

# Category H: Industrial, Institutional and Structural Pest Control

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## Industrial, Institutional and Structural Pest Control Learning Objectives

THIS CATEGORY IS AVAILABLE ONLY TO NON-PRIVATE APPLICATORS BY TAKING A SEPARATE CATEGORY EXAM.

After studying this section, you should be able to:

- ✓ Identify the different types of stored product pests and strategies to control or prevent an infestation of these pests.
- ✓ Describe general industrial and institutional pest control strategies.
- ✓ Describe microorganism pests in industrial and institutional pest control.
- ✓ Describe the most common wood-destroying pest microorganisms and strategies to control or prevent infestations of these pests.
- ✓ List the most common invertebrate pests encountered in industrial and institutional pest control and methods to control them.
- ✓ Identify the most common invertebrate wood-destroying pests and methods to control them.
- ✓ Explain how to tell the difference between termites and ants. Describe the three different types of termites and pest control strategies for each.
- ✓ Identify the most common vertebrate pests encountered in industrial and institutional pest control and methods to control them.

**Category H, Industrial, Institutional and Structural Pest Control describes management practices for pests found in industrial and institutional sites and structural (wood-destroying) pests.**

**Industrial sites include grain elevators, warehouses, hotels, casinos, food establishments, stores, offices and operational sites.**

**Institutional sites include schools, rest homes and hospitals.**

## **Category H, Industrial, Institutional and Structural Pest Control**

Category H, Industrial, Institutional and Structural Pest Control describes management practices for pests found in industrial and institutional sites and structural (wood-destroying) pests. The primary pests found in industrial and institutional sites are insects, rodents and, less commonly, bats. Birds can also be pests; refer to the General Knowledge: General Pest Problems chapter of this manual for information on bird pests. Structural pests are generally wood-destroying pests. The most common wood-destroying pests are termites. Wood-destroying powderpost beetles, carpenter ants and wood-damaging fungi are also pests of concern in this category.

This category **does not** cover pests in ornamental and turf sites. For ornamental and turf pest control information, see the Category D: Ornamental and Turf Pest Control chapter in this manual. This category **does not** cover public health pests, such as bed bugs; for information on bed bugs and other public health pests, see Category K: Public Health Pest Control in this manual.

### **Industrial and Institutional Pest Control**

Both industrial and institutional settings have similar sites. So, many industrial and institutional pest control practices overlap.

Industrial sites include:

- Stored product facilities and farm structures
- Food processing facilities
- Retail sites, such as stores, hotels, casinos and restaurants
- Related sites, such as offices, kitchens and operational sites

Institutional sites include:

- Schools
- Hospitals and rest homes

Good sanitation and cleanliness are the keys to control and management of pests in industrial and institutional sites.

### **Industrial and Institutional Pest Control Strategies**

Effective pest control plans include more than one control strategy or method. Using Integrated Pest Management (IPM) categories, the following are control strategies that have applications in Industrial and Institutional

## Pest Control.

- **Prevention:** Prevention is an essential management practice that includes sanitation and exclusion. Insects and rodents must have food, water and shelter to survive. Remove one or preferably all of these and pest problems will be significantly reduced.
  - **Food:** Clean food preparation areas, classrooms and other problem sites frequently to reduce pest problems. Thorough cleaning under and behind furniture, equipment, shelving and appliances may be necessary to remove all food sources. Remove trash regularly, and use trash can liners. Keep areas around dumpsters clean. Store food in rodent-proof and insect-proof containers.
  - **Water:** Pests find water in numerous places. Wring out and hang wet mops to dry. Repair leaky pipes. Clogged rain gutters and leaking faucets are also important water sources for rodents, insects and birds. Clean floor drains routinely, as they are sources of both food and water.
  - **Shelter:** Restrict the pest's access to shelter and food by sealing entry points. Install door sweeps and window screens. Seal cracks and crevices with screens, silicone or other sealant material. Eliminate clutter, and keep stored products on shelving off the floor. Bird netting and metal bird spikes will restrict birds from accessing sites where they might roost and nest.
- **Inspection and Monitoring:** Routine monitoring is an important part of managing pests in industrial and institutional sites. Monitoring not only includes surveying for pests but also observing conditions that are favorable for pests, including unsanitary conditions, entry sites and shelter locations. When conditions favoring pests are found, they should be corrected as soon as possible.

