - a. "Harmful if absorbed through skin."
  - b. "May be a skin sensitizer."
  - c. The label may specify the use of gloves and wearing long sleeves, in addition to other precautions.
  
- 9. Skin exposure can cause a number of different symptoms and effects.**
  - a. Contact with some pesticides can cause skin to itch, blister, crack, or change color.
  - b. Extreme skin exposure, particularly to concentrates, can progress to nausea, cramps, sweating, difficulty breathing and other more serious symptoms.
  - c. Continued skin exposure to some pesticides over a period of time can cause delayed health effects.
  - d. Some pyrethroids may cause a mild and temporary skin sensitization, such as burning or allergic skin reaction in some individuals.
  
- 10. Follow label directions for first aid for skin (dermal) exposure. If label directions are unavailable, do the following:**
  - a. Immediately drench the skin and clothing with plenty of cool water.
  - b. Remove contaminated clothing and equipment.
  - c. Wash exposed skin and hair with soap and water.
  - d. Cover any chemical burns with clean cloths or bandages. Don't apply any first aid ointments.
  - e. For burns or after exposure to highly toxic concentrates, see a physician and bring the pesticide label and SDS.
  - f. See a physician if any symptoms persist.
  
- 11. Oral exposure can occur in any of the following ways:**
  - a. Not washing hands before eating, drinking, smoking, or chewing.
  - b. Accidentally splashing pesticide in the mouth during mixing or application.
  - c. Accidentally applying pesticide to food, cigarettes, or other objects that then go into the mouth.
  - d. Wiping the mouth with a contaminated hand.
  - e. Mistaking pesticide for food or drink.

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- 12. Before using a pesticide, look for the degree of oral hazard, in the label's Precautionary Statements Section.**
  - a. "May be harmful if swallowed" for a pesticide with a slight oral toxicity.
  - b. "Fatal if swallowed" or "Can kill you if swallowed" for a highly toxic pesticide.
  
- 13. Symptoms of oral exposure to a pesticide vary depending on the pesticide.**
  - a. Oral exposure to certain pesticides can burn the mouth or throat and make it difficult to swallow.
  - b. Some pesticides can burn the digestive system.
  - c. Some can be carried through the blood stream and cause various chronic or delayed health effects.
  - d. For some restricted-use pesticides, swallowing even a few drops from a splash or wiping the mouth with a contaminated glove can make you very ill.
  
- 14. First aid procedures for oral pesticide poisoning are not the same for all types of pesticides, so follow the pesticide label's first aid section carefully. If the label is not available:**
  - a. Rinse mouth with plenty of water.
  - b. Drink large amounts (up to 1 quart) of milk or water.
  - c. Induce vomiting only if the pesticide label, manufacturer, or poison control expert advises so.
  - d. In general, vomiting should not be induced if the victim is having convulsions, or if the victim has swallowed an emulsifiable concentrate or oil solution, or a strong acid or alkali poison.
  - e. Get the victim to a physician as soon as possible.
  
- 15. An applicator can be poisoned by inhaling too much of any airborne pesticide: aerosols, liquid sprays, fumigant gases, or dusts.**
  - a. Inhalation can be a hazard when working in a poorly-ventilated, enclosed space.
  - b. Fumigators need to be especially careful to avoid inhaling a fumigant which can be fatal.
  
- 16. Inhalation exposure can be caused by any of the following mistakes:**
  - a. Failing to use the proper respiratory protection.
  - b. Using a respirator that doesn't fit properly or using old or inadequate filters, cartridges, or canisters.
  - c. Using a pesticide in a closed or poorly-ventilated space and not wearing proper respiratory protection.
  - d. Spills and improper storage in storage facility or vehicle.
  - e. Inhaling vapors or dusts when reentering an area too soon.
  - f. Inhaling pesticide drift from a treated area.

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- 17. Before handling a pesticide, look for a Precautionary Statement on the label about inhalation hazard:**
- "Harmful if inhaled."
  - "Do not breathe dusts, vapors, or spray mist."
  - "Inhalation may cause delayed lung, nerve, or brain injury."
  - The label may specify the use of a specific type or model of respirator.
- 18. Symptoms of inhalation exposure vary with the product and the degree of exposure.**
- Some inhaled pesticides may "burn" the respiratory system, making it difficult to breathe.
  - Some may not affect breathing at all but may be carried through the blood stream causing other harmful effects.
  - Flu-like symptoms such as nausea, headache, chills, and aches may develop.
  - The effects of inhaling a pesticide may result in delayed, or chronic, effects that appear days later.
  - It is very important to follow the label's requirements for respiratory protections. If a label recommends a respirator there is a reason, it is for safety as well as immediate and long term protection.
- 19. Follow the first aid instructions on the label for overexposure to an inhaled pesticide. First aid might include any of the following:**
- Get the victim away from the pesticide vapors and into fresh air immediately. (Make sure you are wearing a respirator and other PPE as necessary.)
  - If other people are in the same area, warn them of the danger.
  - Loosen any tight clothing.
  - If the victim has stopped breathing, immediately call 911 (if possible) and administer CPR.
  - Keep the victim warm and quiet.
  - Get the victim to a hospital or physician.
  - Provide the pesticide container, label, and SDS to health care professionals.
- 20. The health effects from pesticide exposure to an eye depend on the toxicity of the pesticide, how much pesticide is involved, and how long the pesticide remains in contact with the eye.**
- The effects can range from simple eye irritation to eye burns to permanent blindness from some highly corrosive pesticides.
  - Some pesticides may not irritate eyes at all but can pass through eyes and enter the body causing internal poisoning.
  - The eyes offer a very fast route for pesticide absorption.

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- 21. You can get pesticide in eyes by any of the following mistakes:**
  - a. Accidentally splashing or spraying pesticides into eyes.
  - b. Applying pesticides in windy conditions without eye protection.
  - c. Rubbing eyes with contaminated gloves or hands.
  - d. Having dusts, wettable powders, or granules drift into unprotected eyes.
  
- 22. Before handling a pesticide, look for a Precautionary Statement on the label about the need for eye protection:**
  - a. "Avoid contact with eyes."
  - b. "May irritate eyes."
  - c. "Causes eye burns."
  - d. The label may specify the use of a specific type of safety eyewear, such as goggles, especially when pouring or mixing the product.
  
- 23. Usually an applicator will know right away when pesticide gets into an eye.**
  - a. The acute symptoms that occur immediately may include burning or tearing.
  - b. Even if there is no irritation, take immediate first aid measures to keep the pesticide from entering the body.
  
- 24. Follow the first aid instructions on the label for eye contamination. Most importantly wash the eye or eyes quickly, but gently.**
  - a. Use an eye wash dispenser if available. Otherwise, use a garden hose or faucet.
  - b. Hold the eye open and wash with a gentle flow of water across the eye.
  - c. Continue to rinse the affected eye or eyes for at least 15 minutes.
  - d. Don't use eye drops afterwards.
  - e. Inform a supervisor.
  - f. Washing the eye with a gentle flow of water is painful, but necessary to remove all pesticide residue.
  - g. Check with a physician if advised to do so on the label, or if there are any remaining symptoms (irritation, blurred vision, etc.)

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## 25. Certain pesticide formulations present more of a hazard to the applicator than do others.

