<table>
<thead>
<tr>
<th>DISPOSAL OF WASTES (Continued)</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product waste collected in suitable containers and are covered when not in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All waste collected and disposed of at frequent intervals and in a sanitary manner</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>LAVATORY ACCOMMODATIONS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sufficient number of toilets provided</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tissue paper</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All doors to toilet rooms self-closing, tight fitting and do not open directly into a processing area. Maintained in a sanitary condition and kept in good repair at all times</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sign directing employees to wash hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot water present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Soap and sanitizers present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hand-drying facilities present</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waste receptacles</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Toilet rooms separately vented to the outside</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONSTRUCTION AND REPAIR OF EQUIPMENT, CONTAINERS AND UTENSILS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product contact surfaces of all equipment, containers and utensils constructed from suitable, smooth, impervious, nontoxic corrosion-resistant material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Scales, picking tables, packing tables, benches and similar equipment, where it is practicable, made of non-corrosive material</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### CRAB PLANT SANITATION CHECKLIST (Continued)

<table>
<thead>
<tr>
<th>CONSTRUCTION AND REPAIR OF EQUIPMENT, CONTAINERS AND UTENSILS (Continued)</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of equipment, containers and utensils is such that it provides protection from contaminants and can be readily cleaned and effectively sanitized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constructed or located so that all product contact surfaces are accessible for cleaning, maintenance and inspection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment, containers or utensils in good repair</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLEANING AND SANITIZING TREATMENT</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product contact surfaces or equipment, containers and utensils thoroughly cleaned and sanitized after use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning methods prevent contamination or adulteration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemicals used in cleaning and sanitizing treatment are properly labeled or stored</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved chemicals used for cleaning and sanitizing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rooms and areas used for receiving, processing and storing of raw materials and finished product maintained in a clean sanitary manner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>METHODS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methods prevent contamination of product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Methods prevent deterioration of product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SANITATION CONTROLS</td>
<td>YES</td>
<td>NO</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-----</td>
<td>----</td>
</tr>
<tr>
<td>Use of in-plant sanitation program</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitation control of raw materials is sufficient to protect the product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sanitation control of finished product is sufficient to protect the product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test and examination results are on file and made available to the inspector</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CONTROL OF INSECTS, BIRDS AND ANIMALS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birds and animals are excluded from the plant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insect and rodent control measures are effective</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Insecticides or rodenticides are safe for use as prescribed by EPA or USDA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Employed by approved methods or handled and stored in a safe manner</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COOLING AND REFRIGERATION FACILITIES</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facilities adequately cool and maintain the raw materials and finished product in a chilled state</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilities maintain products in a frozen state</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Design of equipment prevents contamination or adulteration of product</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Thermometer present in refrigerated room</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freezers and cold storage compartments are fitted with proper control devices to ensure materials are held at proper temperature</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### STORAGE FACILITIES

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storing methods minimize deterioration</td>
<td></td>
</tr>
<tr>
<td>Storage facilities are clean, sanitary, and in good repair</td>
<td></td>
</tr>
<tr>
<td>Shelves, cabinets or dunnage used where necessary to prevent contamination and deterioration</td>
<td></td>
</tr>
</tbody>
</table>

### VEHICLES AND TRANSPORTATION FACILITIES

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructed or operated to protect contents from contamination and deterioration</td>
<td></td>
</tr>
<tr>
<td>Properly maintained and clean</td>
<td></td>
</tr>
<tr>
<td>Capable of maintaining 40°F or less for chilled product</td>
<td></td>
</tr>
<tr>
<td>Capable of maintaining 0 °F or less for frozen product</td>
<td></td>
</tr>
</tbody>
</table>

### PERSONNEL

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
</table>
| Disease Control  
1. Are personnel with disease, working in plant in any capacity in which there is a reasonable possibility of food ingredients becoming contaminated by such person or of disease being transmitted by such person to other individuals? |   |
| 2. Plant management requires employees to report illness or injury to supervisors |   |
| Cleanliness  
1. Specified personnel wearing clean outer garments, maintaining a high degree of personal cleanliness and conforming to hygienic practices while on duty, to the extent necessary to prevent contamination of food products |   |
### CRAB PLANT SANITATION CHECKLIST (Continued)

<table>
<thead>
<tr>
<th>Cleanliness (Continued)</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Specified personnel wash their hands thoroughly to prevent contamination by undesirable microorganisms before starting, after each absence from the work station and at any other time when the hands may have become soiled or contaminated</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Specified personnel remove all insecure jewelry and when food is being manipulated by hand, remove from hands any jewelry that cannot be adequately sanitized</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Specified personnel use gloves of an impermeable material, except where inappropriate or incompatible with work involved in food handling, maintaining them in an intact, clean and sanitary condition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Specified personnel wear hair nets, caps, masks or other effective hair restraints</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Specified personnel store clothing or other personal belongings, eat food, drink beverages, chew gum, expectorate or use tobacco in any form in area where food or food ingredients are exposed or in areas used for washing equipment or utensils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Specified personnel take other necessary precautions to prevent contamination of foods with microorganisms or foreign substances</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### PERSONNEL (Continued)

<table>
<thead>
<tr>
<th>Education and Training</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Personnel responsible for identifying sanitation failures or food contamination have a background in education or experience or combination thereof, to provide a level of competency necessary for production of clean wholesome food</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Food handlers and supervisors receive appropriate training in proper food-handling techniques and food protection principles and are cognizant of the danger of poor personal hygiene, unsanitary practices, and other vectors of contamination</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Supervision</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Responsibility for assuring compliance by all personnel with all requirements of this document and clearly assigned competent supervisory personnel.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example - For Illustrative Purposes Only

45. FDA INSPECTION FORM

Date____________________________ Time In____________________________

Inspector’s Name (Print)____________________________________________

Badge or I.D. Number_______________________________________________

District Office____________________________________________________

Immediate Supervisor’s Name________________________________________

Inspected Plant with Other Inspectors:
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

Met with Our Personnel: _____________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________

Inspected Our Plant With ____________________________________________
   (Employee’s Name)

Comments During Inspection Trip ______________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
   ________________________________________________________________
FDA INSPECTION FORM (Continued)

Samples Taken (describe) ______________________________________________________
__________________________________________________________________________
__________________________________________________________________________
Lot or Codes_______________________________________________________________
__________________________________________________________________________

Other Identification___________________________________________________________

Did you obtain the receipt for samples taken?____________________________________

Comments After Inspection____________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

Time Out_______________________________________________________________

Signed (Employee) _______________________________________________________

Title____________________________________________________________
46. NOTICE OF UNUSUAL OCCURRENCE AND CORRECTIVE ACTION

(Not covered by other forms)

<table>
<thead>
<tr>
<th>Date</th>
<th>Time</th>
</tr>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Operation or processing step</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Description of the problem</th>
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<tbody>
<tr>
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</table>

<table>
<thead>
<tr>
<th>Corrective Action</th>
</tr>
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<tbody>
<tr>
<td></td>
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<tr>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Name</th>
<th>Date:</th>
</tr>
</thead>
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<tr>
<td></td>
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</tr>
</tbody>
</table>

Reviewed by: ____________________

Date: ____________________
12. Pest Control and Management

Controlling insect and rodent pests is an important part of maintaining the sanitation and quality control standards necessary in seafood processing. Each establishment has its own particular quality control standards and a program to achieve them. An effective pest control program involves the participation of management and pest control personnel. The Plant Manager or Quality Control Manager must work closely with the pest control personnel.

The majority of seafood processing operations assign the most capable and dependable employees to handle pest control. However, their training and experience in pest control may be limited. The objective of this training-resource manual is to provide pest control personnel with the detailed and specific information necessary to design and conduct an effective pest control program. The topics covered include:

- Management and pest control personnel
  - Pest control and objectives
  - Pesticide storage and mixing
  - Spraying techniques
  - Pest identification
  - Rodent control
  - Equipment

A. Management and Control Personnel

A good pest management or pest control program in seafood processing operations is not based on pesticides, equipment, or frequency of application. Rather, it should be based on a coordinated effort between the processing plant management and the pest control personnel. Both groups must understand the other’s role and priorities.

The pest control personnel usually can accomplish little without full involvement and cooperation of management in an overall sanitation effort. Both must understand that controlling pests requires a complete sanitation program, accounting for all facets of the operation from raw material to shipping and distribution.

Management and pest control personnel should survey the facility and discuss the operating and cleaning schedules, physical conditions inside and outside the facility, employee and operating practices, and storage of pest control chemicals and equipment. Both should become aware of the other’s limitations. For example, if the facility is not on a thorough cleaning schedule, which helps to control insects and rodents within equipment and around the building, the pest control personnel will have great difficulty eliminating or managing these pests. If the processor receives rodent or insect-infested materials or doesn’t properly store materials, the pest control personnel will not be able to control infestations of ingredients. Rodent trapping programs and crack and crevice treatments can’t be properly
carried out if storage and processing areas are not organized to allow for perimeter access. Before a pest control program can be developed and carried out, both management and pest control personnel must understand each other’s responsibilities and role in pest control.

2. Pest Control and Management Objectives

Control of pests associated with seafood processing operations must be based on both chemical and non-chemical control methods. Controlling cockroaches and other pests with chemicals alone is becoming increasingly more difficult. In most insect and rodent populations there is some degree of resistance to the commonly used pesticides. Continued dependence on chemicals for the control of pests will increase insecticide and rodenticide resistance in the pest population -- and may result in an uncontrollable increase in the pests. Future pest control programs must integrate chemical and nonchemical (sanitation, traps, preventive measures) methods into an ongoing program, under the direction of trained and properly equipped personnel, and with the objective of pest management.

Guidelines for designing a pest management program for seafood processing operations are as follows:

Program Orientation
Orient the program to the entire pest population, rather than to localized infestations. Individual pests - rats, cockroaches - should be interpreted as members of a large group or population that may occupy an entire building.

Design
Design a program for the entire processing operation, rather than for specific rooms or parts of the operation. Most insect and rodent pests are not limited to infesting one part of a building, but probably move throughout the building. Pest control in only one part may simply force the pests to an untreated portion, and reduce the effectiveness of the control effort.

Objectives
The objective of the program is to manage those pests that are present year round, and are present in large numbers. The objective is to decrease the level of abundance of these pests rather than eliminate or eradicate them.

For some pests and in some situations, elimination may be possible or even necessary. For example, rodents are serious health hazards to food processing operations, and it is necessary to eliminate them from all areas of the operation. Elimination of rodents and some other pests may be possible, perhaps after the pest population is reduced through pest management practices. However, it is more realistic to think in terms of a continuous or on-going pest management program, designed to keep pest populations low, than to work toward pest elimination and program conclusion. It is virtually impossible to eliminate or eradicate most pests from an environment favorable for them. Pest control programs must be on-going and continuously improved.

The concept of pest management involves dealing with pest populations that are interacting
with the total environment. Pest management requires the integration of sanitation, prevention, exclusion, mechanical control methods, and chemical pesticides into a program with the goal of significantly reducing (and possibly eliminating) a pest population.

C. **Pesticides**

1. **Insecticides**

Understanding both the way insecticides kill insects and the dangers of overexposure to humans is an important aspect of pest management programs.

   a) **Exposure** - At the present time, the most widely used organic insecticides are the organophosphates, carbamates, and pyrethroids. These and other pesticide chemicals may enter the body in a wet or dry state through the skin (dermal absorption), through breathing (respiratory absorption), and through the mouth (oral absorption). Dermal absorption is the most common route of exposure.