Sticky traps and pheromone traps are used for insect monitoring. Sticky traps are simple devices made of cardboard with one surface covered in a glue-like material. When insects contact the trap, they become stuck. Some sticky traps include the use of pheromone lures. Pheromones are natural scents produced by insects that are used to communicate with each other. Some pheromones are sex attractants that attract only males and others attract both males and females.

When monitoring, look for pests and evidence of pests, such as fecal material, shed insect skins, tracks and grease marks left by rodents. Routine monitoring will indicate if pests are present and help you to evaluate whether your pest management strategies are successful.

**Insects and rodents must have food, water and shelter to survive. Remove one or preferably all of these and pest problems will be significantly reduced.**

**Routine monitoring is an important part of managing pests in industrial and institutional sites. Monitoring not only includes surveying for pests but also observing conditions that are favorable for pests.**

**Traps can be used both as inspection and monitoring tools and as mechanical controls.**

**Trapping is the most common means of mechanical control for both insects and rodents in industrial and institutional sites.**

**Remember that all pesticides are considered toxic and should be used with caution around food, food storage and food preparation areas.**

- **Mechanical/Physical Control:** While stepping on and smashing an occasional ant or cockroach is considered physical control, it is not a sustainable, effective long-term management method. Trapping is the most common means of mechanical control for both insects and rodents in industrial and institutional sites. Trapping is also a monitoring technique used to determine where pests are present and what species are present.

Sticky traps can be used for insects and small rodents, but they are not considered to be the most effective means of control. Mechanical kill traps, such as snap traps, are used for mice and rats. Live traps may be used, but releasing live rodents is illegal. Most often, live trapping is followed by humane euthanasia. Rodents can transmit diseases, so use proper precautions when working around live or dead rodents.

Other mechanical or physical management options include vacuuming and sweeping up pests such as ants. Mechanical control should be done in conjunction with prevention. If you trap mice or vacuum ants but don't remove food sources and eliminate access, you will never solve the pest problem.

- **Pesticides:** Pesticides, including rodenticides and insecticides, are applied as sprays, dusts, fumigants, baits and granules. The site where the pesticide is applied must be listed on the product label. Applying a pesticide to a site not listed on the label is a violation of federal law. Many industrial, institutional and structural sites are also living areas for people and animals. It is important to consider the formulations, application methods and pre-application site preparation methods to avoid contamination of food, minimize damage to and contamination of areas treated, minimize acute and chronic exposures of people and pets and minimize environmental impacts of outdoor applications.

**Rodenticides:** Rodenticides are usually applied in bait form. Pesticide labels describe how and where to apply baits. Tamper-resistant bait boxes or bait stations are often required. Some rodenticides are applied as tracking powders that are sprinkled in areas where rodents are present. They are picked up by rodents on their feet and fur and are ingested during grooming.

Many rodenticides are classified as restricted-use pesticides and may be used only by certified applicators or persons under their direct supervision.

Rodenticides should be used in combination with preventative methods, including exclusion and sanitation.

**Fumigants:** Fumigants can be used in industrial sites to control commodity pests. Use of fumigants requires additional certification in Category L2, Non-soil Fumigation. Refer to the Category L2: Non-soil Fumigation chapter in this manual for more information.

**Insecticide baits:** Baits used for insect control are typically applied as gels or granules. Some are applied in bait stations, while others are applied in cracks and crevices where insects occur. Baits used for ant control are picked up and taken to the colony, where they are shared with the rest of the colony.

**Insecticide sprays:** Insecticide sprays may be applied to cracks and crevices by broadcast treatment or as perimeter applications. Applicators must identify the insect, select the proper insecticide treatment and apply the product according to label instructions.

## Industrial and Institutional Microorganism Pests

The only microorganisms of importance are fungi and water molds. They both require moisture. Fungi may cause additional damage to structures by the growth of their hair-like mycelia. For control, dry up and aerate the area or materials. If chemical controls are necessary, use phenols and oil, especially borates. Avoid breathing these products, use a respirator, and protect the skin from contact with gloves and protective clothing. Correct underlying conditions such as excessive moisture and poor ventilation.

## Structural (Wood-damaging) Microorganism Pests

Microorganisms that damage wood are generally fungi. Fungi lack chlorophyll. They cannot make their own food like plants can. Fungi feed off organic matter, in this case wood. Fungi damage wood when their mycelia, a mass of thread-like filaments, enter wood and release enzymes that breakdown cell walls and membranes and then absorb the released cell contents. The damp wood is the fungus food, and the fungus causes breakdown or rot. The best control is prevention by monitoring and correcting excess moisture problems in the structure. If a fungal infestation has started, drying the area and applying borates with oil will aid in control. Other chemical controls may be available. Consult your local pesticide dealer for products that will work for your site.