- a. Aerosols can present an inhalation hazard during application, especially in confined spaces, a risk to eyes from splashback, and the propellants in some pressurized aerosol containers are flammable and must be kept from heat, flame, or puncture.
- b. Baits present little hazard to the applicator, when used according to label instructions.
- c. Dusts present an inhalation hazard when filling equipment and during application, they may irritate eyes, nose, throat, and skin, and there is a potential eye hazard from abrasive particles.
- d. Emulsifiable concentrates are sometimes flammable, skin absorption is faster, as a rule, than with wettable powders or other dry formulations, there is a hazard to eyes from splashback, and the finished mix conducts electricity.
- e. Granules present little hazard to the applicator, when used according to label instructions.
- f. Microencapsulates present a hazard to eyes from splashback, and the finished mix conducts electricity.
- g. Wettable powders present an inhalation hazard during mixing (although water-soluble packets eliminate this risk), the packaging of some wettable powders makes them hard to mix without getting on the skin, and the finished mix conducts electricity.

## 26. Take precautions to prevent pesticide residue in clothes from contaminating you or other members of your family.

- a. If clothes have been contaminated, shower and change clothes before going home.
- b. If your company has a uniform service, leave soiled clothing at work for pick up.
- c. If you wash your work clothes at home, do the following:
  - i. The more potentially "contaminated" the clothes, the more thorough the washing.
  - ii. Wash work clothes as soon as possible after wearing.
  - iii. Presoak the clothing.
  - iv. Use hot water and a heavy-duty laundry detergent.
  - v. If clothes are contaminated, run through two cycles.
  - vi. Run a full wash cycle with detergent and clothes to "wash" the washing machine after laundering work clothes.
  - vii. Line dry clothing if possible.
- d. Store work clothes separately.
  - i. Including shoes, boots or hats that may be contaminated.

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## 6.6 PERSONAL PROTECTIVE EQUIPMENT (PPE)

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1. **PPE is short for personal protective equipment. Some PPE is used to protect an applicator from exposure to pesticides.**
  - a. Examples include chemical-resistant gloves, respirators, even pants and long-sleeved shirts.
  - b. The PPE used will depend on the pesticide product label, the application technique, and specific conditions at the site.
2. **The pesticide label will provide instructions for the minimum level of protection required when using the product.**
  - a. An applicator can always choose PPE that provides a larger measure of safety (such as a full-face respirator rather than a standard respirator).
  - b. Food facilities may have additional requirements for wearing PPE.
  - c. Feel free to use more PPE than specified on the label (such as wearing gloves during application even though the label doesn't require them).
3. **Respirators have to be worn whenever airborne contaminants may affect health and safety.**
  - a. Most pest control technicians wear a respirator at least some of the time such as when mixing or applying pesticides.
  - b. OSHA requires that pest control companies have a Respiratory Protective Program in place.
4. **Using a respirator stresses the body because breathing is restricted.**
  - a. How much stress depends on the type of respirator, job conditions, and health.
  - b. Certain medical conditions, such as heart or lung trouble, affect a person's ability to use a respirator safely.
  - c. Other factors that affect ability to use a respirator safely include beards, dentures, the shape of the face, some types of glasses, and the use of certain medications.
5. **A respirator must be suited to the particular hazards encountered, and it must fit properly in order to work.**
  - a. The first step in respirator training is selection of the proper type and size of respirator for the individual and the job.
  - b. Most technicians use a cartridge respirator, but technicians doing fumigation may need a self-contained breathing apparatus (SCBA).

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6. **A fit test is necessary to determine if a respirator fits properly.**
  - a. There are different ways to do a fit test.
  - b. Most pest control companies use a simple substance detection test to check the fit (an odor test uses banana oil; a taste test uses saccharin; other tests use a harmless irritant or smoke).
  - c. While wearing the selected respirator, the substance is wafted into the air in front of applicator. If the substance can be smelled, tasted, or otherwise detected, the respirator doesn't fit properly.
  - d. The fit test must be repeated every year, or more often if the person gains or loses weight or gets dentures or glasses.
  
7. **Conduct a "user seal check" to recheck the fit of the respirator each time it's worn.**
  - a. Seal checks can be positive pressure tests or negative pressure tests.
  
8. **For positive pressure tests, cover the exhalation valve with a hand.**
  - a. Press lightly and exhale gently.
  - b. If the fit is correct, the facepiece should bulge slightly from trapped air.
  - c. If air is escaping around the face seal, recheck and refit.
  
9. **For a negative pressure test, close off the inlet openings by covering them with the palms of the hands, or by replacing the filter seals.**
  - a. Inhale gently so that the facepiece collapses slightly, and hold your breath for ten seconds.
  - b. If the facepiece stays collapsed, and no air is leaking, the fit is correct.
  
10. **All respirators must be inspected for wear and deterioration before and after each use.**
  - a. Check the facepiece for dirt and grime, cracks, or tears. Make sure the shape of the facepiece is not distorted from improper storage or from deterioration of the material.
  - b. Check the headstraps for cracking, loss of elasticity, or broken buckles or attachments.
  - c. Remove the cover of the exhalation valve and check for dirt, debris, or hairs under the valve seat and make sure the valve is seated properly in the valve body.
  - d. Check the condition of the cartridges.
  
11. **Cartridges and filters gradually lose their protective ability. Their useful life depends on the following:**

<ol style="list-style-type: none"> <li>a. The amount of particles in the air.</li> <li>b. The concentration of vapor being filtered.</li> </ol>	<ol style="list-style-type: none"> <li>c. The amount of absorbent material that they contain.</li> <li>d. The breathing rate of the wearer.</li> <li>e. The temperature and humidity.</li> <li>f. The length of time that they've been stored between uses.</li> </ol>
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**12. Follow the manufacturer’s guidelines on when to replace filters and cartridges.**

- a. If there are no guidelines, change cartridges after about 8 hours of use or if you smell pesticides or have trouble breathing.

**13. Respirators should be cleaned and disinfected frequently.**

- a. If a respirator is shared with another worker, it must be cleaned and disinfected after each use.
- b. Proper cleaning requires disassembly.
- c. Use a mix of detergent, bleach, and warm water, or a commercially-available cleaner and disinfectant solution.
- d. Do not use ammonia, hot water, or strong cleaning detergents or chemicals as they can damage respirator parts.
- e. A respirator that has been contaminated with a concentrated pesticide may require a separate decontamination procedure. In such a case, check with the manufacturer of the respirator.

**14. Store respirators where they are protected from dust, sunlight, extreme temperatures, moisture, pesticides, and other chemicals.**

- a. Place them in a normal position to prevent distortion of the shape of the rubber or plastic parts.
- b. During the work day, respirators stored in a vehicle should be kept away from pesticides.
- c. Don’t throw a respirator into a service kit, locker or behind the seat of your service vehicle unless it is protected in a carrying case or box.

**15. Many pesticide labels require chemical-resistant gloves.**

- a. A glove is considered “chemical-resistant” if there can be no movement of pesticide through the material during its use.
- b. If handling or applying a pesticide product that contains a solvent, choose gloves made of butyl, nitrile, or foil-laminate.
- c. Sometimes the label or SDS will specify what type of gloves are resistant to the pesticide or solvents in the product (“Wear chemical-resistant gloves such as butyl or nitrile”).
- d. Remember, latex can be an allergen, so ask the food plant contact before wearing this type of glove.

**16. Pest control technicians often need eye protection when using pesticides.**

- a. Pesticide can splash into your eyes when pouring, or it can splash back during application.
- b. The label may require eye protection from airborne pesticides when applying certain aerosol, dust, or space treatments.
- c. Always check the pesticide label to see what type of safety eyewear is required.