   Insecticides are absorbed at different rates on various areas of the body. Protective clothing should be worn to prevent skin absorption. Special care should be given to protect the scalp, ear canal, and forehead. The abdominal area and waistline should be protected to prevent chemical access to the scrotum area.

   Data have shown that most accidents occur during the mixing and loading operations. It is extremely important to wear protective clothing when concentrated chemicals are being handled, as well as during application.

   b) **How Insecticides Work** - The normal life of an insect depends on a vast number of complex chemical reactions (metabolic processes). Alteration of any of the metabolic processes will affect the insect. Some alterations result in sudden death, while others are less drastic. Different kinds of insecticides may alter metabolic processes in one or more ways; that is, they may have one or more modes of action. As an example, the organophosphate and carbamate insecticides, once inside the body, interfere primarily with the nervous system by inhibiting or depressing the enzyme cholinesterase. All living things with cholinesterase in the nervous system—such as insects, birds, animals, and humans—may be poisoned by these chemicals. However, in order to understand how these insecticides affect the nervous system, and thereby the symptoms and treatments of poisonings, it is necessary to see how the nervous system works.

   The nervous system—which includes the brain—is the most complex system in the body. It consists of millions of cells which make up a message or communication system throughout the body. The messages (or stimuli) travel along this network in the form of an electric impulse. Think of it as a spark!

   The nerve cells are “connected” at the synapse. The ends of the connecting nerve cells intertwine, but do not actually touch each other. Stimuli “spark” across the synapse in a chemical known as acetylcholine. After the stimulus is across the
synapse, the acetylcholine is broken down by cholinesterase. Then the cholinesterase breaks down and the synapse is back to "normal."

When a finger is stuck with a pin, the stimulus begins at the skin. The stimulus or spark travels down thousands of nerve fibers and across the synapses. Some of the stimuli go to the muscles to make you jerk back, while others go to the brain where they are interpreted as the feeling of pain. This example is extremely simplified, but it serves to illustrate the basic components and workings of the nervous system.

Organophosphate and carbamate insecticides each inhibit a type of cholinesterase, causing an accumulation of acetylcholine so that all stimuli or "sparks" continue to arc across the synapses, stimulating continuous muscle contractions or tremors. Thus, the nervous system is "poisoned."

2. Rodenticides

Rodenticides are pesticides used to control rodents such as rats, mice, and squirrels. They are normally employed in solid baits, in liquid forms, as dusts, or as volatile chemicals used as fumigants. The most effective rodenticides are those with a high toxicity and palatability, and with one or more safety features. Rodenticides used in solid baits or liquid forms can be divided into two groups based on the mode of action:

a) the acute rodenticides
b) the chronic rodenticides.

The acute rodenticides are those in which a lethal quantity of poison is ingested in a single dose with the food or drink of a rodent. They cause death by heart paralysis, by gastrointestinal and liver damage, or by attacking the central nervous system. The target animal must consume a lethal dose before the onset of poisoning symptoms. A sub-lethal dose may produce side effects that will make the rodent "bait shy." Pre-baiting is recommended before applying acute rodenticides so the animal will be conditioned to the bait. The non-poisonous bait is first presented to the rodents until they freely feed regularly and then it is replaced by bait containing the poison.

Chronic rodenticides bring about death of an animal only after the poisoned bait or liquid has been consumed on a number of occasions. Because the poison is consumed over a period of time, a low dosage is lethal. For example, a brown rat can survive a single 50 mg/kg dose, but succumbs to 5 consecutive doses of 1 mg/kg taken on successive days. The symptoms of the poison are so delayed that the animal never learns to associate discomfort with the bait consumption, and continues to feed until a lethal dose has been ingested. The main components possessing chronic poisoning action are the anti-coagulants, which interrupt the synthesis of blood-clotting factors so the poisoned animals die from internal bleeding. Chronic rodenticides are relatively nontoxic to domestic animals and man; however, there is no such thing as a "safe" rodenticide.
However toxic a chemical poison may be, it will not be lethal unless a rodent, of its own volition, consumes a lethal dose. Additives are sometimes included in the bait to improve performance. Attractants such as flavoring or oils are sometime added to bait to make it more appealing by enhancing the taste or masking disagreeable odors. Anticoagulants may be made more lethal by adding potentiating agents that accentuate the action of the anticoagulants. Preservatives and binders are used in baits to keep them from deteriorating over time. To guard against accidental consumption of the poisoned bait by nontarget animals, safety additives may be incorporated. Since rodents are unable to vomit, it is often the practice to incorporate an emetic agent in the bait. The emetic agent will induce vomiting and provide a safety factor for non-target animals.

Secondary poisoning to animals which feed on dead or dying rodents should be anticipated. The danger may be reduced by removing rodent carcasses whenever possible.

Acute or chronic poisons may be used in dust formulations. A poisoned dust is placed in the holes and burrows of rodents where it adheres to their feet and fur and is transferred to the mouth during normal cleaning and grooming activities. This method requires a high concentration of poison since the animal can be expected to consume only small amounts. The advantage of contact dusts is that rodents do not suspect the source of illness.

In situations where rodents do not respond to poisoned baits or dusts, a fumigation technique can be used. Rodents breathe the volatile substances and gases which cause death.

3. **Avicides**

Avicides are pesticides used to control birds in pest situations. Some common avicides include compound DRC 1339 and Avitrol. Most avicides are acute poisons which act on the central nervous system. The reaction time required to kill a bird varies with the type of poison. Strychnine used as an avicide will kill birds shortly after the bait is consumed while the avicide containing the compound DRC 1339 does not kill the birds for several hours, generally after they go to roost. This difference in mode of action is important in reducing the effects of secondary poisoning to animals that consume dead birds. Birds dying at the roost sites can be easily picked up and disposed of.

No avicide has been found that is specific for a given bird; thus, there is always a danger that non-target birds will be affected. A poison such as strychnine is lethal to all animals while DRC 1339 is more lethal to starlings and blackbirds, but will also kill smaller birds. Avitrol is an avicide used to control blackbirds. A bird ingesting avitrol reacts with distress symptoms and calls which frighten away the remainder of its flock from the feeding area with a minimum of mortality. The advantage of Avitrol is that only a few birds need to ingest the bait; thus a relatively small amount of bait needs to be put out.

D. **Pests Associated with Seafood Processing**

A variety of insects and other animals are attracted to seafood materials, processing equipment, and plants. Some of these animals can be serious pests in seafood processing
plants; others are only occasionally associated with these operations. The most common pests include insects (cockroaches, flies, flour beetles), rodents (rats, mice), and some birds.

Control of pests associated with seafood processing requires a thorough knowledge of their biology, habits, and seasonal occurrence. Chemical or non-chemical methods can be more effective when the applicator knows the target pest.

E. Insects

Insects are the most common and probably the most difficult pests to control in seafood processing operations. Control strategies depend on the life history and habits of the individual pest, and on the chemicals registered for use against that pest. Some insects, such as house flies, fruit flies, and crickets are seasonal pests; they usually breed outside the processing plant, and are most common in late summer (August, September). Cockroaches and flour beetles are year-round pests, but may be more numerous at certain times of the year.

Information on the biology, habits and certain aspects of control of common and occasional insect pests is presented below.

1. Cockroaches

The most common and most important pests of food-processing plants are cockroaches. Most common because they occur around the world—in every plant, in every food industry; most important because they can carry and spread numerous disease organisms. Cockroaches are known to carry four strains of poliomyelitis, more than 40 different pathogenic bacteria, and the eggs of several pathogenic worms. It has been estimated that a single cockroach can carry a total of 13,470 bacteria.

Female cockroaches do not lay eggs one at a time; instead they produce small egg cases that contain from 6 to 40 eggs. This egg case is deposited in a hiding place with adequate food and water. Young cockroaches begin feeding soon after they hatch from the egg case. They feed on the same materials as the adults, and look like adults except for size and absence of wings. After shedding their skin several times to grow larger, they become winged adults. Adult cockroaches live for a few months to over a year, depending on the species. They mate several times, and the females generally produce one egg case per month.

The mouthparts of cockroaches are the biting-and-chewing type. These insects can feed on a variety of foods, but they prefer starchy and sugary material. They will sip milk, nibble at cheese, meats, pastry, flour, meal, grease, chocolate, and other foods. They can feed just as freely on book binding, shoe lining, dead insects, other cockroaches, and human waste. They usually feed at night when they are not likely to be disturbed by human activities.
a) German Cockroach - This is the most common and widespread cockroach in food processing plants—around the world. It is a small insect, about 3/4" long, and is yellowish brown with two dark-brown stripes behind the head. Both male and female have well-developed wings.

The female carries the egg case protruding from the tip of the abdomen until hatching time. The egg cases are hidden in areas with abundant food, water, and hiding places. The adult female may live for about 9 months and produce about 140 young.

In seafood processing plants, German cockroaches will infest the main food preparation (ground level) and storage areas, as well as offices, clothing lockers, and restrooms. They are not usually found in storage areas below ground level.

b) American Cockroach - This is the largest cockroach in the United States; adults may reach at length of 2 inches. Adult cockroaches are brown, and the young are pale brown.

The female American cockroach hides her egg cases as soon as they are produced. The adult female may live for 12 to 18 months and produce as many as 33 egg cases.

American cockroaches usually inhabit basements, storage rooms, garbage areas, and sewers. These places are slightly cooler than the habitats of the German cockroach, and the cracks and crevices to hide in are larger.

In seafood processing plants the American cockroach usually infests large storage areas (below ground level), loading docks, and basements. This cockroach is frequently associated with door trash bins and storage areas. Adults may move into the building from these areas at night.

c) Oriental Cockroach - This pest is about 1” long, dark brown to black; the wings are very short in the male and absent in the female. The young are pale brown.

The female hides the egg case soon after it is formed. Each female can produce one egg case per month for the 5-6 months of her life.

The preferred habitat of the oriental cockroach is similar to that of the American cockroach. They usually inhabit areas below ground level, such as basements, storage areas, sewers. In seafood processing plants they are common in below-ground storage areas.

d) Cockroach Control - Cockroaches are a year-round pest in all food processing plants. Therefore, control of these pests has to be a year-round project, and it has to be in the form of sanitation and the use of chemicals.
The first step and most important aspect of control is sanitation. Recognizing that cockroaches require food, water, and a hiding place, and then moving against these areas with an ongoing sanitation program, is the foundation of cockroach control. Chemical control has to follow sanitation; it cannot be used alone or in place of it.

2. **Flies**

The most common of the seasonal pests of seafood processing plants are flies. A variety of flies are associated with these plants, but the most common are the house fly and the fruit fly.

**a) House Fly** - This insect is found all over the world. It is a pest to all segments of society, from households to industry. Like cockroaches, house flies can spread pathogenic organisms to humans and their food. It has been estimated that a single fly can carry 3,680,000 bacteria. The pathogenic organisms are collected on the feet and mouthparts when the fly visits garbage, and some of the organisms are taken into the gut. The organisms are deposited when the fly crawls on human food or are deposited in the fly’s excrement.

The house fly passes through three stages on its way to becoming an adult. From 75 to 150 eggs are deposited at one time, and there are several such layoffs at intervals of 3 or 4 days. Under warm summer temperatures, the egg requires 8-12 hours to hatch. The maggot that hatches from the egg begins feeding and gnawing. The maggot stage lasts about 5 days. When full-grown, the maggot changes to the pupa stage. This is a resting stage, and lasts about 4 days. The adult fly comes out of the small seed-like pupa stage - and the cycle starts all over.