**Wood-Destroying Fungi:** Both the sapwood and heartwood of most tree species are susceptible to decay. Decay fungi may grow in the interior of the wood or appear on wood surfaces as fan-shaped patches of fine, threadlike, cottony growths or as root-like shapes. Fungi produce spores that can infect

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**The best control is prevention by monitoring and correcting excess moisture problems in the structure.**

**Fungi require favorable temperatures of 50 F to 90 F and a moisture content of about 30%.**

**Brown rot fungi are probably the most important cause of decay of softwood species used in above-ground construction in the United States.**

moist wood during storage, processing and use. The fungi that grow on wood have the following basic requirements:

- Favorable temperature: between 50 F and 90 F
- Adequate moisture: a wood moisture content of about 30%

Fungal strands grow throughout the wood, digest parts of it as food, and eventually destroy the strength of the wood. Decay will stop when the temperature of the wood is either too low or too high or when the moisture content is drier than required by the fungus.

Wood-decay fungi can be grouped into three major groups:

**Brown Rot Fungi:** This type of fungus breaks down the cellulose component of wood for food, leaving a brown residue of lignin. Affected wood can be greatly weakened, even before the decay can be seen. Brown rot fungi are probably the most important cause of decay of softwood species used in above-ground construction in the United States. Brown rot, when dry, is sometimes called dry rot. The term dry rot is misleading, as wood must have high moisture content for fungi to cause decay. The final stage of wood decay caused by brown rot fungi can be identified by:

- the dark brown color of the wood
- excessive shrinkage
- cross-grain cracking
- the ease with which the dry wood rotted areas can be crushed to powder

**White Rot Fungi:** This fungus breaks down both lignin and cellulose and has a bleaching effect that may make the damaged wood appear whiter than normal.

**Soft Rot Fungi:** This fungus usually attacks green (water-saturated) wood, causing a gradual softening from the surface inward that resembles brown rot.

**Other wood-inhabiting fungi:**

**Sapstaining Fungi** penetrate and discolor sapwood, particularly of the softwood species. Typical sapstain cannot be removed by brushing or planing. Strength of the wood is little affected, but the wood may not be fit for uses where appearance is important. Southern pine beetles often carry blue stain fungi into trees and may cause the wood of infected trees to be stained before they are cut.

**Mold Fungi** first become noticeable as green, yellow, brown or black fuzzy or powdery surface growths on softwoods. As with sapstains, molds do not reduce wood strength; however, they can increase the capacity of wood to absorb moisture, thereby opening the door to attack by decay fungi.

## Stored Product Insect Pests

There are four classes of stored product insects:

- **Internal feeders:** The larvae feed inside the grain. Examples are the rice weevil and the granary weevil.
- **External feeders:** Larvae enter through holes in the outside shell, and the larvae then eat inside the kernel. Examples are the lesser grain borer and the drugstore beetle.
- **Scavengers:** These organisms are eaters of damaged grain. The sawtooth grain beetle (most common) and the confused flour beetle are examples.
- **Secondary:** These are mold and fungi eaters. An example is the yellow mealworm. It eats products that are out of condition.

These pests require very definite temperature ranges (40 F to 70 F) and humidity ranges (40% to 70%) to survive. Moisture and temperature are important factors for reproduction of stored product pests. The importance of good housekeeping cannot be overemphasized. Do not store packaged goods for long periods. In some situations, storing foods in two sealed containers may be required.

Good sanitation and cleanliness aid in prevention and control. In warehouses, grain elevators or retail establishments, any infestation discovered should be immediately removed and destroyed. Seal all cracks and crevices to eliminate additional infestations. If a pesticide application is warranted, apply according to label directions. Cover and avoid contamination of unpackaged goods or exposed foods. Always cover foods with plastic or a nonporous cover. All pesticides are considered toxic, and most have residual effects. Never apply pesticides to uncovered food or utensils. Pesticide formulations change all the time. Consult your local pesticide dealer for the correct product to use in the situation.

## Selected Industrial and Institutional Invertebrate Pests

Invertebrate pests include insects and arachnids, such as spiders and mites. The following are those insects or arachnids most encountered in industrial or institutional settings. Bed Bugs are not included in this category. Please see Category 9: Public Health, in this manual for more information on Bed Bugs and other public health pests.

**Cockroaches:** There are four species of importance.

The **German cockroach** is the most common cockroach in Nevada. Usually found outdoors, these cockroaches enter the premises in search of moisture.