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- 17. There are different types of eye protection equipment and they provide different levels of protection.**
- Unvented goggles protect eyes when applying any pesticide.
  - Vented goggles are less likely to fog, but aerosols and mists may get inside.
  - Safety glasses must have attached brow and side panels.
  - Face shields protect the entire face from pesticide splash and can be worn with eyeglasses.
  - Regular eyeglasses are not considered to be adequate PPE for pesticide use.
- 18. Clothing is a type of PPE since in some sense and to some degree it keeps pesticide from contacting skin.**
- Coveralls worn over regular clothing provide additional protection and can be quickly removed if contaminated.
  - Other types of clothing are specifically designed to protect against skin exposure to chemicals; a common example is Tyvek®.

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## 6.7 PROTECTING PEOPLE AND THE ENVIRONMENT FROM PESTICIDES

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1. **Pesticide misuse, spills, and accidents can affect human health, harm nontarget animals and plants, contaminate surface or ground water, pollute the natural environment, and cause a wide range of impacts ranging from minor to catastrophic.**
  - a. Check the label's environmental hazards section for special warning statements concerning hazards to the environment.
2. **Minimize the risk of exposure to pesticides in the environment by using pesticides judiciously and where necessary.**
  - a. Use pesticides to suppress verified pest problems after consideration of nonchemical control options.
  - b. When use of a pesticide is deemed necessary, choose an effective pesticide product and application method posing the least hazard.
3. **It is a violation of law to use a pesticide in a manner inconsistent with its labeling.**
  - a. Always read label instructions before every application.
  - b. Always follow the label instructions for every application.
  - c. Food facilities may have requirements that go beyond the label.
4. **Follow exactly all mandatory statements and instructions on a label.**
  - a. A mandatory statement will contain such key words as "must," "shall," and "will," or it will use an expression such as "do not," "use only," or "for use only by."
  - b. Statements containing words like "should," "may," and "it is recommended that" are suggestions only and you may depart from them.
5. **Use pesticides only if the application site is specified on the pesticide label.**
6. **Follow proper pesticide application procedures and label instructions to avoid injuring wildlife, pets, children, people, yourself, livestock and other nontarget organisms.**
  - a. Take particular care with rodenticides and avicides (bird control products).
  - b. When using rodenticide baits and tracking powders, apply them out of the reach of children, pets, and wildlife and inside tamper-resistant bait stations.
  - c. Choose formulations of rodent bait that are least susceptible to bait translocation, which is when rodents (or other animals) carry bait out of the treatment site into a new area.
  - d. Do not apply an avicide in areas or at times when nonpest birds might be affected. Killing migratory birds is a violation of federal law and can carry serious punishment for willful disregard of safety.
  - e. Secondary poisoning can also occur when nontarget predators or scavengers feed on poisoned rodents or birds.

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7. **A spill is any accidental release of pesticide.**
  - a. The spill may be minor, requiring little cleanup effort, or it may be major, involving large amounts of pesticide and serious contamination.
  - b. Even a spill that appears minor can endanger the applicator, other people, and the environment, especially if mishandled.
  - c. Large leaks or spills require specially trained and equipped emergency crews.
8. **The early steps you take to control a spill can reduce or eliminate damage or injury, and the faster you act, the less chance the spill will cause harm.**
  - a. Carry a spill control kit in your vehicle.
  - b. Be sure you know what to do before you have a spill.
9. **After a pesticide spill, be calm and reasoned but work quickly to protect people and the environment.**
  - a. Try to enlist responsible help.
  - b. Remember to protect yourself and others who are working on the spill.
  - c. Use personal protective equipment (PPE).
10. **Stop the spill.**
  - a. Turn off the pump, pinch the hose closed, place a leaky container inside a larger container – do whatever is needed to limit the size of the spill.
  - b. Stopping the spill is usually simple, but occasionally is best left to experts; for example, when a spray rig overturns.
  - c. Don't take unnecessary risks.
  - d. If possible, prevent contamination of water sources and prevent product from entering storm drains.
11. **Decontaminate and give first aid.**
  - a. The safety of people in the spill site is your first priority.
  - b. Anyone contaminated by the spilled pesticide should remove the contaminated clothing, wash down, and receive first aid as appropriate (check the label for first aid instructions).
12. **Contain the spill.**
  - a. Keep the spill from spreading.
  - b. Keep the pesticide from entering storm drains, wells, sewers, streams, and other water systems, or from moving into other occupied areas.
  - c. For spills of liquids, create dams and dikes with sand, absorbent snakes, kitty litter, special spill control absorbents or, as a last resort, rags or paper towels.
  - d. Outdoors, trench around the spill area and/or build a dike of soil.
  - e. Dry spills (wetable powders, dusts, granules) should be gently covered with a tarpaulin.

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## 13. Isolate the area.

- a. Keep people and pets out of the spill area.
- b. Rope off the area.
- c. Try to draft someone to act as a “guard” while you deal with the spill.

## 14. Report the spill.

- a. First, call your supervisor for instructions.
- b. Depending on the material spilled, the amount of the spill, and state and federal laws, you or your supervisor may have to contact the fire department, police, certain state and federal agencies, or spill “hotlines.”

## 15. Clean up the spill.

- a. Procedures will depend on the pesticide, the amount of the spill, and the location.
- b. Follow instructions from the office or from a spill hotline.
- c. Do not work alone.
- d. Wear appropriate protective equipment.
- e. Remember, “cleaning up” concentrates may require more PPE than the finished formulation.

## 16. Decontaminate as necessary. The manufacturer of the pesticide will provide information on how to decontaminate surfaces and materials.

## 17. Dispose of contaminants.

- a. Recovered pesticide should be saved and used at a job site, if possible.
- b. All contaminated materials (such as absorbents, rags, soil, and wood) must be removed from the site and disposed of as required by law.
- c. Place the material in a sealable, leakproof drum or, if a drum is not available, in double heavy-duty plastic trash bags, until you find out the proper disposal procedure.

## 18. A leaking pesticide container demands immediate action.

- a. Put on any personal protective equipment, such as rubber gloves or goggles, that is required or suggested on the label.
- b. If the leaking is severe, first contain the leak. A quick way to do this is to temporarily place the container inside a larger volume container.
- c. Transfer the pesticide to another container or into a spray tank or other piece of application equipment.
- d. Clean up any spillage.

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- 19. Ground water can become contaminated with pesticides and decontamination of this water can be difficult or impossible. Contamination can occur when:**
- Rain carries dissolved pesticide down through the soil (a process called leaching).
  - Pesticide is back-siphoned from pesticide tanks. Always allow at least a 1 inch gap between the tank and the hose connected to the water supply.
  - Termiticides enter wells during termite treatment.
  - Pesticides, particularly concentrates, are not disposed of properly.
- 20. Protect ground water from contamination by following the label and good application practices:**
- Assess the risk of ground-water contamination before treatment by checking soil type, looking for wells, cisterns, springs, streams, storm drains, and other potential routes to ground water, and knowing the depth of the ground water in an area.
  - Choose products least likely to leach (check the label or contact the manufacturer).
  - Avoid spills and clean up any spills immediately.
  - Use a backflow preventer and/or air gap when filling spray tanks.
  - Do not apply outdoor applications if rain is forecast, or if the ground is saturated or frozen.
- 21. Pesticide applicators are legally responsible for “properly” disposing of their leftover pesticides including all of the following:**
- Rinsewater – solutions used to rinse application equipment and product containers.
  - Empty containers – containers that retain pesticide residues.
  - Unused pesticides – old pesticides, unusable, diluted pesticides, or unidentifiable materials.
  - Contaminated soil – soil or other substrate (carpets, furniture, spill control products) contaminated from spills.
- 22. Check the label for specific disposal instructions for a particular product.**
- Instructions will usually be found in a section called “Disposal” or “Storage and Disposal.”
  - Sometimes, however, the disposal instructions may be found under a different heading so be sure to read the entire label.
  - State rules may sometimes be more specific on methods of disposal so be familiar with them.