The maggot stage in the fly’s life does most of the feedings; the adult simply takes in a little fluid for quick energy. The adults may be attracted to rotting garbage by the smell and also by a desire to lay eggs. They are attracted to window screens and picnics for the same reason - the smell of food. The danger comes when flies move from garbage or manure to human food.

House flies are more abundant in the late summer and fall because the population has been building during the warm summer months. The adults enter buildings in search of food and shelter from the cool nights. Once inside they seldom leave.

House Fly Control - Since house flies are probably breeding away from the plant site, and flying to the site, there is little hope of controlling the size of the fly population outside the plant. Control must be aimed at 1) preventing entrance to the plant and 2) reducing the number inside the plant.

Most food processing plants use air screens and appropriate doors. These are excellent mechanical controls for flies, if they are strong enough. The stronger the better.
Control inside the plant can be achieved with electric grids. These work by attracting the adult flies to a special blue light and killing them with an electrical shock. These traps should be run day and night, and the catch basin should be cleaned out every day.

b) Fruit Flies - These tiny flies are also seasonal pests. They are abundant in the late summer and fall. The adults are small (about \( \frac{1}{10} \)" long), with light brown bodies and red eyes. The adults are attracted to fruit, especially rotting fruit. Since they are not attracted to sewage or animal waste, the amount of pathogenic bacteria they carry is probably limited.

The life cycle and feeding habits of fruit flies are similar to those of house flies. In the late summer there is an abundance of rotting plants and fruit, thus allowing the fruit fly population to increase rapidly. The adult flies live about a month.

Fruit Fly Control - Complete control of these pests-as for most insect pests-is nearly impossible. Air curtains and electric traps may be somewhat effective. Removal of all attractive material (rotting fruit, fermenting foods) around the building will help.

3. Flour Moths

The flour moths are among the most common insect pests of grain products. They are called flour moths because they prefer milled cereal products such as flour and meal; they seldom attack sound kernels of grain.

Flour moths and other insect pests of grain products are present throughout the flour manufacturing and distribution scheme. These pests can be found at the mill, in warehouses, in delivery trucks, and at their final destination. Therefore, these insects are likely to be a constant problem and will need constant attention.

Female moths lay eggs singly or in small groups, not in egg cases like cockroaches. Caterpillars hatch from the eggs and feed on the foodstuff. The caterpillars grow and shed their skin several times before they are fully grown. The caterpillar spins a silken cocoon and transforms into a pupa, from which the adult develops and later emerges. Males and females live for a short time; the females die soon after the eggs are laid.

The infestation and damage to the flour is done by the caterpillar stage. Adult moths do not feed; they return to the flour only to lay eggs.

Indian Meal Moth
This medium-sized moth has a wing expanse of about three-fourths inch. The adult moth is easily distinguished from other grain pests by the color bands on the large, front wings. The outer two-thirds of the wings are reddish brown; the region behind the head is gray.
Female moths can lay from 100 to 300 eggs, singly or in groups, on food material. The eggs hatch in about three days. The caterpillars feed upon grain products, dried fruits, nuts, and a wide variety of foodstuffs.

When full grown, the Indian meal moth caterpillar is about half an inch long and is grayish white, sometimes varying to greenish and pinkish colors. The caterpillar spins a web as it becomes fully grown and leaves a silken thread behind wherever it crawls. This webbing is often dense enough to attract attention when sacks of flour or meal have become heavily infested.

During warm weather, the Indian meal moth may pass through the egg, larval, and pupal stages in 6-8 weeks.

**Mediterranean Flour Moth**

This small moth has a wingspread of about 1 inch. Its large front wings are gray with wavy black markings.

The female moth lays small white eggs in accumulations of flour and meal, on which the hatched catapillars feed. The full-grown caterpillar spins a silken cocoon, in which it transforms into a reddish-brown pupa.

During warm weather, the Mediterranean flour moth requires 8-9 weeks to pass through the egg, larval, and pupal stages.

4. **Flour Beetles**

Such a great number of beetles infest stores of flour that listing them all or providing life history data is not practical. Three of the most common species are presented here; the other species have similar habits and life histories.

Flour beetles are often present throughout the manufacturing and distribution process. Like flour moths they can be a pest at the mill and in the food-processing operation, and require constant attention.

Female beetles lay eggs singly in the flour. The larva or “grub” that hatches from the egg will feed on the foodstuff. The grub stage may last 14-16 months. The full-grown grub builds a cocoon out of scraps of the food material and transforms to a pupa. Male and female beetles often live for several months to a year.

The infestation and damage to the flour is done by the adult and grub stages. Adults and grubs have chewing mouthparts.

**Sawtoothed Grain Beetle** - This small, brown beetle is probably the most common flour pest. It is slender, about one-tenth inch long, with six sawtooth projects on each side of the thorax.
Adult beetles usually live 6-10 months, but some may live as long as 3 years. The female lays 43-285 eggs loosely in the flour and meal. The eggs hatch in about 4 days and the grub begins feeding. The adult and grub stages feed on all food of plant origin, especially grain products such as flours, meals, nut meats, candies, and dried fruits.

Red Flour Beetle and Confused Flour Beetle - These small, shiny, reddish-brown beetles are about one-seventh inch long. They are distributed over the world and are very abundant in the United States. They are general feeders on grain products, and are the most abundant and injurious insect pests of flour mills in the United States.

The average life of the adults is about 1 year. The female lays an average of 450 eggs loosely in flour or food material in which the adults live. The eggs hatch in 5-12 days and small worm-like grubs emerge. The grub stage feeds on flour or other food material made from grain.

When fully grown, the larvae transform into pupae; they do not construct a cocoon. Shortly afterwards they transform to adults. In summer, the period from egg to adult is about 6 weeks. The life cycle is prolonged by cold weather, as is true of all grain pests.

Cigarette Beetle
As its name implies, the cigarette beetle is primarily a pest of dried tobacco either in the stored, bundled form or in cigars and cigarettes. But they can feed on a variety of stored products including cereal products, ginger, raisins, dates, pepper, and dried fish.

The adult beetles are oval, about one-tenth of an inch long, and are covered with small hairs which give them a silky, yellowish-brown color. The female produces about 100 eggs, which are deposited on or near the adult beetles. The larvae are creamy white except for the yellow head and brown mouthparts. They become fully grown in about 40 days. The entire life cycle can be completed in 45-50 days, and there may be 3-6 generations a year.

5. Casual Invaders

There are several other insects and arthropods that occasionally invade food-processing operations. They represent no threat or potential infestation, but may cause concern.

a) Silverfish
These insects are often found in food processing operations, but are not a serious or potentially harmful pest. These insects prefer vegetable matter with a high carbohydrate and protein content. However, indoors they will feed on flour, starch, paper, glue, sugar, molds, and dried fish. They can go for up to 1 year without food, so sanitation alone will not eliminate an infestation, although it may prevent new ones from starting.
b) **Ground Beetles**
These blackish-brown beetles are common in late summer and fall. The adults are good fliers, and will come to lights at night. The larval stages live outdoors.

c) **Sowbugs**
These small relatives of the crawfish are usually found in dark, moist environments. They feed on vegetation, and will not infest buildings unless there is a moisture problem.

d) **Centipedes**
These fast-moving, predacious animals are usually not seen in numbers. They feed on insects and spiders inside and outside buildings. Control is rarely recommended for these animals.

e) **Ants**
Only a few ants build their nests inside buildings. Most have their nests outside in the soil and invade buildings looking for food. Control must be directed at the point of entry, outside the building.

f) **Crickets**
These insects are most common in late summer and fall, when the population is composed of adults. They are good fliers, are attracted to lights at night, and will seek a warm location on cool fall nights.

g) **Spiders**
Spiders are usually pests in the spring and fall. They are abundant in the spring when males and females are mating, and in the fall when some seek shelter from the cool weather. It may be very difficult to eliminate this problem, but there is some relief in knowing that spiders are beneficial animals-feeding on insects and other spiders.

The black widow and brown recluse spider are the only poisonous species in the eastern United States.

6. **Rodents**

a) **Mice**
Mice can cause a great deal of damage to processing plant materials. Because of their habit of nibbling, they contaminate much of the material not actually destroyed. A knowledge of mouse habits is important in developing effective control programs. Each male mouse stakes out a territory around his nest. He may not travel more than ten feet from his nest if food is close. For this reason, baits should be placed 10-20 feet apart. Mice are not suspicious of new foods and eagerly sample them. Mice also investigate any new object in their territory, so that changing bait or trap placements will improve control.
b) **Rats**

Rats are serious pests because they contaminate and destroy food products, carry diseases and external parasites, and often bite people. A knowledge of rat behavior is essential to successful control.

Rats which have become conditioned to eating a particular food approach new food cautiously. If it tastes bad or makes them sick, they won’t eat it again (bait shyness). When baiting, more effective control can be obtained by using a bait that is fresh and identical to the food the rats are using. If different food is used, it may be necessary to pre-bait a few nights before adding a toxicant to the bait. Rats also require free water to drink. If water sources can be eliminated, liquid baits are effective. Rats, especially males, establish “territories” and fight to preserve this area from strange males. Reducing or eliminating of food sources and harborage increases this competition, and the rat population decreases. Rats also prefer to run next to walls or other surfaces; therefore, traps and baits should be placed in these runways.

The first part of any good rat control program consists of determining just where the rats are living, feeding, and traveling, and the extent of the infestation. Once this has been done, it is essential to eliminate their shelter areas and their food and water supplies. These sanitation measures are the backbone of successful control. However, in many instances, it may be best to poison or trap before upsetting the environment so that the rats do not scatter. It is also necessary to close off all entrances and exits rats can use to come and go from buildings. This is called rat-proofing, and must be done in many instances to obtain adequate control.

7. **Pest Birds**

There are many species of birds in the United States, but only three are normally considered pests around food manufacturing plants. All three cause problems in cities. All three survive well in close association with man. They are objectionable primarily because their droppings can be a serious food contaminant. They may also spread disease. Their droppings deface buildings, and their nests plug gutters and cause roofs to leak. Their noise and odor are offensive to many people. They sometimes also carry mites which can bite people.

a) **English Sparrows (House Sparrow)**

These birds are grayish, 3-4 inches long. The male has a prominent black throat, and a small black conical beak. The voice is a non-musical chirp. The egg is creamy white.

The nest is made of loosely-woven grasses, paper, and string. Sparrows prefer openings or hollows for nesting and will use any sort of nesting box, cavity, or opening in buildings.

They produce several broods each year using the same nesting areas over and over.
b) Pigeons
 These birds are 6-10 inches long and vary in colors. They have a fan-shaped tail
during take-off and landing, and the head bobs when walking. Their voice is a long,
soft coo-oo-o. The eggs are white. They prefer to live and roost on roofs and high
ledges.

The nest on ledges is not woven, but made with twigs and often soiled with
excrement.

c) Starlings
 The body and wings are gold-flecked, iridescent blue-black. They have large
speckled bills that are yellow or olive.

In flight, they can be recognized by their short square tails and their short triangular
wings. The eggs are bluish green.

Control - Shooting may be hazardous in some locations and may not be allowed by
some local ordinances. It is a very effective means of killing scattered individuals
or small flocks. It is best carried out by no more than a few individuals with low-
powered guns who understand what they are doing. Where permissible, shooting
with a 22-calibre gun, using # 12 birdshot, is effective.

Chemical control with avicides or other pesticides in certain situations may be the
only means of effective control. Pesticides may not be used in a manner
inconsistent with the label. Decisions as to the need, type of toxicant used, and
manner in which it is used should be made by professionals. Information on current
registered uses of specific compounds is available from the manufacturer or retailer.
Sources of up-to-date pesticide recommendations include: industry representatives:
the Cooperative Extension Service; local health, environmental, and agricultural
departments; and technical experts in universities and state and federal agencies.