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**Good sanitation and cleanliness aid in prevention and control.**

**Pesticide formulations change all the time. Consult your local dealer for the correct product for the situation.**

**The German cockroach is the most common cockroach in Nevada.**



**Clockwise from top left: German, brown banded, American and oriental cockroaches.**

Art Cushman, USDA,  
Smithsonian Institution,  
Department of Entomology,  
Bugwood.org



**Clothes moths**

Clemson University - USDA  
Cooperative Extension Slide  
Series, Bugwood.org

Limit food and water sources and eliminate access to aid in control. The German cockroach has developed resistance to chlorinated hydrocarbons, so use one of the newer insecticides developed for cockroach control. Contact your local dealer for specific insecticides to control German cockroaches.

The **American cockroach** is large and red. Like the German cockroach, the American cockroach is usually found outdoors and enters the premises in search of moisture. Limit food and water sources and eliminate access to aid in control. A quick knockdown residual insecticide is generally used to control these pests. Contact your local dealer for specific recommendations.

The **Oriental cockroach** is black and shiny. Usually outside, these cockroaches also enter premises in search of moisture, like the German and American cockroaches. Limit food and water sources and eliminate access to aid in control. A quick knockdown residual insecticide is generally used to control these pests. Contact your local dealer for specific insecticides.

The **brown banded cockroach** is very common in certain areas. Unlike the other three species mentioned, brown banded cockroaches prefer warm and dry locations. They are found in structures, generally away from water sources. Good sanitation is important. Eliminate food sources. Block entry points by filling in cracks, crevices and other entry sites at ducts, moldings or other openings. Baits and traps are used to control these pests, along with quick knockdown residual insecticides. Contact your local dealer for specific recommendations.

**Clothes Moths:** These pests eat holes in clothing and furniture. While termites can digest cellulose, the clothes moth is capable of digesting keratin for its protein requirements. Keratin is a protein component found in all animal hair, such as wool and the hair of hide-producing animals. These pests feed on wool clothing, fur garments, animal hides, upholstered furniture, carpets and rugs. They may also feed on wool blend fabrics. They are small, ¼ inch in length. They generally do not fly far from the site of infestation. The larval stage is the damage-producing stage. Storing susceptible items in air-tight containers can limit infestations. They prefer humid conditions, so lowering the humidity inside structures can aid in limiting infestations. Practice good sanitation by removing pet hair accumulations or wool debris and removing infested items before they spread. Insecticidal sprays may be used, but make sure the sprays themselves will not damage the infested fabric, fur or hide.

**Ants:** There are many types of ants that are very common and widespread. Most colonies contain at least three castes: queens, males and workers. The feeding habits of ants are rather varied. Many are carnivorous, feeding on the flesh of other animals; some feed on plants and some on dew or similar

substances. All ants may bite, and some bites are rather severe. Identification of the specific species is important in control. Adequate control is only possible when the species and habits are considered. Satisfactory results rely on insecticides that provide prolonged exposure. Formulations used are wettable powders (WP), emulsions (EC), dusts (D), granules (G) and poison baits. Contact your local dealer for specific insecticide recommendations once you have identified the species of ant. For aid in identification, contact the University of Nevada, Reno Extension or the Nevada Department of Agriculture.

**Wasps:** Wasps include those insects called yellow jackets, hornets, umbrella (paper) wasps and mud daubers. Wasp control varies with the location of the nest. It is recommended that control applications be made at dusk or during the coolest period of the day. When treating aerial nests, spray the insecticide directly into the nest opening as well as the entire nest. Liquid insecticides may be poured into openings of subterranean nests. Contact your local dealer for specific recommendations.

**Spiders:** Most spiders are beneficial, preying on insect pests. In an industrial or institutional setting, tolerance for spiders is not as high as it is in a garden or outdoor setting. The brown recluse is very rare in Nevada. It has been found only in the southern portion of state. Black widow spiders are the most common poisonous spiders. Black widows can be found both inside and outside dwellings. They do not like direct sunlight, but favor cool, dark and quiet areas. They are not aggressive. Contact your local dealer for recommendations on pesticides for spider control.

## Structural (Wood-Destroying) Invertebrate Pests

The most common wood-destroying insect pests in Nevada are termites, carpenter ants and wood-destroying beetles. Pesticide applications for the control of wood-destroying pests can be extremely complex and hazardous; it is recommended that they only be performed by licensed pest control operators.