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- 23. Many pesticide containers, especially plastic jugs, must be “triple-rinsed” before disposal, and the steps are as follows:**
- Drain the “empty” container into your application equipment for at least 30 seconds.
  - Fill the container ¼ full of clean water, replace the cap, and swish the liquid around.
  - Pour the rinsate into the sprayer and let it drain for 30 seconds.
  - Repeat these steps two more times, for a total of three rinses.
  - Use the rinse water in the sprayer according to the product label (as a diluent or end-use dilution).
  - Puncture or crush the container so it cannot be reused (unless it is being returned to the manufacturer as recyclable).
- 24. When you clean a sprayer or other application equipment, you cannot just pour the rinse water down the drain.**
- The rinse water from this cleaning, called “rinsate,” contains diluted pesticide.
  - If you can, handle this rinsate just as you do rinsate from triple-rinsed containers—use it in a sprayer as a diluent or an end-use dilution.
  - Otherwise, this diluted pesticide must be disposed of as a hazardous material.
- 25. Drift is the movement of the pesticide away from the site or pest you are treating and into nontarget areas.**
- Pesticide drift is the responsibility of the applicator and, when it occurs, may be considered a misapplication under FIFRA.
- 26. Learn how to anticipate and avoid problems with drift.**
- Drift is most common outdoors with power sprays, or mist applications.
  - Drift is most likely during outdoor application with winds 10 mph and higher.
  - Other factors, such as temperature, humidity, and droplet size also contribute to pesticide drift.
- 27. When treating outdoors, technicians need to check for things that could be contaminated by pesticide drift, (i.e., ponds, pets, plants, etc.)**
- 28. When spraying outdoors, take steps to reduce the risk of drift.**
- Do not spray when wind is blowing toward sensitive areas.
  - Do not spray when it is windy.
  - Use the lowest application pressure practicable.
  - Choose a nozzle that produces a coarse spray.
  - Use a commercial “drift reduction” (thickening) agent in your tank.

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**29. Pesticide drift can, on rare occasions, occur even hours or days after an application.**

- a. A dried wettable powder residue might be tracked into a processing area on a worker's shoes.
- b. The day after a perimeter treatment, a storm can blow piles of treated leaves into a nearby fish pond.

**30. Pesticide drift can happen during indoor applications, as well.**

- a. Fans, air conditioners, and blowers create indoor wind that moves pesticide where it is not wanted.
- b. Even void treatment can generate drift if applied under too high a pressure, drifting out of the void through holes, electrical outlets, or vents.
- c. Check for air intakes and turn off all ventilation during treatment.
- d. Never apply dust near a motor that can cause drift when it turns on.

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## CHAPTER 7

# PESTS OF FOOD PROCESSING & HANDLING FACILITIES

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## 7.1 GENERAL

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1. **Almost any pest that infests in and around structures can become a pest at a food processing and handling facility.**
2. **Correct identification of, and knowledge about, these pests is essential.**
  - a. To understand the pest's biology and habits.
  - b. Before deciding to take any pest control action.
  - c. To determine the best pest management options.
  - d. To determine the root cause (may pre-empt pest management options).
3. **To effectively manage pests in a food facility, technicians need basic knowledge of the biology and habits of the more common pests that infest foods as they are processed or stored.**
4. **This section briefly reviews the biology and habits of the major species in the following categories of pests:**
  - a. Stored product pests.
  - b. Rodents.
  - c. General pests.
    - i. Flies
    - ii. Cockroaches
    - iii. Ants
    - iv. Occasional invaders
5. **For more information on pest identification, biology, and habits, consult one of the following references:**
  - a. NPMA Field Guide to Structural Pests.
  - b. Truman's Scientific Guide to Pest Control Operations.
  - c. Handbook of Pest Control.

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## 7.2 STORED PRODUCT PESTS

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1. **Stored product pests are a major contributor to food loss and contamination in milling, processing, food storage and retail facilities.**
  - a. Any packaged food product or bulk food can be infested.
  - b. Most of these pests (but not all) are adapted to living on foods with low moisture content.
  - c. Breeding populations can also exist in waste grain, cereal debris and dust, and other debris spilled in and around food being processed or in storage.
  - d. To control these pests effectively, technicians must understand the biology, behavior, and feeding habits of these pests.
  
2. **Stored product pests generally fall into four categories:**

a. Internal feeders.	c. Scavengers and secondary pests
b. External feeders.	d. Feeders on meats and cheeses

### INTERNAL FEEDERS

3. **Rice weevil**
  - a. Feeds on grains and seeds including rice and beans.
  - b. Considered the most destructive pest of stored grain.
  - c. The larvae and pupae are found within the grain kernel, adults feed outside the grain.
  - d. Adults are good fliers.
  - e. Aggregation traps are available to attract males.
  
4. **Granary weevil**
  - a. Similar to rice weevil.
  - b. Found in wheat, oats, rye, barley, and other whole grain in storage.
    - i. Occasionally infests legumes (beans) and nuts.
  - c. The larvae and pupae are found within the grain, adults feed outside the grain.
  - d. Adults cannot fly.
  
5. **Lesser grain borer**
  - a. Feeds on whole grains and seeds, especially corn and wheat
  - b. Will also attack rodent bait, book bindings, tobacco, nuts, beans, and many other products.
  - c. Both larvae and adults can bore through packaging.
  - d. Adults fly and are attracted to light; will come to insect light traps.
  - e. Pheromone trap available which attracts males.

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## 6. Angoumois grain moth

- a. Feeds on whole corn, wheat, rice, and other grains and seeds.
  - i. Often found in bird seed.
  - ii. Can infest rodent bait containing whole seeds.
- b. Larva consumes the inner portion of the grain, leaving a hollow shell.
- c. When adult emerges, it leaves a unique “trap door” at its exit.
- d. Badly infested grain has a sickening taste and smell.
- e. Pheromone traps are available that attract males.

## EXTERNAL FEEDERS

## 7. Cigarette beetle

- a. Attacks tobacco products, spices, pet food, seeds, and a wide range of dried products.
- b. It has also been found infesting books, pyrethrum, drugs, and dried plants.
- c. Adults are strong fliers and are attracted to light.
- d. Can be trapped in insect light traps and pheromone traps (capture males only).
- e. Can gnaw through package materials.

## 8. Drugstore beetle

- a. Similar to cigarette beetle.
- b. Attacks a wide variety of foods, spices drugs, leather, hair, horn, bread, flour.
- c. Also a pest of books.
- d. Adults good fliers and are attracted to light.

## 9. Indian meal moth

- a. Larvae attack grain and grain products, seeds, nuts, fruits, dried dog food, cat food, bird seed and a wide range of products.
- b. Larvae spin white silk cocoons in which they pupate.
- c. Adults fly in a zigzag pattern and are attracted to light.
- d. Pheromone traps available for capturing males.

## 10. Warehouse beetle

- a. Feeds on a very wide variety of products, both animal and vegetable.
- b. Commonly infest pet foods.
- c. Often found feeding on insects in insect light traps.
- d. Adults fly.
- e. Pheromone traps available for attracting males.