Poisons may be prohibited or may be too risky to use because of the dangers to
humans, pets, or desirable birds. Poison sprays on roosts may be effective but
dangerous; label directions must be followed precisely.

Toxicant baits, when eaten by pigeons, starlings, or sparrows, produce distress
reactions in some birds, which frighten the rest of the flock away from the area.

Prebaiting is necessary when chemical baits are used, just as when trapping is to be
done.

Chemical baits are most effective when used against small flocks and when
conditions can be carefully controlled.
Associated Problems - Dry, dusty droppings may contain fungus spores that can cause human diseases. Workers cleaning such areas, or involved in hand-capture of birds, should wear approved respirators. A worker should not smoke, eat, or drink anything until after his dusty clothes are removed and he has washed thoroughly.

Ectoparasites such as mites, made homeless when pigeons are removed, may migrate into areas where humans work and live. This problem can be prevented by spraying or dusting nesting or roosting areas as part of the control operations. Any good acaricide can be used if the label directions are followed.

8. Rodents and Their Control

Domestic rodents constitute a major food industry pest problem. There are three major domestic rodents in the United States, the house mouse, Mus musculus; the Norway (brown or sewer) rat, Rattus norvegicus and the roof (black or ship) rat, Rattus rattus. Rats eat almost everything people or livestock use as food. They contaminate much more than they eat, with the result that contaminated food products must be destroyed. Damaged packages must be repaired or replaced. Before you can control rodents, it is important you identify the correct species and know its behavior patterns.

9. Rodent Control Procedures

Complete control of rats and mice is essential to every food and feed processing plant and storage facility and must be accomplished to satisfy legal requirements, prevent losses, and meet individual company operating standards. While the degree of emphasis on any single phase of rodent control varies with the building structure, location, and species of rodent involved, an effective control program must start by building rodents out.

Exclude rodents from plants and warehouses by having every possible opening in outer walls, at floor/wall junctions, and at all exterior doors tight enough to prevent rodent entry, and by installing guards across runways to prevent entry at loading doors. There should be no openings larger than 1/4 inch.

Good housekeeping and proper storage practices discourage rodents by eliminating their food and harborage. It is important to maintain a clearance of 18 inches between pallets of merchandise and the wall. This clearance allows room behind the stock for proper cleaning and pest control. A stock rotation system, utilizing the first in - first out method, is a necessity in all sound warehousing programs.

After every practical measure to build rodents out, and to eliminate their food and harborage has been taken, these preventive controls can be supplemented with baiting and trapping. In most cases, only those rodenticides falling within the anticoagulant group can be used in specific areas of food-processing facilities. These are available in several forms, such as granular, cereal-based bait, paraffinized bait pellets, and bait blocks. Paraffinized bait pellets and bait blocks should be limited to granular or cereal-based materials.
Unless there is a possibility of rat entry into a plant, liquid baits will be ineffective, since rodents require little water and they can live for many months on a grain diet, obtaining sufficient moisture from their food. The toxic ingredient in all of these baits is one of several anticoagulants, so named because they inhibit the normal coagulation of blood. The use of colored dyes for rodent baits helps prevent accidental human consumption through mistaken identity. Those cereal baits dyed with alkali-fast green appear to have the greatest rodent acceptance.

Proper placement of bait stations is very important. It is necessary to place bait stations around the exterior boundaries of food plants because the purpose in exterior perimeter baiting is to attract and eliminate rodents before they can invade the building. On the outside, bait stations should be positioned approximately every 50-100 feet around the perimeter of the building, which has been cleared of all vegetative matter and trash. Also the perimeter of the property line should be included in the baiting program. Again, the bait stations should be positioned approximately every 50-100 feet around the perimeter.

Bait stations being used around the exterior of the building should be large enough to accommodate more than one rat at a time. Each station should have at least two openings approximately 2 1/2 inches in diameter. The bait stations for exterior use may be constructed of metal or wood, so as to protect the bait from the weather and from disturbance by nontarget animals and children.

If bait stations are used inside plants, they need to be limited to non-food storage areas. Two inexpensive materials for bait stations, which can be used in non-food storage areas, are water-resistant cardboard and formed plastic. Bait stations should be placed against walls and the adjacent areas kept clean.

When handling any baits, do not smoke, eat, drink, or put your hands near your mouth. After handling baits, wash your hands, using soap and water. As a safety factor, it is suggested that only ready-mixed baits be used.

All rodenticides received and used must be properly labeled. Labels contain directions of safe use, caution statement, and first aid and medical instructions. It is important that you read the label, understand label instructions, and follow label instructions during use. All bait stations and bait handling containers must also be properly labeled.

Store unused rodenticides in a locked area with access restricted to authorized personnel. The locations of all bait stations should be noted so that inspections can be made rapidly and the bait that has been consumed can be quickly replaced. At each inspection, smooth the surface of the granular baits so that new signs of feeding will show readily. Also, examine bait blocks for signs of rodent gnawing. Replace moldy, wet, caked, or insect-infested baits with fresh ones.

Records should be maintained indicating where baits have been disturbed, dead rodents found, droppings or tracks observed, or rodents have been caught in traps.
Some rats prefer burrows for nesting and harboring. Burrows are found in earthbanks, in grassy areas, around weeds, under trash, around concrete slabs and railroad tracks, and in similar secluded places.

Reliance entirely upon bait stations for rodent control will not produce the desired results. It is necessary to kill rodents quickly upon entry into a building and, therefore, trapping must be used. The most popular, least expensive, and probably the most effective trap is the wooden 4-way snap trap. An enlarged trigger can be fitted into the wooden trap by inserting a piece of cardboard on the tripping device. This provides a treadle, covering nearly half the trap, which is easily sprung by a rodent traveling from any angle. Different size traps are used to catch mice and rats. To be effective, traps must be placed along walls or other runways with the trigger end abutted to the passage. An ample number of traps should be placed in each area requiring preventive control.

Be sure that the trap is properly set and in place.

Overhead beams, trusses, and ceiling wall junctions should not be overlooked as potential runways. Traps should be set across any obvious runways in overhead areas. On vertical structures, traps can be glued or otherwise fastened across runways.

When a rodent is suspected of being in a particular area, whether inside or out, lightly smooth a dusty material, such as talcum powder, around the suspected area. If rodents are present, you can observe their tracks in the dust. Then cover all possible avenues of escape with traps. Traps can be placed either unbaited or baited. When baiting traps, a variety of baits can be used, such as gum drops, peanut butter, bacon, or a piece of hot dog or cheese. The proper method of applying bait to traps is to pace a small amount on the trigger. Too much bait could prevent the trigger from activating properly, plus it looks messy.

Where a variety of food is plentiful, it is often just as effective to use traps without bait on them. The key is to place the trap properly so it is tripped by the rodent as it travels the wall/floor. All traps should be checked at least 3 times a week to be sure they are properly set and that dead rodents have been removed.

In order to indicate locations where traps are to be placed, a marking can be painted about the trap.

The automatic Ketch-All trap is especially good in wet areas and where other mouse traps are frequently tripped accidentally. A Ketch-All is a spring-powered box-type trap capable of catching up to 10 or more mice in one setting. These traps must be properly positioned against the wall. The easiest method of disposing of mice caught in a Ketch-All trap is to dunk the entire trap into a bucket of water to drown the mice. The mice can then be disposed in a covered waste container.
Remember the three fundamentals for effective rodent control:

a) build them out.
b) good housekeeping and proper storage.
c) trapping and baiting.

10. **Mouse and Rat Facts**

Preventing rodents from entering buildings requires some knowledge of their biology and behavior. The following list of facts will help provide basic information on rats and mice.

A mouse can squeeze through a 1/4" wide crack under or beside a door. A rat needs 1/2" wide crack to get in.

Mice live successfully outside or inside buildings. They can live in trash, grass, even in a small hole in the soil. Mice do not construct long, wandering burrow systems as rats do.

A mouse needs only a 3" x 1" hole for a home. A stable, protected place available for only a few days will induce a mouse to build a nest. Rats require a larger, more protected place, stable for several days before nest building.

Mice are very inquisitive. The average mouse takes only 10 minutes to investigate a new feeder. Rats will wait about 30 hours to explore a new food source.

A house mouse will eat at 2 or 3 locations, and just nose around 20 others in a 2-hour period (9:00 p.m. - 11:00 p.m.) in one night. The next night it will completely change the feeding locations, but still nose around those visited the first night. Rats will eat at the same location night after night.

A mouse may not seek out water in a dry location, but it will drink if water is available.

Mice are “stay-at-homes” compared to rats. Home territory is about 15 ft. to 30 ft. from an established nest. A rat has a home territory of 150 ft., but may travel 1/2 mile from its nest site.

Mice can travel in some rail car and truck shipments, particularly in wrapped pallets. Rats have rarely been received in shipments of merchandise.
## Characteristics of Domestic Rodents

<table>
<thead>
<tr>
<th></th>
<th>Norway Rat</th>
<th>Roof Rat</th>
<th>House Mouse</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td>10 - 17 oz.</td>
<td>8 - 12 oz.</td>
<td>1/2 - 3/4 oz.</td>
</tr>
<tr>
<td><strong>Total Length, nose to tip of tail</strong></td>
<td>12 3/4 - 18 in.</td>
<td>13 3/4 - 17 3/4 in.</td>
<td>6 - 7 1/2 in.</td>
</tr>
<tr>
<td><strong>Head and Body</strong></td>
<td>Blunt muzzle</td>
<td>Pointed muzzle</td>
<td>Small</td>
</tr>
<tr>
<td></td>
<td>Heavy, thick body</td>
<td>Slender Body</td>
<td>2 1/2 - 3 1/2 in.</td>
</tr>
<tr>
<td></td>
<td>7 - 10 in.</td>
<td>6 1/2 - 8 in.</td>
<td></td>
</tr>
<tr>
<td><strong>Tail</strong></td>
<td>Shorter than head plus body</td>
<td>Longer than head plus body</td>
<td>Equal to or a little longer than body plus head</td>
</tr>
<tr>
<td></td>
<td>Carried with less movement, comparatively, than roof rat. Lighter colored on underside</td>
<td>Uniform coloring top and bottom at all ages and for all subspecies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>6 - 8 1/2 in.</td>
<td>7 1/2 - 10 in.</td>
<td>3 - 4 in.</td>
</tr>
<tr>
<td><strong>Ears</strong></td>
<td>Small, close-set</td>
<td>Half buried in fur, Large for size of animal</td>
<td>Large, prominent, stand out from head</td>
</tr>
<tr>
<td></td>
<td>Appear prominent</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Fur</strong></td>
<td>Coarse, generally red-brown to gray-brown</td>
<td>Black to slate gray; tawny above, gray-white below; or tawny above, white to lemon belly</td>
<td>Silky, dusky gray or gray</td>
</tr>
</tbody>
</table>
The four incisor teeth of rats and mice are as hard as steel. These animals can chew through asphalt, most plastics, plaster, sheet aluminum, wood, etc.

Building materials which will resist the “cutting” attack of rats and mice are: concrete block, brick or tile, 26 gauge or thicker galvanized sheet steel, 1/4" glass, 1/4" mesh, 19-gauge steel wire mesh or hardware cloth, 1/4" 26 gauge perforated metal.

11. Physical Control

There are four goals for an effective physical control program for rodents:

a) stable nesting sites inside and outside the building must be eliminated;

b) all access holes must be closed;

c) traps, glue boards, bait stations, and all other safe control measures must be used inside and out to control rodents; and

d) a reliable inspection program must be established to prevent rodents from being introduced in delivered merchandise.