It is easy to confuse ants with termites. Both are insects, with three body parts, six legs and one pair of antennae. Both may have two pairs of wings. The following will help you distinguish termites from ants:

- **Thorax-abdomen junction:** Ants have a thread-like waist with spikes. Termites have a thick waist.
- **Antennae:** Ants have “elbowed” antennae or antennae with an almost 90-degree bend. Termites have straight antennae that may also look like strings of beads (called moniliform).



### Wasp

Whitney Cranshaw, CSU,  
Bugwood.org



### Black widow spider

James Solomon, USFS,  
Bugwood.org;

### Wood destroying insects fall into three groups:

- **Termites**
- **Carpenter ants**
- **Beetles**

**Pesticide applications for the control of wood-destroying pests can be extremely complex and hazardous; it is recommended that they only be performed by licensed pest control operators.**

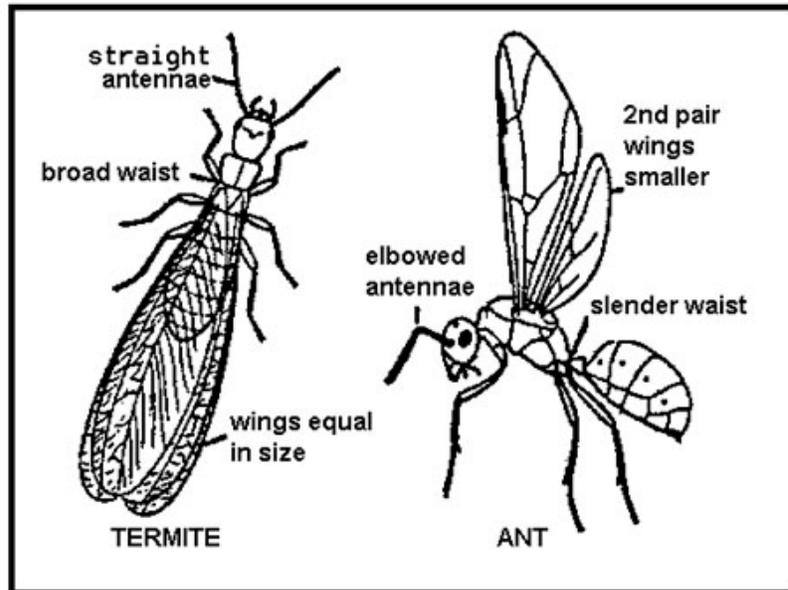
**Termites use wood for food and shelter. They are the most destructive of all the wood-damaging insects.**

**There are three types of termites:**

- **Subterranean**
- **Dry wood**
- **Damp wood**

**Subterranean termites require a constant source of moisture that is usually obtained from the soil.**

- **Wings:** Both ants and termites may have two pairs of wings. The second pair of ant wings is smaller than the first pair. Ant wings do not have a lot of veining. Both pairs of termite wings will be the same size and show a lot of veining.



*How to tell winged ants from termites.*

U ARK EXTENSION

**Termites** use wood for food and shelter. They are the most destructive of all the wood-damaging insects. All termites are social insects, meaning they live in groups. The nest or colony can have a number of different looking individuals, called castes. The largest termite is the queen, who lays eggs. A king is always by her side. There can be a soldier caste, with large heads and powerful jaws. The most numerous is the worker caste. Termites are unique in the insect world, as the workers can be both female and male. Termites can be long lived; queens and kings can live for decades, and workers can survive for several years. Termites utilize fungi for their protein requirements and digest cellulose with the aid of a microorganism they have in their gut. Termites provide a vital function in the wild by helping in the decomposition of wood and plant materials. They become a problem when the wood they choose to consume is part of a man-made structure.

There are three types of termites: subterranean, dry wood and damp wood.

**Subterranean termites:** This group of termites basically has three castes: worker, soldier and reproductives (queen and king). They feed on sound or decaying wood. They require a constant source of moisture that is usually obtained from the soil. They make mud tunnels that regulate their moisture requirements and harbor the fungi they must have for their protein requirement. The tunnels they form in the wood are usually full of debris. All

subterranean termites are soft bodied, and all require contact with the soil. Evidence of the presence of subterranean termites may be noted by:

- The swarming of winged forms and discarded wings observed after swarming.
- Earthen shelter tubes built over masonry or other foundations to a source of wood.
- The presence of white workers when termite shelter tubes are broken open.
- The hollowed-out condition of badly infested wood products.