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## 11. Cadelle beetle

- a. Found in stored products such as cereals, breakfast foods, nuts, fruit, spices, and grains.
- b. Larvae cause extensive damage in grains because they graze from grain to grain, eating only the “germ” portion.
- c. Both larvae and adults can gnaw through packaging (paper, cardboard, and sacks), and can even bore into wood, such as the wood supporting grain bins.
  - i. The holes are large and provide entry to other pests.
- d. Larvae bore into tobacco.
- e. Adults avoid light and are cold hardy.

## SCAVENGERS AND SECONDARY PESTS

## 12. Sawtoothed grain beetle

- a. Feeds on cereals, flour, dried fruits, nuts, macaroni and a long list of foods.
- b. Cannot feed on whole grains; often infests after whole grain feeders, such as the rice weevil, have damaged the grain.
- c. Flat form allows it to penetrate into imperfectly sealed packages.
- d. Adult rarely or never flies although it has developed wings.

## 13. Merchant grain beetle

- a. Closely resembles sawtoothed grain beetle in both appearance and habits.
- b. Feeds on products made from cereals, flour, dried fruits, nuts, and other oil-bearing seeds.
- c. Flat form allows it to penetrate into imperfectly sealed packages.
- d. Adult can fly.

## 14. Foreign grain beetle

- a. Feeds on fungi on damp and moldy grains, and is also a scavenger.
- b. Adults are strong fliers and are attracted to lights.
- c. Often associated with moisture problems.
- d. Can be trapped in insect light traps.

## 15. Yellow mealworm and dark mealworm

- a. Closely-related beetles that feed on damaged grain, grain refuse, and debris.
- b. Larvae prefer dark, damp locations.
- c. Often found in neglected corners and under equipment where grain is rotting.
- d. Larvae have been known to infest the human gastrointestinal system after being consumed in cereals and breakfast foods.

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## 16. Spider beetle

- a. Scavengers that feed on a wide range of materials, both plant and animal.
- b. Many species only active at night.
- c. Many species attracted to lights.
- d. Often associated with poor sanitation.

## 17. Red flour beetle

- a. Common in plants processing flour, mills, warehouses and storage areas.
- b. Similar to confused flour beetle but can be identified by antennae.
- c. Attracted to light and can fly.
- d. Cannot feed on unbroken grain.
- e. Opportunistic and feeds on flours, spices, nuts fruits, etc.

## 18. Confused flour beetle

- a. Infests areas similar to red flour beetle.
- b. Similar in biology to red flour beetles
- c. Attracted to light but does not fly.

## 19. Psocids

- a. Look like small worker termites.
- b. Found in damp, warm, undisturbed areas.
- c. Feed on mold, fungi, starches.
- d. Commonly called book lice.

## FEEDERS ON MEATS AND CHEESES

### 20. Cheese or Ham skipper–

- a. Flies that attack hams, bacon, aged meats, salt beef, old cheese.
- b. Also feed on cadavers, rotting meat, excrement, and other animal products, as well as fungus.
- c. Adults feed on liquids on larval breeding material and are short lived
- d. Skippers are so-named because the larva grabs its rear end with its mouth curling into a c-shape and then releases its hold and snaps itself forward up to 10 inches.
- e. Good fliers.

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## 21. Hide beetle

- a. Attacks skins and hides, feeding primarily on inner surface.
- b. Also feeds on smoked meat, hams, cheese, and dead animals and insects, as well as rodent bait, old wasp and bee nests.
- c. Larva may bore into wood to pupate.
- d. Adults are strong fliers.
- e. Adults attracted to light, larvae repelled by light.
- f. Adults may be trapped in insect light traps.

## 22. Redlegged ham beetle

- a. Attacks dried and smoked pork, cheese, hides, dried and salt fish, and some vegetable products.
- b. Also feeds on the larvae of other insects.
- c. Avoids light.
- d. Poor flier, prefers to run.

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## 7.3 RODENTS

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1. **Accurate identification of rodents is essential for rodent management.**
  - a. The vast majority of rodents are not pests at all, but the ones you find in and around food facilities most likely are.
  - b. There are over 1500 different species of rodent in the world, and roughly 500 of these are mouse-like or rat-like.
  - c. The major pest rodents are the Norway rat, roof rat, house mouse, deer mouse, and white-footed mouse.
  - d. There are important differences in the biology and behavior of the five main pest rodents.
  
2. **There are often differences in where you find each of the pest rodents.**
  - a. Roof rats usually nest in trees, bushes and other dense vegetation, and typically travel above our heads, and enter structures up near the roof.
  - b. The Norway rat prefers to live near the ground, typically nesting in burrows and foraging at ground level when outdoors.
  - c. House mice can be found in any dark, sheltered locations in and around structures, from below ground to upper floors.
  - d. Deer mice and white-footed mice are primarily found outdoors, but may move into structures at ground level, particularly during colder weather.
  
3. **The size of the rodents' territories differ as well. Territory size and foraging range depend on population density, abundance of food, water, shelter and social dynamics.**
  - a. Territory size and foraging range depend on population density, abundance of food, water, shelter and social dynamics.
  - b. A rodent recently introduced to a building will behave differently than a rodent that has an established nest
  - c. Mice generally have shorter home ranges from their nests than rats.
  
4. **Knowing the typical sizes of the different rodents' territories is important in their control.**
  - a. It's not unusual for a colony of rats nesting outdoors to be feeding at a building more than 100 feet away.
  - b. In contrast, a mouse feeding on a countertop is likely to be nesting nearby.
  - c. Rats in urban environments often remain within one city block, but will visit multiple properties within that range

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- 5. Rats and mice react differently to new objects and change.**
  - a. Mice tend to investigate new objects in their territory. They're curious.
  - b. When something new is added, mice will investigate it thoroughly.
  - c. Most rats are wary of all things strange or foreign appearing in their territory.
  - d. Rats tend to avoid anything new—a bait station, trap, the smell of insecticide.
    - i. This can make baiting and trapping ineffective unless special procedures are followed.
  
- 6. Feeding behavior also differs greatly between pest rodents.**
  - a. Mice are nibblers, and may feed twenty different times throughout an evening.
  - b. Norway rats are cautious feeders, but once they find a food they like, they may consume a large quantity at a single feeding.
  
- 7. Rodents' food preferences are also different, although all will feed on many human foods.**
  - a. Norway rats will feed on almost any food that people will eat and are often dependent on human foods and trash.
  - b. Roof rats outdoors can survive successfully on berries, seeds, fruits, slugs, shellfish, and snails.
  - c. House mice feed on a wide variety of foods but seem to prefer cereals and seeds.
  - d. Deer mice and white-footed mice feed on insects, seeds, nuts, bird seed, pet food, even other small animals.
  
- 8. A mature Norway rat is 12-18 inches from the tip of the nose to the tip of the tail and usually weighs less than a pound.**
  - a. The Norway rat is never "as big as a cat" as commonly claimed by untrained people.
  - b. No one has ever officially recorded a Norway rat bigger than a pound and a half.
  - c. Young rats are much smaller.
  - d. Individual Norway rats vary greatly in color, but are usually in various shades of brown and gray.
  
- 9. The roof rat is sleeker than a Norway rat.**
  - a. A mature roof rat is about 14-16 inches from the tip of its nose to the tip of its tail (similar to the Norway rat),
  - b. The roof rat usually weighs much less – from a quarter-pound to a little over a half pound for a mature adult.
  - c. They are commonly reported as black or nearly black with gray or white belly, but they come in a variety of colors. It is important not to depend entirely on coloration for identification.