A good physical control program would include the following control measures:

a) Fill all potential nesting holes inside the building.

b) Eliminate all entry or nesting holes on the exterior of the building walls by closing holes down to an 1/8" gap under doors; filling holes around pipes, electrical service through walls, vents, and cover drains.

c) Remove weeds and grass around outside of building.

d) Clean up spilled food as soon as possible.

e) Use multi-catch mouse traps inside and outside every entrance leading into the building. They catch mice and small rats outside more easily than inside.

f) Use trigger mouse traps where a severe problem exists and manpower is available for twice daily inspection.

g) The careful and correct use of ultrasonic devices can be very helpful.
12. Equipment

Pest control personnel cannot carry out an effective program without quality equipment and chemicals. The most important pieces of equipment include:

a) stainless steel, compressed air sprayer
b) mechanical or thermal fogging device (ULV/ULD)
c) bulb duster,
d) flashlight.

Two especially useful items of equipment are air screens (or air curtains) and insect electrocuting units.

The proper use and maintenance of pest control equipment is an important part of any program.

1. Compressed Air Sprayer

The one-gallon sprayer is the most important tool for insect control. A stainless-steel sprayer with a multiple-spray nozzle can apply insecticides safely and accurately to insect harborage. Routine maintenance to keep this piece of equipment in proper working order will insure the safe and accurate placement of chemicals in a seafood plant.

2. Fogging Devices

Mechanical fogging devices are relatively simple to operate and require little maintenance. The aerosol particles are produced by spinning discs and rotors. In some of the units these discs and rotors need periodic adjustment to keep the size of the droplets small. If they are out of adjustment, the droplet size in the fog will be large and the fog will not travel into cracks and crevices to reach insects.

Examine the pesticide tank for residues, and clean tank regularly to prevent clogging. Check the hose to the pesticide tank for dirt, and clean regularly.

3. Bulb Duster

Small bulb dusters can be effective tools for applying insecticide powder into small cracks and crevices. When used properly, these small (4 to 8 oz.) hand-operated dusters can apply a thin layer of dust to insect harborage. Clumps of powder or thick layers of dust should be avoided. A small pebble or bearing in the bulb will aid in breaking up clumps of powder, and will agitate the contents of the duster, thus making it easier to apply a fine layer of dust.
4. Insect Electrocuting Units

Most insects are attracted to light. Flies in a dark room will move toward a window. Moths and other insects will fly to lights at night, and even some cockroaches will fly to lights. Insects are attracted to both visible light and ultraviolet (black) light (light just beyond the violet end of the visible spectrum). Some flies and moths are strongly attracted to ultraviolet light, and this attraction can be used against them in a control device - an electrocuting unit.

Electrocuting units are designed for either indoor or outdoor use. They are usually of aluminized frame construction, with chrome-plated electrical grids and guards, and removable insect-catch traps. Units are available in a variety of sizes and shapes, and are designed to hang from the ceiling, attach to a wall, or stand free. The attractant lamps are usually 40 or 80 watt.

How the units work-Insects attracted to ultraviolet (black) light are lured to the electrocuting unit through the strong attraction of the 40 or 80 watt bulb. In flying toward the light, the insects contact the electric grid in front of the bulb. When contact is made, night and day-flying insects-such as house flies, fruit flies, moths-are electrocuted by the grid charged with high voltage (about 4000V) and low current (9 milliamps). This charge is harmless to humans should the units be accidentally touched.

Range
The attractant range of electrocuting units is difficult to measure. Each insect species has a different eye structure with a different range of visual activity, ranging from 2 feet to 90 feet. Effective results with an electrocuting unit depend on the visual range of the insect, and the power factor of the attractant bulb. A 40 to 80 watt bulb-will usually perform 3 to 10 times more effectively than a 15 to 40 watt bulb.

Placement
Correct placement is a key factor in the degree of control achieved with electrocuting units. The units should be placed so as to attract and/or intercept the target pests. Moths and other night-flying insects are best controlled with ceiling-mounted units, while house flies are more likely to be intercepted from floor level up to a four to five foot height. Because sunlight or other strong light sources, as well as air currents, affect insect behavior, and flight patterns, units should be placed out of drafts and away from strong light.

5. Air Screens

Air screens (or air curtains) are the most effective method of keeping flies and other flying insects out of food preparation areas. Air screens create an invisible barrier of high velocity air to stop insects from infiltrating food facilities and other clean work areas. To assure maximum efficiency in repelling insects, select a model that fits the door size and can provide adequate air velocity at ground level as well
as at the nozzle. Flies may be prevented from entering a doorway at the doorknob level, but walk easily through the door at ground level. To be effective, air screens must be installed on the outside of the doorway, be aimed properly to repel insects, and have adequate velocity at the top and bottom of the doorway. Conventional fans mounted above doors do not provide effective air screens.

13. Calculations and Mixing

Directions for mixing pesticides are always given on the pesticide label. Always read the directions before mixing; do not rely on old labels or directions-labels and mixing directions are frequently updated. When mixing a pesticide to spray, it is most important to add the correct amount of chemical to the water. Too little may result in a poor control job, while too much chemical may result in illegal residues, exposure to non-target animals, or unnecessary expense. Read the label and follow the directions to achieve effective control and safe use.

Sometimes it is necessary to prepare large quantities of a pesticide, and the calculations may not be explained on the label. The calculations necessary for large quantities are relatively simple; some examples are presented below.

a) Calculations

Sometimes you will find directions on how to make a finished spray of a specific percentage, for instance a 1% spray for cockroaches. The pesticide may be formulated as a 57% emulsifiable concentrate (EC). To make a 1% finished spray you would add 1 part of pesticide to 56 parts of water. For example, for 1 fluid ounce you would add 56 fluid ounces (1 3/4 quarts) of water.

When mixing percentages you should remember that 1 gallon of water weighs about 8.3 pounds. Thus, to make a 1% mix of pesticide in 100 gallons of water you must add 8.3 pounds of active ingredient (actual pesticide) of pesticide to 100 gallons of water.

Formula for wettable powder percentage mixing: to figure the amount of wettable powder (WP) to add to get a given percentage of active ingredient in the tank:

\[
\text{(gallons of spray wanted) x (% pesticide wanted) x 8.3 (lbs/gal)}
\]

\[
\text{(% active ingredient in pesticide used)}
\]

Formula for emulsifiable concentrate percentage mixing: to figure the amount of emulsifiable concentrate (EC) to add to get a given percentage of active ingredient (actual pesticide) in the tank:
(gallons of spray wanted) x (% of pesticide wanted) x 8.3 lbs/gal
(pounds of active ingredient per gallon of concentrate) x 100

Useful Facts to Remember:

- 1 gallon of water weighs about 8.3 pounds
- 1 pound = 16 ounces = 453.6 grams
- 1 pint = 16 fluid ounces = 473 milliliters
- 1 quart = 32 fluid ounces = 946 milliliters

b) Mixing

Most modern pesticides are designed to be mixed with water, then applied to control specific pests. Mixing wettable powders and emulsifiable concentrates requires careful attention to some simple rules:

- fill spray can or container to 1/2 with water,
- add the measured amount of pesticide,
- add the remainder of water to the full mark.

14. Pesticide Application Methods

Before undertaking insect control with an insecticide near food processing, it is essential to recognize that EPA has established some definitions to assist in the regulation and control of insecticides in food-handling establishments. The definitions they use are as follows:

a) Food is defined by Section 201 (f) of the Federal Food, Drug and Cosmetic Act to mean (1) articles used for food or drink of man and animals, (2) chewing gum, and (3) articles used for components of any such article.

b) A Food Handling Establishment is an area or place other than a private residence in which food is held, processed, prepared, and/or served.

1) Non-Food Areas of food-handling establishments include garbage rooms, lavatories, floor drains (to sewers), entrances and vestibules, offices, locker rooms, machine rooms, boiler rooms, garages, mop closets, and storage areas (after food has been packed, canned, or bottled).

2) Food Areas of food-handling establishments include areas of receiving, serving, storage (dry, cold, frozen, raw), packaging (canning, bottling, wrapping, boxing), preparing (cleaning, slicing, cooking, grinding), edible waste storage, and closed processing systems.
c) Non-Residual Insecticides are those products applied to obtain insecticidal effects only during the time of treatment, and applied either as space treatments or contact treatments.

1) Space Treatment is the dispersal of insecticides into the air by foggers, misters, and aerosol devices for control of flying insects and exposed crawling insects.

2) Contact Treatment is the application of a wet spray for immediate effect.

d) Residual Insecticides are those products applied to obtain insecticidal effects lasting several hours or longer and are applied as general, spot, or crack and crevice treatment.

1) General Treatment is application to broad expanses of surface such as walls, floors, ceilings, or as outside treatment.

2) Spot Treatment is application to limited areas on which insects are likely to occur, but which will not be in contact with workers. These areas may be floors, walls, and bases or the outside of equipment. For this purpose, a “spot” will not exceed 2 square feet.

3) Crack and Crevice Treatment is application of small amounts of insecticides into cracks and crevices in which insects hide or through which they may enter the building. Such openings commonly occur in expansion joints, between different elements of construction, and between equipment and floors. These openings lead to voids such as hollow walls, equipment legs and bases, conduits, motor housing, and electrical junctions or switch boxes.

15. Application for Methods for Specific Pests

Cockroaches

These pests are associated with almost all aspects of seafood processing, and are present throughout the year. Cockroach control must be an ongoing program, and includes sanitation along with accurate placement of chemical insecticides.

Cockroaches require food, water, and a hiding place to successfully infest an area. Sanitation can eliminate some of the food and water, and therefore help to control cockroaches. Chemical insecticides applied to cockroach hiding places can be very effective in controlling cockroach infestations. Chemicals applied along baseboards, or as a general spray or fog are not effective in controlling cockroaches. Indeed, these “general applications” may promote infestations that are resistant to insecticides and difficult to kill. Chemicals should be placed where cockroaches hide (cracks and crevices, in equipment, behind sinks, etc.) so that they will be forced to come in contact with the insecticide that can kill them.
Chemicals applied to open spaces, exposed to air, light, and heat, can lose their potency in a short period of time. Cockroaches contacting these chemicals may not die because the residue is not potent enough. However, chemicals applied to cracks and crevices, where cockroaches hide, will remain potent longer, and contact more individual cockroaches.

The best application method for cockroach control is to use a compressed air sprayer with the nozzle set on pin stream or a nozzle equipped with a special plastic crack-and-crevice tip. Use the pin stream or the special tip to direct the chemical into suspected cockroach hiding places. Dust formulations can be effective if applied to dry areas where there is little or no air movement.

Some of the typical places to treat for cockroaches include:
   a) compressor area of refrigerators and freezers
   b) drip pan of a “frost free” refrigerator
   c) electrical boxes
   d) floor drains
   e) above drop ceilings
   f) boxes stored near food or water, especially near refrigerators
   g) employee locker room and lunch areas
   h) soft drink machines
   i) dishwashing machines

Periodically changing the chemical used for cockroach control is not recommended, unless the effectiveness of the chemical is decreasing. Cockroaches can become resistant to some chemicals when used over a long period of time (and used improperly). Changing chemicals every six months or year may result in resistance to several insecticides, and leave nothing that provides control. Continue to use one chemical; switch to another only when it fails to give control.