Control of subterranean termites requires prevention (proper construction and good sanitation) and chemical controls. Proper construction requires that all wood portions of structures be at least 12 inches above the soil beneath the building. Good sanitation reduces food sources for termites. Do not stack wood on the bare ground next to a wood structure. Pick up wood debris in the yard, especially if it is adjacent to a structure (house, shed, barn, etc.). Remove dead wood, tree stumps, lumber scraps or other attractants to termites. Contact your local pesticide distributor for the latest information on pesticide products available for your site and situation. Oils or other adjuvants may be required to achieve penetration of the chemical into the soil.

**Dry wood termites:** Dry wood termites have soldier, nymph and reproductive castes. They do not have a worker caste. The immature termites or nymphs perform the “worker” tasks in the colony. Dry wood termites are most prevalent in hardwoods. The tunnels they make are very clean. They produce very small holes that lead into large galleries. The galleries are also very clean. Dry wood termites do not require as much moisture to establish a colony, hence the name. Because they tolerate less moisture, they do not require contact with the soil, as subterranean and damp wood termites do. The ability of the drywood termite to live in dry wood without direct contact with the soil increases its menace. However, it reproduces slowly and does not destroy wood as quickly as the subterranean termite. Dry wood termites form new colonies when mature, winged reproductives (queen and king termites) fly in search of a new site. Any openings in a structure may provide access for a new colony to form. After swarming, drywood termites enter cracks and crevices in dry, sound wood. In excavating their galleries, they occasionally discharge oval-shaped pellets through temporary openings in the wood face.

Control of dry wood termites requires prevention (sanitation), physical control (exclusion) and chemical controls. Locating the colony is a difficult

**Good sanitation reduces food sources for termites.**

**Dry wood termites are most prevalent in hardwoods.**

**Dry wood termites do not require as much moisture to establish a colony as subterranean or damp wood termites.**

**Damp wood termites are the largest sized termite in Nevada.**

**Damp wood termites are most often associated with rotting wood, often near the soil.**

**Damp wood termites, like the subterranean termites, require contact with the soil.**

task and may require the services of a licensed professional. Openings, cracks, gaps or improperly covered vents in attics, substructure, garages, window frames, outbuildings or any other susceptible cellulose building materials may provide colonization sites for these termites. A thorough inspection is required. Prevention includes using resistant wood or pressure-treated wood. Mechanical control includes blocking all access points where dry wood termites could enter and colonize a structure or a site. Use fillers, wire mesh or putty. Putty can be destroyed by normal wear and tear and may not be one hundred percent effective as an exclusion measure. Exposed wood can be protected by a heavy coat of paint.

Chemical control for these termites is complicated. For attic and wall protection, a preventive dusting with silica aerosol that is impregnated with a termiticidal compound can be blown into attic and wall voids. The best form of chemical control for dry wood termites is fumigation. **Use of fumigants requires additional certification in Category L2, Non-soil Fumigation. Refer to the Category L2: Non-soil Fumigation chapter in this manual for more information.**

**Damp wood termites:** These are the largest sized termites in Nevada. They occur mostly in western Nevada. Damp wood termites have soldier, nymph and reproductive castes; they have no worker caste. These termites may cause structural damage, but they need wood with an excessive amount of moisture to be successful. They are most often associated with rotting wood, often near the soil. Like the subterranean termites, they require contact with the soil.

Control of damp wood termites requires prevention (good sanitation), mechanical control (exclusion) and chemical controls. Prevention, first and foremost, requires routine monitoring and correcting any excess moisture. Fix leaks, dry out the wood and prevent rot from starting. Good sanitation reduces the food sources for termites. Remove any rotting wood from sites near or adjacent to structures. Store all firewood and other wood products off the ground to eliminate the wood-soil interface that damp wood termites like. Do not stack firewood adjacent to wood structures. Eliminate all openings and make sure all wood portions of structures are at least 12 inches above the soil beneath the building. Use lumber from resistant wood or pressure-treated wood products. Contact your local pesticide distributor for the latest information on pesticide products available for your site and situation. Contact your local pesticide distributor for the latest information on pesticide products available for your site and situation. Oils or other adjuvants may be required to achieve penetration of the chemical into the soil.

**Carpenter ants:** Carpenter ants may be black or red. They only damage wood while constructing a nesting site. They do not actually feed on the wood. They generally attack only soft or decaying wood, but once they have established a nest, they may attack adjoining wood that is not decaying. They also commonly nest in wall voids, hollow doors and insulation. The nests carpenter ants form in structures are commonly satellites of a larger parent nest located outside in a live or dead tree, a firewood pile, a lumber pile or even in wood-based landscape materials. Infestations can also start in new construction when the construction process disrupts an existing outdoor nest. Carpenter ants feed on dead and living insects, nectar, fruit juices and honeydew produced by plant-sucking insects, such as aphids.