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**10. The small size of the house mouse often surprises people.**

- a. An adult mouse usually weighs less than an ounce.
- b. It measures about seven inches from the tip of its nose to the tip of its tail.
- c. Color is variable but there is typically no significant color change between the back and the belly.

**11. Deer mice and white-footed mice are roughly the same size as the house mouse.**

- a. About six inches from the tip of the nose to the tip of the tail.
- b. Deer mice and white-footed mice weigh about an ounce or less when mature.
- c. Deer mice and white-footed mice are bicolored—grayish buff to deep red-brown above and white below.

**12. Where the ranges of Norway and roof rats overlap, you need to know how to tell them apart.**

- a. The best characteristic is tail length. If you pull a rat's tail over its back, a Norway rat's tail will not reach beyond its ears, a roof rat's will reach its nose or beyond.
- b. The Norway rat is stockier and heavier-looking than the roof rat, and typically lighter colored.
- c. The Norway rat's ears and eyes are smaller and its nose is blunter compared to the large ears, large eyes, and pointed snout of the roof rat.
- d. A roof rat's ears are so large that they can be pulled over its eyes.
- e. Female roof rats have 10 teats while female Norway rats have 12.

**13. A very young rat and a very large mouse can also be confused.**

- a. A young rat is like a puppy: its feet and head look proportionally bigger than they should.
- b. A young rat's hind foot will measure an inch or longer, while a mouse's will be much shorter than an inch long.

**14. House mice can be distinguished from deer and white-footed mice by their tails.**

- a. The house mouse's tail is almost naked.
- b. The tails of the deer mouse and white-footed mouse are covered with short fur, and sharply bicolored dark above and white below.

**15. Rodent populations increase as their resources increase and territories generally become smaller.**

- a. The more food and cover, the more rats and mice.
- b. Rodent infestations in and around buildings are usually related to sanitation problems with housekeeping, trash handling, the quality of food storage, clutter, and landscaping.
- c. One male will dominate the territory and mark with urine; will fight to protect territory.

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## 7.4 FLIES

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1. **Those flies that breed in organic waste are generally called filth flies.**
  - a. Filth flies are synanthropic pests that include house flies, blow flies, bottle flies, and flesh flies.
  - b. Filth flies attracted to decaying matter of plant or animal origin; unlike blow/bottle flies and flesh flies, house flies do not typically breed in meat or carcasses.
  - c. Filth flies transfer bacteria and other disease-causing pathogens to food and food-handling surfaces; diseases include dysentery, diarrhea, eye infects, cholera, and food poisoning.
  
2. **Another group of pest flies could be called the “small flies.”**
  - a. These are the tiny flies that often breed in the semi-liquid crud or slime that accumulates in drains, cracks, garbage cans, and other sites as well as fruit and vegetable matter.
  - b. This group includes the fruit flies, moth (drain) flies, fungus gnats, and phorid flies.
  
3. **Flies can be identified based on physical characteristics.**
  - a. All flies belong to the order Diptera because they only have two true wings (a pair of forewings); the hindwings are reduced to organs called halteres that help flies balance in flight.
  - b. House flies (Family: Muscidae) are dull-colored with four black stripes going down thorax.
  - c. Blow flies and bottle flies (Family: Calliphoridae) are iridescent and either blue, green, bronze, or black.
  - d. Flesh flies (Family: Sarcophagidae) are dull-colored with three black stripes going down thorax.
  - e. Fruit flies (Family: Drosophilidae) are small with bright red eyes.
  - f. Moth (drain) flies (Family: Psychodidae) are stout with hairy wings and bodies that resemble a moth.
  - g. Fungus gnats (Multiple families) are tiny with relatively long legs and wings.
  - h. Phorid flies (Family: Phoridae) are tiny with humpbacked bodies.
  
4. **The female fly deposits her eggs on the surface of a good food material for the larvae or maggots.**
  - a. This may be fermenting fruit in the case of the fruit fly or decaying garbage in the case of the house fly.
  - b. The larvae feed in the food material for several days, then crawl to drier areas, or even leave the food, to pupate.
  - c. Under optimum conditions, both the house fly and the fruit fly can develop from egg to adult fly in as little as 8 days.

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- 5. Adult filth flies feed on a wide variety of foods, that range from human foods to manure to carcasses.**
  - a. The adult filth fly eats by regurgitating fluid onto its food and then sopping up the dissolved result with its sponging mouthparts.
  - b. Filth flies also leave fecal deposits wherever they feed.
  
- 6. The breeding site for filth flies is almost always within 100 yards of the problem area, but they can travel a mile or more from the breeding site. Up to 20 miles has been documented.**
  - a. The number one breeding site for house flies is animal manure, while blow flies and flesh flies prefer dead animals.
  - b. Filth flies will also breed in garbage.
  - c. The closer the dumpster or compactor is to a building, the more likely it is to be the source of fly problems.
    - i. Look for open dumpsters with crud and liquefying garbage in the bottom, or food garbage spilled nearby.
  - d. Other breeding sources for filth flies include rotting garbage in the bottom of garbage cans, overlooked and rotting fruits and vegetables in loading docks or other out-of-the-way sites, grease barrels, rotting grass clippings or spoiled grain.
  - e. The presence of flesh flies on the interior of a building may indicate a dead animal (e.g. rodent) in a wall void or other hard to reach area due to the preference this fly species has for carcasses and carrion.
  
- 7. Fruit flies are attracted to ripe or rotting foods and breed in moist, fermenting foods and liquids.**
  - a. They're found in the semiliquid gunk that accumulates around syrup dispensers, unclean or clogged drains, in recycling containers, the bottoms of garbage cans or refrigerator drip pans, in dirty mop buckets, even in catsup or wine bottles.
  - b. Overlooked and rotting fruits and vegetables are a prime source.
  - c. Because fruit flies need such a little amount of material in which to breed, there are usually multiple breeding sites in an account.
  
- 8. Moth flies and phorid flies are found in moist areas with organic matter such as sewers, slimy or clogged drains, dirty garbage cans, garbage disposals, and dirty drip pans.**
  - a. When you can't find the source of phorid or moth flies in an account, it may mean that there is a break in a sewer line under the slab.
  
- 9. You can check for small fly larvae by using a knife or spatula to scrape the debris out of drains or crevices.**
  - a. Spread it on a flat surface, shine your flashlight across the surface, and look for wiggling maggots.
  - b. You can check for flies escaping from drains by taping a plastic bag over the drain opening, or suspend a sticky trap over the drain opening.
  
- 10. Flies are not necessarily breeding in the same room where they are causing problems.**

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- 11. There are sticky traps with an attractant lure available for both house flies and fruit flies that can help pinpoint breeding sites.**
  - a. Fruit flies like to fly upwards to land on a surface so place sticky traps just above potential breeding sources with the sticky surface facing down.
  - b. Breeding attractants do not work well against filth flies as they do not last long and do not “pull” from a distance; food attractants can work very well against filth flies.
  
- 12. Insect light traps (ILTs) can be effective monitoring tools and can act as an “early warning system” to alert you to fly problems in an account.**
  - a. Check collection trays or glue boards in ILTs often, usually once a week.
  - b. If large numbers of flies suddenly are found in the trap, you can be fairly sure that there is a nearby breeding source.
  - c. It may also be that they are flying in from outside through an open window or door.
  
- 13. Fly-proofing can be effective in reducing fly pressure on the interior.**
  - a. Screens should be installed and any tears repaired. Screen size must be small enough to keep out the tiniest flies.
  - b. Doors, windows and vents should be caulked and tightened.
  - c. Door sweeps or weather-stripping should be installed on doors.
  - d. The client must be sure that doors are not left propped open.
  