Flies
Several species of flies can be pests of seafood processing operations, including house flies, fruit flies, and cluster flies. These pests are a seasonal problem; the warm summer and fall weather provide excellent breeding conditions for the larvae. Rarely do house flies and fruit flies breed inside food processing operations. The adults present inside have come in through doors and windows. Fly control must include sanitation outside buildings, and the exclusion of adult flies. Chemical control of flies is limited to fogging or space sprays. Mechanical and electrical devices are effective.

There have been several improvements on the traditional “fly paper” strips for fly control. Devices that attract adult flies to a sticky surface are effective and have been approved for food-handling areas.

The placement of electrocuting devices can influence how effectively they control indoor flies. Consider these facts about house flies and black light (=looks blue) electrocuting units:
a) 3-day-old male house flies are most attracted to black lights.
b) 5- to 6-day-old male house flies are not attracted to black lights.
c) The older (in days) and the hungrier male and female flies, the more they are attracts to blacklights that are about 1 foot off the floor.

When positioning black-light electrocuting units, consider placing at least one unit 1 to 2 feet off the floor, and other units 6-8 feet off the floor. This arrangement should provide maximum coverage.

There are some chemical methods of controlling flies inside and outside seafood processing plants. Granular baits (commonly called “fly grits”) can be scattered around garbage and refuse areas. Adult flies are attracted to these baits and are killed. Some of these baits are effective even in damp or wet conditions, and some are not effective in wet areas. Chemical control inside buildings is usually limited to aerosol sprays, fogging, or ULV/ULD (Ultra Low Volume/Ultra Low Delivery) treatment. Each of these methods disperses chemicals into the air to kill various flying insects, including flies. The chemicals most commonly used include pyrethrins and resmethrin. In general, these chemicals provide quick knockdown and kill, but provide no residual control. Fogging and ULV/ULD treatment methods must be used only when production is stopped. All exposed surfaces must be cleaned before being again exposed to food or preparation materials.

**Flour beetles, mealworms, silverfish.** There are a variety of pests that must be treated on a need basis. Treatment with insecticides should follow a thorough inspection and clean up program. Flour beetles and mealworms do not move far from the site of infestation. The use of a heavy-duty vacuum cleaner can be very effective in controlling these pests. Direct the hose into cracks and crevices to pick up loose flour and other food particles. A strong vacuum will pick up infested food and insects.

Chemical control of these insects requires the use of a residual insecticide in cracks and crevices, and spot application. Apply the insecticide in an area where the insects are most often seen. Repeat application on a 10- to 15-day schedule.

16. **Commonly Used Insecticides and Rodenticides**

a) **Insecticides**

A variety of insecticides are registered for use in and around food processing operations. They differ in residual activity and in where (crack and crevice, food storage, food preparation areas) they can be applied.

**BAYGON (propoxur)** - A carbamate insecticide characterized by fast knockdown, long residual and flushing effect. Particularly effective against insects such as cockroaches and flies where rapid knockdown and residual properties are important.
**BAYTEX** (fenthion) - An organophosphate insecticide characterized by long residual activity. For general use as a residual insecticide in crack and crevice application indoors and general treatment outdoors for a wide variety of pests.

**BORIC ACID** - A common household or medicine cabinet item that can be used as an insecticide, primarily for the control of cockroaches. Applied as a dry, light dust, boric acid has residual activity. It can be used as a crack and crevice treatment, but must be kept dry to be effective.

**CYGON** (dimethoate) - An organophosphate insecticide used as a residual spray for controlling houseflies and other insects. For treating the outside of buildings.

**DIAZINON** (diazinon) - An organophosphate insecticide used extensively in controlling a variety of insects, particularly cockroaches. It is characterized by a long residual effect and broad-spectrum control of insects indoors and outdoors. Available in dust, emulsifiable concentrate, and encapsulated formulations.

**DURSBAN** (chlorpyrifos) - An organophosphate insecticide effective in controlling a variety of insects. Particularly effective against insects such as cockroaches where residual activity is necessary. Can be used in crack and crevice treatment of food areas and general treatment outdoors.

**DDVP** (dichlorvos) - An organophosphate insecticide. A contact and stomach poison, it acts also as a fumigant. Can be applied as a crack and crevice, and as a general spray, to both food and non-food areas. Effective against a wide range of insects. Available formulations include: emulsifiable concentrations, wettable powder, oil-base concentrations, aerosols, resin strips, and baits.

**DRIONE** - A combination of amorphous silica gel and pyrethrins synergized with pepperyl butoxide. This insecticide dust can be applied as a crack and crevice treatment to food and non-food areas. It is effective against a wide variety of pests.

**FICAM** (bendiocarb) - A carbamate insecticide. A contact insecticide, it has no fumigant action at normal working temperatures, and is characterized as a non-repellent/non-flushing, odorless, and non-staining insecticide. Effective against a wide range of insects, it can be applied as a crack and crevice and general spray to both food and non-food areas. Available formulations include a wettable powder and a dust.

**KNOX OUT** (diazinon) - An organophosphate insecticide in which diazinon is enclosed in tiny capsules (or beads) of thin plastic material to control release of the chemical and extend the residual life. It is effective against a wide range of insects.

**KILLMASTER** (chlorpyrifos) - An organophosphate insecticide in which chlorpyrifos is held in an organic solvent or binder and released a little at a time at the top surface of the coating. Applications can be made as a paint-on, spot, or crack-and-crevice treatment.
MALATHION (malathion) - An organophosphate insecticide, characterized by its broad spectrum control and its low toxicity to mammals. Cythion (a brand name for malathion) is a low-odor product manufactured by a patented process, and is recommended for indoor use. Malathion can be applied as a crack-and-crevice and general spray to food areas and non-food areas.

ORTHENE (acephate) - An organophosphate insecticide. Spot treatments can be applied to food and non-food areas, but not while food is being prepared. Effective against resistant strains of German cockroaches.

PYRENONE - This combination of pyrethrins and piperonyl butoxide is used in ratios ranging from 5:1 to 20:1 by weight, as pressurized sprays, solutions, wettable powders. It is effective against a variety of insects.

PYRETHRINS - A botanical insecticide, the flowers of a chrysanthemum plant are the source of the active principle of this insecticide. Pyrethrins are characterized by a flushing-action and rapid knockdown of a wide range of insects. However, there is little residual activity. Pyrethrins have a low order of toxicity to mammals, and can be applied as a spray to both food areas and non-food areas.

PYRETHORIDS - Pyrethroids are synthetic pyrethrin-like compounds produced to duplicate the activity of natural pyrethrins.

RESMETHRIN - A synthetic pyrethroid insecticide, characterized by flushing activity and a moderate residual life. It can be applied to non-food areas and outside areas.

SAFROTIN (propetemphos) - An organophosphate insecticide, effective against cockroaches, ants, silverfish, and other insect pests. It may be used only in non-food areas of food-handling establishments.

SEVIN (carbaryl) - A carbamate insecticide, characterized by short residual activity. This insecticide can be applied only to non-food areas and outside areas.

b) Rodenticides

Rodenticides differ widely in their chemical nature. They also differ widely in the hazard they present under practical conditions.

WARFARIN - An anticoagulant that is effective in controlling rats and mice. It is odorless and tasteless and effective in very low dosages. Action is not rapid; usually about a week is required before a reduction in the rodent population is effected. Warfarin has found ready acceptance where rodents do not tend to become bait shy after once tasting the material. They continue to consume it until its anti-clotting properties have produced death through internal bleeding.
**FUMARIN** - An anticoagulant that is effective in controlling rats and mice. It is recommended as a multiple-dose rat poison. Three to five consecutive feedings, daily or not over two days apart, cause death by internal bleeding.

**RED SQUILL** - A rodenticide made from plant material. It is specific for rats and non-toxic to other warm-blooded animals when used in recommended dosages. The specific toxicity to rats is due to their inability to vomit; the product induces vomiting in other animals. Red Squill is mixed in baits.

**DIPHACIN. PIVAL** - Anticoagulants- that have the same anticoagulant properties as Warfarin, and have replaced Warfarin where rodent avoidance behavior (bait shyness) has made it ineffective. Sold as baits, they must be ingested for several consecutive days before they become effective.

**TALON** - An anticoagulant that is effective against a variety of pest rodents. It is effective against rodents which are resistant to conventional anticoagulants. Only a single feeding is necessary for rodent death to occur.
13. Product Recall Plan

From time to time a seafood processor may need to remove one of its products from the market. The vast majority of recalls are voluntary. Whether the problem is minor or life-threatening, good advance planning is the key to resolving it thoroughly and quickly. This section of the operations manual is intended to help a company create a product recall plan or help it evaluate and improve a recall plan that is already in existence.

Definitions
For precise legal definitions, consult an attorney on FDA guidelines. Generally speaking, terms are interpreted as follows:

Correlation
A correction means a firm is modifying, adjusting, relabeling, destroying, or inspecting a product, without removing it to another location, so firm will not be in violation.

Recall
A recall means a firm, on its own initiative or at the request of a government agency, is removing or correcting some aspect of a marketed product which would be found to be in violation and against which action would otherwise be taken. Recall does not include a market withdrawal or a stock recovery.

Market withdrawal
A market withdrawal means a firm is removing or correcting a distributed product where either there is no FDA violation or a minor violation against which FDA would not act. This includes such purposes as normal stock rotation and, in the absence of manufacturing or distribution problems, response to actual or alleged tampering with individual units.

Stock recovery
A stock recovery means a firm is removing or correcting a product that is unmarketed and/or has not left the firm’s control.

Recall classification
A recall classification is the FDA number designating the severity of the health hazard presented by the recalled product.

- **Class I** indicates a strong chance the product will cause bad health consequences or death.
- **Class II** indicates the product will probably cause temporary or medically reversible bad health consequences, but serious consequences are remote.
- **Class III** indicates the product is not likely to cause adverse health consequences.

Depth of recall
Depth of recall are levels used to indicate how far into the distribution chain the recall will extend, depending on the seriousness of the hazard and how far the product has been distributed.
Consumer or User Level may vary with the product and includes any intermediate wholesale or retail level; may include the individual consumer.

Retail Level is the recall level immediately before the consumer level—for example, grocery stores—and includes any intermediate levels.

Wholesale Level includes all distribution levels between the manufacturer and the retailer.

**Objectives**

A recall has three basic objectives:

1. Locate the recalled product already in the marketplace.
2. Remove the product from the marketplace.
3. Provide accurate, up-to-date information throughout the recall.

Failure to conduct a recall when products are, or could be considered to be, illegal, unsafe, or a threat to public health can have serious consequences, including product liability lawsuits and civil or even criminal penalties. Lawsuits against a company, its officer and/or its employees seriously degrades a product’s image and damages a company’s reputation. The more serious the problem, the more swift and effective the recall must be.

**FDA Considerations**

A good recall plan must include an understanding of the United States Food and Drug Administration (“FDA”) requirements. Keep in mind that FDA has the responsibility for insuring that food products which present a real or potential threat to public health are removed from the marketplace and reconditioned or destroyed. FDA is always concerned that recalls of such products are done quickly and completely. While the firm is morally and legally responsible for its product, it is FDA’s privilege and duty to evaluate whether that responsibility is being met. Although it does not have statutory authority to compel a recall, FDA can request one and can back up its request with the real threat of enforcement action. Once FDA is involved in monitoring a recall, you can be certain that, to some extent, FDA will call the shots and will not accept a poorly done, last-minute plan of action. For this reason, a recall plan should be drafted thoroughly and in advance, with the help of an attorney, and legal advice should be sought before considering any recall. The FDA’s guidelines, policies, and procedures for recalls are contained in Title 21 of the Code of Federal Regulations Part 7, more specifically 21 C.F.R. 7.40-7.59. Details on FDA enforcement actions related to this question can be found in Chapter 18, Section C of this manual.
State Regulations
State regulations vary concerning product recalls. Some states have recall powers while other states have limited authority. Each processor should be aware of their state’s regulations and include a copy in this section.