Control of carpenter ants includes prevention, good sanitation, physical controls (exclusion) and chemical controls. Prevention includes not using wood-based mulches adjacent to structures, especially if the wood mulch touches wooden portions of the structure. Eliminate any wood-to-soil contact for any portions of the structure. Good sanitation includes removing any potential food sources in the structure, removing any piles of wood materials that may start decaying and provide nesting sites for carpenter ants on the property, and trimming any tree branches or shrubs that are in close of contact with the structure. Good sanitation also requires replacement of any decayed or damaged wood in the structure.

You must also correct whatever problem is causing the excess moisture that led to the decay. Increasing ventilation in damp areas can eliminate decay and discourage infestation. Exclusion methods include sealing off all potential access points in the structure. Openings, cracks, gaps or improperly covered vents in attics, substructures, garages, window frames, outbuildings or any other susceptible cellulose building materials may provide colonization sites. Chemical controls may be required. Pesticides for the control of wood-destroying pests may only be applied by licensed pest control operators. Contact your local pesticide distributor for the latest information on products available for your site and situation. Remember that if you are planning to apply pesticides to the parent nest that is probably outside the structure in the landscape, you will need to have ornamental and turf certification also.

**Wood-destroying beetles:** There are four species of importance:

**Powder Post or Lyctus Beetles** attack both freshly cut and seasoned hardwoods and softwoods. Adults lay eggs in the wood pores. The larvae burrow through the wood, making tunnels from 1/16 inch to 1/12 inch in diameter. The tunnels are left packed with powder. After a larval period (two to 12 months or longer) and a much shorter pupal stage, newly formed

**Carpenter ants use wood for shelter, not for food. They do not actually feed on the wood.**

**Carpenter ants generally attack only soft or decaying wood.**

**Remember that if you are planning to apply pesticides to the carpenter ant parent nest that is probably outside the structure in the landscape, you will need to have ornamental and turf certification also.**

**Powder post beetles attack both freshly cut and seasoned wood.**

**Roundhead borers damage seasoned wood in buildings.**

**Flathead borers infest live trees as well as recently felled and dead standing softwood trees.**

adults chew round, 1/16-inch holes through the wood surface and emerge to lay eggs. The powder post beetle is the most common wood-destroying beetle in Nevada. The larva of this insect produces a fine, dust-like powdered frass, a mixture of feces and fine wood fragments. Much of the frass remains in the boring tunnels the larva cut into the wood, but some can spill out of the holes and form small piles on or adjacent to infested materials (furniture, moldings, paneling, door frames, plywood, flooring, etc.). These pests most commonly attack hardwoods, but they also attack bamboo. They prefer low-moisture wood materials.

**Anobiid Beetles** attack softwoods in damp and poorly ventilated spaces beneath buildings.

**Roundhead Borers** are longhorn beetles that damage seasoned pine timbers. Their tunneling may weaken structural timbers, framing members and other wooden parts of buildings. Larvae may reduce sapwood to a powdery or sawdust-like consistency. They make a ticking or gnawing sound while working in the wood. Adult beetles make a ¼-inch diameter, oval emergence hole in the surface of the wood.

**Flatheaded Borers** infest live trees as well as recently felled and dead standing softwood trees. They can cause considerable damage in rustic structures and some manufactured products by mining into sapwood and heartwood. Typical damage consists of rather shallow, long, winding galleries that are packed with fine powder. Most of the adult beetles are metallic in color.

As with all pests, prevention is the best method of control. Remove all dead wood, scrap lumber and other waste wood products before infestation can occur or spread. Only bring in enough firewood for daily use to limit the chances of infestation. Inspect all furniture and wood products before bringing them inside structures. Small items can be heated (if they are not upholstered, painted or fur-covered) for six hours at 120 F to 140 F. Small items can also be frozen at 0 F for 72 hours. Remove and replace all infested structural wood whenever possible once an infestation is discovered. The wood should be burned or disposed of in a landfill. If removal of infested materials is not possible, chemical controls maybe required. Contact your local pesticide distributor for the latest information on products available for your site and situation. Oils or other adjuvants may be required to achieve penetration of the chemical control into the wood. Fumigation may be required for severe infestations. **Use of fumigants requires additional certification in Category L2, Non-soil Fumigation. Refer to the Category L2: Non-soil Fumigation chapter in this manual for more information.**

## Selected Industrial and Institutional Vertebrate Pests

**Rats and Mice:** Rats and mice are the rodents most likely to be found in industrial and institutional sites. These rodents eat and contaminate food and animal feed. They also cause structural damage by chewing both wood and wiring. They carry diseases contagious to humans, such as Rickettsial pox, bubonic plague and leptospirosis.

**No control method will be successful unless mice and rats are kept from entering the site.** Seal any opening over ¼-inch wide. Use good sanitation practices and remove any food supply that may attract these rodents. Use rodent-proof containers to store all food and animal feed to prevent attracting and feeding these pests. Line garbage cans with plastic bags, and put garbage cans up on racks. Make entranceways rodent-proof. All of these practices will discourage both rats and mice.

Anticoagulant baits are the most commonly used chemical controls. Use care when placing them. Pesticide baits must be applied in approved bait stations.

Snap traps can be effective, provided exclusion measures are also put in place. Baits for trapping include peanut butter plus oatmeal, bacon, gumdrops or other candy, sardines, nutmeats, dried fruit or anything oily.

Rat and mouse urine fluoresces under UV light. This characteristic can be used to locate their trails and commonly frequented areas. Bait and trap in these areas. Check traps daily and use care when handling dead rodents.

Norway rats are good climbers, jumpers and diggers. They contaminate 25 times as much as they eat by urination and defecation. They eat a wide variety of foods but are wary of new food items. Pre-baiting may be required. They are active mainly at night.

Roof rats are not widespread in Nevada and are primarily found in Las Vegas and the vicinity. Excellent climbers, they live in trees and often nest in palms, etc. They can transmit diseases, especially plague. Controls are similar to control measures for the Norway rat.

House mice are very prolific and can have six to eight litters per year. Mice harbor mites that spread rickettsial pox. They are random feeders, so set baits or traps 10 feet to 15 feet apart. The life span of a mouse in the wild is usually less than one year.

**Deer Mice:** Deer mice can carry hantavirus. Although the chance of infection is low, the mortality rate is high. As with other mice and rats, anticoagulant baits, snap traps and excluding the mice from structures are recommended management measures. Clean up droppings and urine with disinfectants or a 5% to 10% bleach solution. Do not sweep, vacuum or atomize these wastes.



### Rat

Clipart ETC, Florida's Educational Technology Clearinghouse, University of South Florida,  
<http://etc.usf.edu/clipart/index.htm>

**No control method will be successful unless mice and rats are kept from entering the site.**



### Deer Mouse

Clipart ETC, Florida's Educational Technology Clearinghouse, University of South Florida,  
<http://etc.usf.edu/clipart/index.htm>



### Little brown bat

Ohio Department of Natural Resources,  
<http://www.dnr.state.oh.us>

**Exclusion is the best method of control for all industrial and institutional pests.**

Use a micron-filtered dust mask and gloves during the cleanup. Close openings over one-quarter inch in size to exclude further infestation. See the Category K: Public Health Pest Control chapter in this manual for further information on deer mice and hantavirus.

**Bats:** Big brown and little brown bats are the most common species found in buildings in Nevada. Nursery colonies are produced in summer. Occasionally, these nursery sites are in the attics or basements of buildings or in other structures. These sites may also be used for hibernation during the winter. The best control is exclusion. Young bats must be able to fly before an exclusion strategy will work. If you seal entry/exit points while young are present, they will die inside the building. This results in additional problems. Make sure the bats have departed for the evening and then seal up all openings greater than ¼-inch wide. This includes vents, chimneys and other openings in the roof, eaves or soffits, gaps around windows or doors, gaps around conduits or pipes, and holes or gaps in window screens. For migratory species, the best time to implement exclusion measures is during fall or winter. Bats can carry rabies, but the infection rate is low. Most bat bites occur when people handle or provoke a bat. As with all animals, use caution and common sense when handling dead bats. Some species of bats in Nevada are protected. No chemicals are registered for bat control.

### Summary

If a pesticide application is warranted, use extreme caution when applying the pesticide. Pesticide formulations change all the time. Consult your local pesticide dealer for the correct product to use in your situation.

Originally published in 1987 as Category 7a and 7b, Industrial and institutional Pest Control, Nevada Pesticide Applicator's Certification Workbook, SP-87-07, by W. Johnson, J. Knight, C. Moses, J. Carpenter, and R. Wilson.  
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