- 14. A sprayer filled with water, degreaser, and a foaming agent, or a biological cleaner can be used to clean drink dispensers, drains, kitchen equipment, and other sites where fruit flies and other small flies breed.**
  
- 15. Strong air currents will keep flies from entering areas or landing on surfaces.**
  - a. Air doors or air curtains will keep flies from entering warehouses and processing areas.
  - b. Strategically placed pedestal or rotating fans can be used indoors to keep fruit flies away from equipment.
  - c. The air movement from fans will also help to dry out scummy, moist fly breeding sites in hard-to-reach areas like under equipment.
  
- 16. The key to indoor fly control is to find and eliminate the food source.**
  - a. Controlling just the visible adult flies by spraying or trapping will not eliminate the fly problem.
  - b. The breeding source (usually on the exterior of the building) will continue to produce more adult flies on a daily basis until the source is found and eliminated.
  - c. Identify the source and draft a plan to reduce or eliminate flies. Sometimes a neighboring property is the source and measures to reduce fly on that side e.g. trapping should be considered.

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## 7.5 COCKROACHES

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1. **Only a few of the thousands of species of cockroaches are pests, but these few have adapted extremely well to the human environment.**
  - a. Some can live and breed indoors year round.
  - b. Most hide by day in small cracks and crevices in human dwellings and come out at night to search for water and small bits of food.
2. **The German cockroach, *Blattella germanica*, is the most important domestic cockroach species in North America.**
  - a. Until recently, this cockroach was the number one pest faced by a technician.
  - b. The development of effective cockroach baits have greatly reduced the importance of cockroaches as pests in many sites.
3. **Cockroaches are public health pests.**
  - a. They can be mechanical transmitters of human pathogens when they crawl over feces or contaminated materials and then crawl over human food, processing equipment, etc.
  - b. The shed skins, egg cases, and feces of cockroaches can produce asthma or allergic reactions in sensitive individuals.
4. **Cockroaches are cautious and nervous.**
  - a. They prefer dark corners and stay out of sight.
  - b. The average German cockroach spends about 75% of its time hiding in cracks and crevices.
  - c. Because they like to have a crack to quickly dart into, they travel along the edges of walls and other objects.
  - d. Given a choice of routes, a cockroach will take the long way around the perimeter, hugging the edges rather than striking out across an open space.
5. **Cockroaches feed on everything people feed on and many things we wouldn't consider feeding on.**
6. **Cockroaches are not attracted to food beyond a short distance.**
  - a. They must come within a few inches of a food or bait, sometimes literally bumping into it, before they realize they have found food.
  - b. Cockroaches learn where food can be found.
  - c. They travel between nearby daytime hiding places and their regular feeding sites, usually at night.

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- 7. Cockroaches produce egg cases.**
  - a. Egg cases can contain from 16 developing nymphs (oriental cockroach) to 40 nymphs (German cockroach).
  - b. Most cockroach females carries their egg case for several hours after it is formed. They then deposit or glue it in a protected place.
  - c. The German cockroach female is an exception. She carries (and protects) her egg case until only a day or two before it hatches.
  - d. Egg cases protect the developing nymphs from insecticide application.
  
- 8. The four pest cockroach species tend to occupy different sites in a building.**
  - a. Each species has different requirements for temperature and moisture.
  
- 9. The German cockroach can be found on the first floor or upper floors of a building.**
  - a. It likes warm, dry areas but since it requires water it is most often found where there is noticeable moisture.
  - b. It is the most common species found in food-handling establishments.
  
- 10. The brownbanded cockroach is less common and tends to prefer hotter and drier locations than the German cockroach.**
  - a. The brownbanded cockroach has less need for water than the German cockroach.
  - b. The brownbanded cockroach is often found on upper floors and is more likely to be found away from moisture sources.
  - c. The brownbanded cockroach can be found behind and inside equipment.
  
- 11. The American cockroach is most often found on the ground floor or lower levels of a building in warm, dark, damp areas.**
  - a. American cockroaches are rarely found above the first floor of a building and are more common in commercial buildings.
  - b. Typical infestation sites are boiler rooms, storage rooms, garbage rooms, sewers, and near steam pipes.
  
- 12. Oriental cockroaches infest the crawlspace or basement level of a building, preferring cool, dark, damp, and poorly ventilated areas.**
  - a. Oriental cockroaches are often found in cellars, crawlspaces, basements, or near floor drains, water pipes, water meter vaults, and sewers.
  - b. In warm weather, oriental cockroaches are often found outside around building foundations.
  
- 13. In commercial accounts, technicians need to identify areas with debris, grease, and other potential food and harborage for cockroaches.**
  - a. Potential sites include food carts, tray carts, drains, trash rooms, trash cans, dumpsters, compactors, and loading docks.
  - b. Other areas include mop and storage closets, around wet processing areas, and dock levelers.

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## 7.6 ANTS

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- 1. Ants are among the most successful of insects.**
  - a. There are over 12,000 kinds of ants worldwide.
  - b. A few dozen species commonly cause problems inside buildings and in yards.
  - c. Yet those few dozen cause serious problems, and ants have replaced cockroaches as the number one pest in surveys of pest management professionals.
  
- 2. Ants are social insects (like termites, honey bees, and yellowjackets).**
  - a. Ants live in colonies, which are large cooperative groups.
  - b. Two or more generations overlap in the colony.
  - c. Adult ants take care of the young.
  - d. Adult ants are divided into castes: female reproductives, non-reproductive workers and males.
  - e. Depending on species of ant, colonies can contain anywhere from dozens of workers up to millions, as is the case of the Argentine and pharaoh ant.
  
- 3. Ant colony organization varies greatly from species to species.**
  - a. Some ant species have only a single egg-laying queen (monogyny) in each colony.
  - b. Others produce multiple egg-laying queens (polygyny).
  - c. Some species have a single nest, others have multiple nests.
  - d. Carpenter ants and a few other species can have a primary nest plus smaller satellite nests containing workers and brood.
  - e. Depending on the type of ant, colonies can contain anywhere from dozens of workers up to millions, as in the case of the Argentine ant.
  - f. Most ants form new colonies by swarming, some by budding, and some by both.
  
- 4. Budding is the breakaway of a group of ants from a mature colony to form a new colony.**
  - a. The group usually consists of one or more queens and some workers carrying larvae.
  - b. Budding is common with species of ants, such as pharaoh ants, that have multiple queens.
  
- 5. Most species of ant have a single queen, a single nest, and form new colonies through swarming.**
  - a. Swarming is the release of large numbers of winged ants (alates) to mate and form new colonies.
  - b. Ants with a single queen tend to be easier to control than those species of ants having multiple queens that form new colonies by budding.
  - c. With single-queen, single-nest ants, technicians can effectively spend their time finding the nest, so it can be removed or treated.

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6. **Multiple-queen, multiple-nest ants are opportunistic and can be more difficult to control.**
  - a. Examples include pharaoh ants, Argentine ants, odorous house ants, and some fire ants.
  - b. These ants evolved to quickly take advantage of short-lived, patchy, or scarce resources and so are preadapted for man-made environments.
  - c. These ants are distributed widely by human commerce.
  - d. When disturbed, even only slightly disturbed, by physical changes, flooding, mortality, or chemical irritation, these ants disperse or bud into new colonies.
  - e. Infestations in and around buildings can ultimately involve dozens of small colony units, regularly emigrating, dispersing, fusing together again.
  - f. Populations of these ants are often best controlled through baiting, because insecticide spray or dust may trigger budding and dispersal.
  
7. **Knowing the food habits of the particular ant species is important in ant management.**
  - a. It can enable you to find and eliminate the food that is attracting them to the site.
  - b. It can help you locate foraging trails to track the ants back to their nest.
  - c. It can help you choose an effective bait.
  
8. **Ants feed on many different types of food.**
  - a. Ants will feed on sugars and carbohydrates, proteins and grease.
  - b. Some species will feed on practically anything; others may limit their food to a narrow range.
  - c. Ants infesting structures are typically feeding on “people food,” both food in storage (sugar, cakes, cookies, breakfast cereals, etc.) and food from spills and garbage.
  - d. Ants may also be preying on other insects, or scavenging on dead insects in windows or lights.
  
9. **Food preferences of ants are often seasonal.**
  - a. When the queen is actively laying eggs, worker ants typically gather protein-based foods for the queen.
  - b. At other times they may ignore protein foods completely and restrict their foraging to sugars and greases.
  - c. Knowing the ant’s food preference at a particular time is important so you can choose the best ant baits.
  
10. **Many ants obtain sugar by feeding on “honeydew” secreted by aphids and other plant-sucking insects.**
  - a. Worker ants often defend these insects from predators and tend them as if they were their personal herd of “cows.”
  - b. Indoor infestations of ants are occasionally traced to large populations of aphids on outdoor foundation plants or indoor houseplants.

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- 11. You should typically spend 80 percent of your time on ant jobs inspecting the account, and twenty percent on control action, not the reverse.**
  - a. You can spray insecticides and kill hundreds of individual ants without ever solving the ant problem.
  - b. Proper inspection and monitoring allows you to identify the ant species causing trouble and locate where the workers are feeding, their foraging trails, and their nest sites (indoors or out).
  - c. Ants causing trouble inside a structure may be nesting outside and coming inside to feed.
  - d. Ants can also be nesting in walls, behind a baseboard, under the structure, or in decayed or rotting wood in the structure.
  
- 12. Some ants follow defined trails.**
  - a. If possible, follow these trails to the nest, especially if they are carrying food pupae.
  - b. Ants often trail along baseboards inside rooms and hallways.
  - c. Ants may also trail behind the baseboard. Try putting a putty knife under the baseboard to entice the ants out or even consider removing a section of the baseboard.
  - d. If you see ants in a carpeted room but cannot find their foraging trails, use a pair of needle-nose pliers to pull up small sections of carpet edge and check for ants.
  - e. Other areas to check include behind electrical plates, junction boxes, on window sills, inside light fixtures, and inside plumbing inspection areas.
  
- 13. Be sure to inspect outdoors for ant nests or ant trails.**
  - a. Look for “ant hills” or mounds and disturb them to see if they contain ants.
  - b. Nests may also be constructed next to or under the building’s foundation, under sidewalks, driveways and slabs, or in decaying logs or tree trunks.
  - c. Turn over rocks, boards, flagstones and similar things near the structure.
  - d. Check leaf litter and grass against foundation walls. Thick mulch is often good harborage.
  - e. Check inside equipment and other items that may provide nesting sites or moisture (in-ground sprinkler heads, yard lights, water meter boxes, and similar items).
  - f. Look for trailing ants along the edges of sidewalks, walls, tree trunks, tree branches touching the structure, fences, downspouts, and utility lines.
  
- 14. For some nocturnal species, such as carpenter ants, you may need to conduct evening inspections (a couple of hours after sunset) when the ants are most active.**
  
- 15. Identification of the worker ant is paramount to successfully developing a treatment strategy**
  - a. Several species have many similarities as in the Pharaoh ant and Thief Ant which are distinguished by one club on the antennae.
  - b. The wrong identification may cause the problem to spread rather than reduce.
  - c. Use a pictorial key to help with identification and consult someone for a second opinion.
  - d. Swarmers and Queen ants typically are not good representatives for identification.

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## 7.7 OCCASIONAL INVADERS

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**1. Nuisance pests that sporadically enter structures but are not associated with damage are called occasional invaders.**

- a. Species include centipedes, millipedes, crickets, lady beetles, earwigs, silverfish, and boxelder bugs
- b. They enter structures, sometimes in large numbers, when conditions outdoors are less favorable
- c. They are often found near building openings such as windows as a means for escape
- d. They are a nuisance for different reasons including biting, producing unfavorable sounds and odors, and staining furnishings

**2. Silverfish are small and wingless insects whose physical appearance resembles a fish.**

- a. They require moist environments to live
- b. They can move very quickly allowing them to escape frequently from predators like centipedes
- c. They are typically found in attics, sinks, bathrooms, basements, kitchens, and showers
- d. They are highly attracted to starchy foods

**3. Crickets are among the most popular occasional invader pests.**

- a. The males produce an extremely annoying chirping noise
- b. The common house cricket is tan in color and about 1 inch in length
- c. They consume human and pet food and are attracted to garbage and fermenting liquids
- d. They survive best in moist, humid conditions
- e. In the Fall, sealing foundation cracks and gaps, and reducing vegetation and mulch within and around a building will help reduce their entry into structures

**4. Boxelder bugs have a small black body with red-orange markings.**

- a. They tend to emerge after long, warm days in Fall or milder winters
- b. They are found on and around trees and other woody objects as well as building structures when it is warm outside
- c. They tend to spend cold months in wall voids, attics, and basements
- d. Their fecal matter can stain fabrics and other materials or objects
- e. They produce a bad odor when crushed
- f. They should be separated using a hose or pump sprayer as they produce a pheromone that attracts other boxelder bugs when in large numbers

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- 5. Lady beetles come in a variety of colors but are characteristic for having spots on their elytra (hard forewings).**
  - a. They are well known for invading structures in the Fall in large numbers to seek shelter during cold months
  - b. The Multicolored Asian Lady Beetle is an invasive species and is one of the most common lady beetle pests invading structures
  - c. When crushed they secrete a bad-smelling, orange-colored fluid from their legs that can stain carpets and fabrics
  - d. They tend to invade buildings close to woods and fields
  
- 6. Centipedes and millipedes are often confused but are quite different.**
  - a. Centipedes have one pair of legs per body segment (chilopod); millipedes have two pairs of legs per body segment (diplopod)
  - b. Millipedes are cylindrical and slower-moving; centipedes are flattened and faster-moving
  - c. Centipedes can inflict a stingful bite on skin and inject venom into prey
  - d. Millipedes can produce a foul odor that deters predators away
  - e. They enter structures to seek moist areas and when once inside centipedes do better because they prey on other arthropods like spiders and other insects
  
- 7. Earwigs are brown insects up to  $\frac{3}{4}$  inches in length.**
  - a. They possess characteristic pincer-like appendages on the posterior end of their body used for catching prey, defense, and mating
  - b. They can pinch humans during handling
  - c. A common myth is that they can bore through the ears of humans where they lay eggs -- this is not true
  - d. They are attracted to moisture and spend their time in moist cracks and crevices during the day
  
- 8. Managing occasional invaders can be accomplished using a variety of methods.**
  - a. Exclusion – caulk, concrete, and screens
  - b. Modification of habitat – reduce the presence of moist vegetation, mulch, and soil around structures
  - c. Mechanical control – vacuuming and hosing are popular methods against large aggregations of occasional invaders
  - d. Chemical control as a last resort in the ground and on the wall surrounding the structure.