Investigating Product Problems
Recalls are initiated as a result of customer or consumer complaints. It is essential that every legitimate consumer and/or customer complaint be investigated thoroughly and documented. Sometimes a product problem is identified in-house, that is, before the product leaves the processor; it should be investigated and documented in the same way. Any investigation should be as objective as possible, and every effort must be made to assess a complaint fairly and not cover over a problem. The company must keep an accurate record of what was reported, when, and by whom, as well as how the company acted in response. If a product problem is determined to be one that could threaten public health, recall action must be taken right away, with consideration given to involving FDA in the process.

General Recall Procedures
An example of how a product recall plan is implemented is included at the end of this chapter. Important steps to initiating a recall include the following:

- Have a well-thought-out, written recall plan in place that can be activated immediately; speed will be critical if management determines recall to be necessary.
- Have a well-trained recall team in place, from management down, prepared to organize, analyze, document, and disseminate critical information about a product problem.
- Management should actively and promptly seek detailed information on the nature and level of the product problem.
- Management, depending on the nature and extent of a product problem, should make and document a decision for either immediate recall, market withdrawal, stock recovery, or the need for additional information.
- Once a decision has been made to institute a recall, the recall must be initiated immediately, and those involved must be given appropriate written notice.
- If management believes the product problem endangers public health, a further decision must be made about informing FDA or other relevant governmental authorities.
- If a determination is made to notify FDA, follow FDA procedures and requests regarding the recall; be prepared to present a recall plan for FDA’s review and, if well done, agreement.
- The recall team must be fully informed of their responsibilities, which will depend on the depth of the recall, determined by the nature of the product problem and, in some instances, by its FDA classification or state requirements.
- Determine the distribution of the product and identify the code numbers to be recalled.
- Decide as soon as possible what will be done with the recalled product, whether it is to be destroyed, reconditioned as food for human beings, as food for animals, or for another use. Destruction plans can require contact with Environmental Protection Agency personnel at the state or federal level, depending on the nature of the product problem.
- Issue warning to the public when, as, and if necessary.
. Prepare weekly status reports documenting the recall and use them to prepare status reports for FDA or for the appropriate state agency.
. Monitor the recall closely and assess whether it is being carried out quickly and effectively, take remedial steps as necessary, and document all effectiveness checks and remedies.
. Stay in contact with customers and consumers, as necessary.
. Stay in contact with FDA and/or state agencies, as necessary.
. Decide in advance what constitutes completed recall; notify all involved.
Product Recalls

All products will be labeled with a production code. This is an example of the code: 0901911. The first two digits represent the month, the second two the day, the third two the year and the final digit the production line. The example above would be a production day of September 01, 1991 from line one. Each product will have a corresponding code to represent that date of production and the production line.

All customer complaints are directed through the sales representative who handles that account. The sales representative fills out a complaint memo and gives it to the Quality Assurance Manager.

The Quality Assurance Manager decides if a product recall should be initiated, whether it be from a customer complaint or an internal finding. Once the Quality Assurance Manager decides to initiate a recall, he will first identify the product and production dates that need to be recalled. Next all of the sales representatives are notified of the recall. The sales representatives then notify the customers who are under their responsibility. Each sales representative will then notify the Quality Assurance Manager as to which customers have the affected product and how much of the product they have. All recalled products will be delivered back to Example Blue Crab Company.

A. Federal Recall
If the recall is of a serious nature, i.e. illness, death or injury, the Quality Assurance Manager will notify the media and the local FDA district office of the recall. Recalled products will be destroyed by the Example Blue Crab Company or reconditioned as deemed appropriate by FDA.

B. State Recall
There may be occasions in which a recall is initiated by the Virginia Department of Health, Division of Shellfish Sanitation. If this occurs, there is some specific information that will be required by the Division. The name, type, size, form, shipping or unit package, and a brief description of the product are needed in addition to the code numbers from the lot, the recalling firm, the reasons for recall, the volume of product in commerce, the distribution pattern, the firm’s recall strategy, and the contact official at the firm. The Division will work closely with the firm to assure that the recall occurs smoothly and that the problem which precipitated the recall is abated. The plan for final disposition of the recalled product will be worked out with the Division. The Division’s objective in any recall is to abate a potential health hazard as soon as possible with minimal inconvenience to the public and the producer.

Note: See page 13-3 for a discussion on product recalls
Example - For Illustrative Purposes Only

14. Consumer Complaint File Procedure

All consumer complaints are directed through the sales representative that handles the account where the complaint originated. The sales representative fills out a complaint memo and gives it to the Quality Assurance Manager. The Quality Assurance Manager fills out a Customer Complaint Form and investigates the cause of the complaint. Action is taken to correct the cause of the complaint if it is a legitimate complaint. If any action is taken because of a complaint, it is recorded on the Customer Complaint Form.

All of the Customer Complaint Forms and memos from the sales representatives are kept on file in the Quality Assurance Manager’s office.
SUBJECT: Control of Hazardous Energy Sources (Lockout/Tagout) Standard

A. Purpose.

This directive establishes and amends procedures for uniform enforcement of the Lockout/Tagout Standard, § 1910.147 of Subpart J.

B. Scope.

This directive applies to all VOSH personnel and specifically to Occupational Safety Enforcement (General Industry) and Voluntary Compliance personnel.

C. Reference.

45 Federal Register 41012 (June 17, 1980).
53 Federal Register 15495 (April 29, 1988).
54 Federal Register 36644 (September 1, 1989).
55 Federal Register 38667 (September 20, 1990).
OSHA Instruction STD 1.73 (September 11, 1990).

D. Cancellation.

VOSH Program Directive 02-211.

E. Action.

The Assistant Commissioner, Directors and Supervisors shall assure that employers understand the provisions of this Directive and comply with the policies and procedures contained in it.

F. Effective Date.

The effective date is July 1, 1991.

G. Expiration Date.

Not Applicable.

H. Background.

Please refer to VOSH Program Directive 12-237C.
I. **Summary**

This standard is federal identical and includes federal technical corrections. It supplements existing lockout related provisions contained throughout the general industry standards by providing comprehensive and uniform procedures. The standard requires that lockout be used for machines and equipment which are capable of being locked out unless the employer can demonstrate that use of a tagout device is as effective as use of a lockout device in disabling a machine and in protecting employees from the releases of potentially hazardous energy during the performance of maintenance and servicing activities.

J. **Standard with Citation and Compliance Guidelines.**

**CAVEAT:** This standard is NOT applicable to the safeguarding of workers from the normal production operations related to operating various production and process equipment in the General Industry environment, not it applicable to the hazards of contacting electrically live parts (exposure to electric current). Such hazards continue to be regulated at VOSH Standard 1910, Subparts 0 and S, respectively.

**CAVEAT:** This standard does NOT replace existing specific VOSH lockout/tagout provisions, such as those noted in Appendix B. Where applicable, it supplements the requirements of such standards by establishing a lockout/tagout procedure, the training of employees in energy control programs and periodic inspections of the programs.
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**APPENDICES**

A. Typical Minimal Lockout or Tagout System Procedures  
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§ 1910.147 - COMROLOF HAZARDOUS ENERGY SOURCES (lockout/tagout).

(a) Scope, application and purpose.

(1) Scope.

(i) This standard covers the servicing and maintenance of machines and equipment in which the unexpected energization or start up of the machines or equipment, or release of stored energy could cause injury to employees. This standard establishes minimum performance requirements for the control of such hazardous energy.

(ii) This standard does not cover the following:

(A) Construction, agriculture and maritime employment;

(B) Installations under the exclusive control of electric utilities for the purpose of power generation, transmission and distribution, including related equipment for communication or metering; and

(C) Exposure to electrical hazards from work on, near, or with conductors or equipment in electric utilization installations, which is covered by Subpart S of this part; and

(D) Oil and gas well drilling and servicing.

(2) Application.

(i) This standard applies to the control of energy during servicing and/or maintenance of machines and equipment.
(ii) Normal production operations are not covered by this standard (See Subpart 0 of this Part). Servicing and/or maintenance which takes place during normal production operations is covered by this standard only if;

(A) An employee is required to remove or bypass a guard or other safety device; or

(B) An employee is required to place any part of his or her body into an area on a machine or piece of equipment where work is actually performed upon the material being processed (point of operation) or where an associated danger zone exists during a machine operating cycle.

Note: Exception to paragraph (a)(2) (ii): Minor tool changes and adjustments, and other minor servicing activities, which take place during normal production operations, are not covered by this standard if they are routine, repetitive, and integral to the use of the equipment for production, provided that the work is performed using alternative measures which provide effective protection (See Subpart 0 of this Part).

(iii) This standard does not apply to the following.

(A) Work on cord and plug connected electric equipment for which exposure to the hazards of unexpected energization or start up of the equipment is controlled by the unplugging of the equipment from the energy source and by the plug being under the exclusive control of the employee performing the servicing or maintenance.

(B) Hot tap operations involving transmission and distribution systems for substances such as gas, steam, water or
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petroleum products when they are performed on pressurized pipelines, provided that the employer demonstrates that (1) continuity of services is essential; (2) shutdown of the system is impractical; and (3) documented procedures are followed, and special equipment is used which will provide proven effective protection for employees.

(3) Purpose.

(i) This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization; start-up or release of stored energy in order to prevent injury to employees.

(ii) When other standards in this part require the use of lockout or tagout, they shall be used and supplemented by the procedural and training requirements of this section.

(b) Definitions applicable to this section.

Affected employee. An employee whose job requires him/her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him/her to work in an area in which such servicing or maintenance is being performed.

Authorized employee. A person who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when

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VOSH agrees with federal OSHA’s intent that this operation should be allowed in certain limited conditions where continuity of service is essential and system shutdown is impractical such shutdown may not be practical because shutting down the system may be more hazardous than allowing the continued operation of the system. Conducting such operations simply to expedite work is prohibited.

Implicit in this definition is that the authorized employee has been designated to perform such duties by the employer.
that employee’s duties include performing servicing or maintenance covered under this section.

**Capable of being locked out.** An energy isolating device is capable of being locked out if it has a hasp or other means of attachment to which, or through which, a lock can be affixed, or it has a locking mechanism built into it. Other energy isolating devices are capable of being locked out, if lockout can be achieved without the need to dismantle, rebuild, or replace the energy isolating device or permanently alter its energy control capability.

**Energized.** Connected to an energy source or containing residual or stored energy.

**Energy isolating device.** A mechanical device that physically prevents the transmission or release of energy, including but not limited to the following: A manually operated electrical circuit breaker; a disconnect switch; a manually operated switch by which the conductors of a circuit can be disconnected from all ungrounded supply conductors and, in addition, no pole can be operated independently; a line valve; a block: and any similar device used to block or isolate energy. Push buttons, selector switches, and other control circuit type devices are not energy isolating devices.

**Energy source.** Any source of electrical, mechanical, hydraulic, pneumatic, chemical, thermal, or other energy.

**Hot tap.** A procedure used in the repair, maintenance and services activities which involves welding on a piece of equipment (pipelines, vessels or tanks) under pressure, in order to install connections or appurtenances. It is commonly

This standard also applies to piping systems, and specifically at paragraph (d) (S), requires that accumulators shall be discharged and that pressurized lines shall be blocked and bled.
used to replace or add sections of pipeline without the interruption of service for air, gas, water, steam, and petrochemical distribution systems.

**Lockout.** The placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

**Lockout device.** A device that utilizes a positive means such as a lock, either key or combination type, to hold an energy isolating device in the safe position and prevent the energizing of a machine or equipment. Included are blank flanges and bolted slip blinds.

**Normal production operations.** The utilization of a machine or equipment to perform its intended production function.

**Servicing and/or maintenance.** Workplace activities such as constructing, installing, setting up, adjusting, inspecting, modifying and maintaining and/or servicing machines or equipment. These activities include lubrication, cleaning or unjamming of machines or equipment and making adjustments or tool changes, where the employee may be exposed to the unexpected energization or start-up of the equipment or release of hazardous energy.

**Setting up.** Any work performed to prepare a machine or equipment to perform its normal production operation.

**Tagout.** The placement of a tagout device on an energy isolating device, in accordance with an established procedure, to indicate that the energy isolating device and the equipment being con-
trolled may not be operated until the tagout device is removed.

Tagout device. A prominent warning device, such as a tag and a means of attachment, which can be securely fastened to an energy isolating device in accordance with an established procedure, to indicate that the energy isolating device and the equipment being controlled may not be operated until the tagout device is removed.

(c) General-(1) Energy control program. The employer shall establish a program consisting of energy control procedures, employee training and periodic inspections to ensure that before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing start up or release of stored energy could occur and cause injury, the machine or equipment shall be isolated from the energy source, and rendered inoperative.

(2) Lockout/tagout (i) If an energy isolating device is not capable of being locked out, the employer’s energy control program under paragraph (c)(1) of this section shall utilize a tagout system.

(ii) If an energy isolating device is capable of being locked out, the employer’s energy control program under paragraph (c)(1) of this section shall utilize lockout, unless the employer can demonstrate that the utilization of a tagout system will provide full employee protection as set forth in paragraph (c)(3) of this section.

(iii) After January 2, 1990, whenever replacement, or major repair, renovation or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy

Such program and procedures must be in writing as outlined in paragraph (c)(4). Refer to Appendix A for an example of typical procedures Use of this Appendix is not mandatory

This section will normally be cited as "serious" if an employer fails to have an energy control program except as provided by the note under (C)(4)(i).

VOSH agrees with federal OSHA that lockout is a surer means of ensuring deenergization of equipment than tagout, and that it should be the preferred method. If equipment is capable of being locked out, and an employer chooses to implement a tagout procedure, it must be demonstrated to provide equivalent safety to a lockout for such equipment.

This section will normally be cited as "serious" if an employer utilizes a tagout device in lieu of lockout and full employee protection is not provided.

This section will normally be cited as “other-than-serious” whenever an employer has failed to modify such machines or equipment to accept a lockout device.
isolating devices for such machine or equipment shall be designed to accept a lockout device.

(3) Full employee protection. (i) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program.

(ii) In demonstrating that a level of safety is achieved in the tagout program which is equivalent to the level of safety obtained by using a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energization.

(4) Energy control procedure. (i) Procedures shall be developed, documented and utilized for the control of potentially hazardous energy when employees are engaged in the activities covered by this section.

Note: Exception: The employer need not document the required procedure for a particular machine or equipment, when all of the following elements exist: (1) The machine or equipment has no potential
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for stored or residual energy or reaccumulation of stored energy after shut down which could endanger employees: (2) the machine or equipment has a single energy source which can be readily identified and isolated; (3) the isolation and locking out of that energy source will completely deenergize and deactivate the machine or equipment; (4) the machine or equipment is isolated from that energy source and locked out during servicing or maintenance; (5) a single lockout device will achieve a locked-out condition; (6) the lockout device is under the exclusive control of the authorized employee performing the servicing or maintenance; (7) the servicing or maintenance does not create hazards for other employees; and (8) the employer, in utilizing this exception, has had no accidents involving the unexpected activation or reenergization of the machine or equipment during servicing or maintenance.

(ii) The procedure shall clearly and specifically outline the scope, purpose, authorization, rules, and techniques to be utilized for the control of hazardous energy, and the means to enforce compliance including, but not limited to, the following:

(A) A specific statement of the intended use of the procedure;

(B) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(C) Specific procedural steps for the placement, removal and transfer of lockout devices or tagout devices and the responsibility for them; and

(D) Specific requirements for testing a machine or equipment to determine and
verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(5) Protective materials and hardware. (i) Locks, tags, chains, wedges, key blocks, adapter pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing or blocking of machines or equipment from energy sources.

(ii) Lockout devices and tagout devices shall be singularly identified; shall be the only devices(s) used for controlling energy; shall not be used for other purposes; and shall meet the following requirements:

(A) **Durable.** (1) Lockout and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(2) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(3) Tags shall not deteriorate when used in corrosive environments such as areas where acid and alkali chemicals are handled and stored.

(B) standardized. Lockout and tagout devices shall be standardized within the facility in at least one of the following criteria: Color, shape, or size

This section will normally be cited as "serious" if an employer fails to provide protective materials and hardware.

A facility-wide utilization of one of following is an acceptable lockout device:

a. A standardized lock adopted by the employer and used for no other purpose.

b. Any lock uniformly identified or marked by the employer and used for no other purpose.

This section will normally be cited as "other-than-serious" if an employer fails to implement an acceptable lockout and tagout device identification or uses such devices for other purposes. This section will normally be cited as "serious" if something other than such a lockout or tagout device to be used.

This section will normally be cited as "other-than-serious" for nondurable devices

This section will normally be cited as “other-than-serious” for a deteriorated device that is still legible. A “serious” violation shall be issued if such device is illegible.

This section will normally be cited as “other_than_serious” for a deteriorated device that is still legible. A “serious” violation shall be issued if such device is illegible.

This section will normally be cited as "other-than-serious" if lockout and tagout devices are not standardized
and additionally, in the case of tagout devices, print and format shall be standardized.

(C) Substantial-(1) Lockout devices. Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or other metal cutting tools.

(2) Tagout devices. Tagout devices, including and [sic] their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a non-reusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than 50 pounds and having the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(D) Identifiable Lockout devices and tagout devices shall indicate the identity of the employee applying the device(s).

(iii) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

(6) Periodic inspection. (i) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the requirements of this standard are being followed.

This section will normally be cited as "serious" if such lockout devices could be removed by hand.

This section will normally be cited as "serious" if such tagout devices could be removed by hand.

This section will normally be cited as "serious" if tagout devices do not include warning legends against hazardous conditions.

This section will normally be cited as "other-than-serious" if the device does not indicate employee applying the device(s).

This section will normally be cited as "serious" if periodic inspections are not conducted.
(A) The periodic inspection shall be performed by an authorized employee other than the one(s) utilizing the energy control procedure being inspected.

(B) The periodic inspection shall be conducted to correct any deviations or inadequacies identified.

(C) Where lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee’s responsibilities under the energy control procedure being inspected.

(D) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee’s responsibilities under the energy control procedure being inspected, and the elements set forth in paragraph (c)(7)(ii) of this section.

(ii) The employer shall certify that the periodic inspections have been performed. The certification shall identify the machine or equipment on which the energy control procedure was being utilized, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

(7) Training and communication. (i) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are acquired by employees. The training shall include the following:

This section will normally be cited as “serious” if periodic inspections are not conducted by an authorized employee as stated.

This section will normally be cited as “other-than-serious.”

This section will normally be cited as “other-than-serious.”

This section will normally be cited as “serious” where the employer fails to make such certification.

This section will normally be cited as “serious” if an employer fails to provide any training. For the purposes of this standard, there are three types of employees: (1) "authorized" "affected" and "Other." Different levels of training are required for each type. The differing training requirements are based upon their respective roles in the control of energy and the knowledge which they must possess to safely accomplish their tasks as related to lockout/tagout procedures.
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(A) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of the energy available in the workplace, and the methods and means necessary for energy isolation and control.

(B) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(C) All other employees whose work operations are or may be in an area where energy control procedures may be utilized, shall be instructed about the procedure, and about the prohibition relating to attempts to restart or reenergize machines or equipment which are locked out or tagged out.

(ii) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(A) Tags are essentially warning devices affixed to energy isolating devices, and do not provide the physical restraint on those devices that is provided by a lock.

(B) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

(C) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

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This section will normally be cited as "serious" if an employer fails to provide a training program which covers, at a minimum the following three areas: the energy control program elements of energy control procedure relevant to employee duties, and the requirements of the standard.

This section will normally be cited as "serious" if an employer fails to provide instruction.

The term "other employees" means non-affected or non-authorized employees. The training requirements for these other employees are minimal, essentially what is required is only that these employees know what the energy control program does and that they are not to touch any locks, tags or equipment covered by the program. This section will normally be cited as "other-than-serious".

This section establishes a requirement for additional training for all employees in plants or facilities where tagout is the preferred method of energy control. This section shall normally be cited when an employer has not complied with subsections A through F below. This section will normally be cited as "serious."
(D) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(E) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(F) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

(iii) Employee retraining.

(A) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment or processes that present a new hazard, or when there is a change in the energy control procedures.

(B) Additional retraining shall also be conducted whenever a periodic inspection under paragraph (c)(6) of this section reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in the employee’s knowledge or use of the energy control procedures.

(C) The retraining shall reestablish employee proficiency and introduce new or revised control methods and procedures, as necessary.

(ii) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee’s name and dates of training.
(8) **Energy isolation.** Lockout or tagout shall be performed only by the authorized employees who are performing the servicing or maintenance.

(9) **Notification of employees.** Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout devices or tagout devices. Notification shall be given before the controls are applied, and after they are removed from the machine or equipment.

(d) **Application of control.** The established procedures for the application of energy control (the lockout or tagout procedures) shall cover the following elements and actions and shall be done in the following sequence:

1. **Preparation for shutdown.** Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

2. **Machine or equipment shutdown.** The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown must be utilized to avoid any additional or increased hazard(s) to employees as a result of the equipment stoppage.

3. **Machine or equipment isolation.** All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from the energy source(s).
(4) **Lockout or tagout device application.** (i) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(ii) Lockout devices, where used, shall be affixed in a manner to [sic] that will hold the energy isolating devices in a “safe” or “off” position.

(iii) Tagout devices, where used, shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the “safe” or “off” position is prohibited.

(A) Where tagout devices are used with energy isolating devices designed with the capability of being locked, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(B) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

(5) **Stored energy.** (i) Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, and otherwise rendered safe.

(ii) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed, or until the possibility of such accumulation no longer exists.
(6) **Verification of isolation.** Prior to starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and deenergization of the machine or equipment have been accomplished.

(e) **Release from lockout or tagout.** Before lockout or tagout devices are removed and energy is restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employee(s) to ensure the following:

1. **The machine or equipment.** The work area shall be inspected to ensure that nonessential items have been removed and to ensure that machine or equipment components are operationally intact.

2. **Employees.** (i) The work area shall be checked to ensure that all employees have been safely positioned or removed.

   (ii) Before lockout or tagout devices are removed and before machines or equipment are energized, affected employees shall be notified that the lockout or tagout devices have been removed.

   (iii) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout device(s) have been removed.

3. **Lockout or tagout devices removal.** Each lockout or tagout device shall be removed from each energy isolating device by the employee who applied the device.

This section will normally be cited as "serious.”

This section will normally be cited as “serious” if subsequent items 1 through 3 of the standard are not accomplished.

This section will normally be cited as “serious”

This section will normally be cited as “serious”

Such failure to notify would normally be cited under section (c)(9).

Unauthorized lockout or tagout device removal will normally be cited as "serious". Exceptions to paragraph (e)(3) must be documented in the employers written program. VOSH agrees with federal OSHA’s intent that: