

# Ohio Pesticide

# Applicator

# Training

Wood  
Preservation

Student Workbook

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**Acknowledgements**

The beginning text of this publication was produced by the University of Georgia Cooperative Extension Service.

We would like to express our appreciation to the following individuals for contributing to or reviewing the manuscript prior to publication:

*Tom Harrison*  
Ohio Department of Agriculture

*Randall Heiligman*  
Department of Natural Resources, Forester

*Jack Kerrigan*, Extension Agent  
Cuyahoga County

*Robert Romig*  
Department of Natural Resources, Wood Products

**How to Use this Workbook**

Users of this workbook should read the text in this book and Bulletin 740 *Wood Preserving Chemicals and Procedures* before attempting the workbook. Bulletin 740 is published by The Ohio State University Extension and is available from any of The Ohio State University Extension offices.

When completing this workbook, use the flap on the back cover to conceal the answers while answering the questions on the left-hand page. Once all the questions are answered, the user should check to see if the responses are correct, mark those incorrect, and read the explanation for each question.

This guide for applicators and handlers of wood preservatives and wood treated products contains information you must know to meet category standards. This guide discusses the prevention of wood deterioration and degradation. It includes: recognition of pests and the damage they can cause, methods of control, and environmental and safety precautions.

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8/95—1M—130887

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Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, Keith Smith, Director of The Ohio State University Extension.

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# PESTS THAT DAMAGE WOOD

Under proper use conditions, wood can give centuries of good service. But under unfavorable conditions, wood may readily be damaged and destroyed by fungi, insects, and marine borers. These pests can attack in many ways, using the wood for food or shelter. Consequently wood must be protected to insure maximum service life when used under conditions favorable to these pests.

## Wood-Inhabitation Fungi

Wood decay, mold and most sapwood stains, are caused by fungi. These fungi feed on living or dead wood. The many fungi that develop on or in wood can be divided into two major groups, depending on the damage they cause:

- \* wood-destroying fungi (decay fungi),
- \* wood-staining fungi (sapstaining fungi, mold fungi).

Both of these fungi groups produce spores (analogous to tiny seeds), which are distributed by wind and water. The spores can infect moist wood during storage, processing and use.

All fungi that grow on wood have certain basic requirements:

- \* Favorable temperature - usually ranging between 50 degrees and 90 degrees F. The optimum is about 70 degrees to 85 degrees F. Wood is basically safe from decay at temperatures below 35 degrees F and above 100 degrees F.
- \* Adequate moisture - Fungi will not attack dry wood ( i.e. wood with a moisture content of 19 percent or less). Decay fungi require a wood moisture content (M.C.) of about 30 percent ( the generally accepted **fiber saturation point** of wood). Thus, air dried wood, usually with a M.C. not exceeding 19 percent and kiln dried wood with a M.C. of 15 percent or less can usually be considered safe from fungal damage.
- \* Adequate oxygen - Fungi cannot live in water-saturated wood
- \* Food source (wood itself).

## 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 rootlike shapes.

The color of these growths may range from white through light brown, bright yellow, and dark brown. The spore-producing bodies may be mushrooms, shelf-like brackets, or structures with a flattened, crustlike appearance. Fine, threadlike fungal strands grow throughout the wood and digest parts of it as food. In time, the strength of the wood is destroyed.

Decay will stop when the temperature of the wood is either too low or too high or when the moisture content is drier than the fungi's requirements. However, decay can resume when the temperature and moisture content become favorable again.

Wood decay fungi can be grouped into three major categories:

- \* brown rot,
- \* white rot, and
- \* soft rot.

**Brown rot** - Fungi which cause brown rot are able to break down the cellulose component of wood for food, leaving a brown residue of lignin. Brown-rotted wood can be greatly weakened even before decay can be seen. The final stage of wood decay by the brown rots can be identified by:

- \* dark brown color of the wood
- \* excessive shrinkage
- \* cross-grain cracking, and
- \* the ease with which the dry wood substance can be crushed to powder.

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'. This is a poor term, because wood must have moisture and will not decay when it is dry.

A few fungi that can decay relatively dry wood have water-conducting strands that are able to carry water from damp soil to wood in lumber piles or buildings. These fungi can decay wood that otherwise would be too dry for decay to occur. They sometimes are called the 'dry rot fungi' or 'water-conducting fungi'.

**White rot** - White-rot fungi, which break down both lignin and cellulose, have a bleaching effect which may make the damaged wood appear whiter than normal.

**Soft rot** - Soft rot fungi usually attack green (water-saturated) wood (high M.C.), causing a gradual softening from the surface inward that resembles brown rot.

## The Wood-Staining Fungi

**Sapstaining fungi** - These fungi penetrate and discolor sapwood, particularly of the soft wood species. Typical sapstain, unlike staining by mold fungi, cannot be removed by brushing or planing. Sapstain fungi may become established in the sapwood of standing trees, sawlogs, lumber and timbers soon after they are cut and before they can be adequately dried. Strength of the wood is little affected, but the wood may not be fit for uses where appearance is important (such as siding, trim, furniture and exterior millwork that is to be clear-finished).

Southern pine beetles often carry blue stain fungi into trees. This can cause the wood of infected trees to be stained before they are cut.

**Mold fungi** - These fungi first become noticeable as green, yellow, brown or black fuzzy or powdery surface growths on softwoods. Freshly cut or seasoned stock, piled during warm, humid weather, may be noticeably discolored in 5 to 6 days or less. 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.

## Chemical Stains

Chemical stains may resemble blue or brown stains, but are not caused by fungi. These stains result from chemical changes in the wood during processing or seasoning. The most important chemical stains are the **brown stains** that can downgrade lumber for some uses. They usually can be prevented by rapid drying at relatively low temperatures during kiln drying.

## Insects

Several kinds of insects attack living trees, logs,

lumber and finished wood products for food and/or shelter. These pests include various termites, ants, and beetles.

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

Ants cannot use wood for food, but they are often confused with termites because the two look somewhat similar. However, there are several distinct differences in their physical appearance. Ants have 'elbowed' antennae; termites do not. Ants have narrow waists whereas termites' bodies are broad. Ants' wings have few veins and the hind wings are smaller than the front wings. Both pairs of termite wings are similar in shape and size and have very small veins.

Termites are divided into three major groups.

- \* Subterranean or ground-inhabiting termites
- \* Drywood Termites
- \* Dampwood Termites

*Subterranean Termites* - These termites attack wood products in buildings and other wood products throughout most of continental United States, but most damage occurs in the warm, southern coastal regions along the Atlantic Ocean and Gulf of Mexico.

At certain seasons of the year, winged males and females are produced by the termite colony. They swarm, mate, lose their wings, and attempt to begin a new colony in the soil. Termites build tunnels through earth and around obstructions to get to a source of food (either sound or decaying wood). They also require a constant source of moisture - usually obtained from the soil.

The presence of subterranean termites may be noted by:

- \* the swarming of winged, ant-like insects and the 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

**Drywood Termites** - Drywood termites are found naturally only in Hawaii, Puerto Rico, and in a narrow strip of land extending from southern California and Texas to Florida and along the Atlantic coast to Virginia.

After swarming, drywood termites enter cracks and crevices in dry, sound wood. In excavating their galleries, they occasionally discharge oval-shaped fecal pellets through temporary openings in the wood surface. The ability of the drywood termite to live in dry wood surface. 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.

**Dampwood Termites** - Dampwood termites are a serious pest along the Pacific Coast. They do not require contact with the soil, but do need wood with a high moisture content.

## Ants

Carpenter ants may be black or red. They usually live in stumps, trees, or logs, but often damage poles or structural timbers set in the ground. Elevated portions of buildings, such as windowsills and porch columns, are susceptible to damage. Carpenter ants use wood for shelter not for food. They usually prefer wood that is naturally soft or has been softened by decay. The galleries are large, smooth and, unlike those of termites, are free of refuse and powdery wood. Mounds of sawdust indicate their presence.

## Beetles

**Powder Post or Lyctus Beetles** - Powder post beetles attack both freshly cut and seasoned hardwoods and softwoods. They attack the sapwood of ash, hickory, oak, and other hardwoods.

Adults lay eggs in the wood pores. The larvae burrow through the wood, making tunnels from 1/16- to 1/12-inch in diameter, packed with a fine powder. After a larval period (from a few months to a year, or longer - depending on the species) and a much shorter pupal stage, newly formed adults chew holes through the wood surface and emerge to lay eggs for another brood. Signs of damage by powder post beetles are:

- \* small round 1/16' holes in the surface of the wood made by emerging adults, and

- \* fine powder that falls from the wood.

**Anobiid beetles** - may attack softwoods in damp and poorly ventilated spaces beneath buildings. Eliminating the source of moisture will cause the colony to slowly die out.

**Roundheaded Borers** - A longhorn beetle, commonly known as the old house borer, damages seasoned pine timbers. The larvae bore through the wood. Over many years their tunneling can weaken structural timbers, framing members, and other wooden parts of buildings. Contrary to its name, the old house borer most often infests new buildings. It is found in the Eastern and Gulf Coast States.

Larvae reduce sapwood to a powdery or sawdust-like consistency. They may take several years to complete their development. While working in the wood, they make a ticking or gnawing sound. When mature, the adult beetle makes an oval emergence hole about 1/4 inch in diameter in the surface of wood.

**Flatheaded Borers** - 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. Adults are often called metallic wood-boring beetles because of their color. They are about 3/4 inch long, with wing covers usually rough, like bark.

## Marine Borers

Extensive damage is done to submerged portions of marine pilings, wharf timbers, and wooden boats by a group of animal organisms known collectively as marine borers. In the United States they are especially active in the warm waters of the Pacific, Gulf, and South Atlantic coasts. Untreated timbers can be destroyed in less than a year.

The major marine borers are the **shipworm** and **pholad** mollusks (related to the clams and oysters), and the **crustacean borers** (related to the crabs and lobsters).

# CONTROL OF PESTS THAT DAMAGE WOOD

If wood is to be used where it will be subject to pest attack, it must be protected. This protection can be achieved by:

- \* control of moisture content
- \* use of a wood that is naturally resistant to the pests
- \* chemical treatment

In addition, mechanical barriers (such as metal termite shields and caps on pilings, poles and posts) are sometimes used, but are usually ineffective.

## Moisture Control

The moisture content of living trees and the wood products obtained from them may range from about 30 percent to more than 200 percent. Much of this moisture must be removed for most uses. 'Green' lumber usually is dried:

- \* to prevent stain and decay
- \* to reduce damage by insects,
- \* to reduce uncontrolled dimensional change (shrinkage),
- \* to reduce weight and increase strength, and
- \* to prepare the wood for treatment with chemical preservatives.

The amount of water in wood (its moisture content) is usually expressed as a percentage of its oven dry weight. The moisture is measured by:

- \* the oven-drying method—a small sample of wood is weighed, dried, and reweighed until it has reached a constant weight when subjected to temperatures of 212 degrees - 220 degrees F.
- \* the electrical method - use of a moisture meter that measures moisture by electrical resistance.

Timber or logs stored for a long time before processing can be protected from fungi and insects by:

- \* keeping the logs submerged in a pond of water
- \* keeping them under constant water spray

The water reduces the oxygen content and temperatures necessary for growth of fungi.

**Seasoning or Drying** - The moisture content of wood is reduced by:

- \* air drying in a yard, shed or pre-drier
- \* drying in a kiln, retort or by radio frequency

The most efficient and most widely used system is kiln drying. It offers better control of air movement, temperature and drying rate than air drying. Although kiln drying is more expensive in terms of capital investment and energy cost, it is much faster and provides more uniform and better quality drying. Unless lumber is properly stacked and protected, air drying may result in surface checking, end cracking, warping, staining and discoloration due to weathering.

Even after being well-seasoned, wood may again reach a moisture level favorable to pests if exposed to rain or prolonged high humidity and favorable temperatures.

## Storage and Handling

To avoid pest induced degrading of lumber during storage or handling, you should:

- \* Convert logs into lumber as quickly as possible.
- \* Dry the lumber as quickly as practical, even after pressure treatment with a preservative chemical, to prevent degrading (surface checking, and end cracking).
- \* Locate air-drying yards and sheds on well-drained sites with good air circulation, and keep the yards free of weeds.
- \* Practice good sanitation by removing debris or rotted wood which serves as source of fungal infection and insects.
- \* Inspect stored wood products often. Termites, for example, may invade untreated stacked lumber if it remains undisturbed for long periods.
  - \* Avoid rough handling of treated wood. Chipping, gouging, or splitting can expose unprotected interior wood and allow attack by decay fungi.

## Use of Naturally Resistant Wood

The sapwood of all native tree species and the heartwood of most species have a low natural resistance to decay. However, the heartwood of some species is quite resistant. Examples are the heartwood of old-growth bald cypress (limited supply), cedar, redwood, and post oak. They are resistant but definitely not immune to attack by decay fungi and insects. Black locust and resinous southern pine heartwood, called 'fatwood' or 'lighterwood' is also highly resistant to decay.

Unfortunately, some naturally resistant woods are expensive or unavailable in commercial quantities (i.e. chestnut) or in dimensions needed. Because of high costs for labor and materials, the variable and undependable resistance of these species should preclude their use for most high hazard construction applications.

## Chemical Control

The proper application of chemical preservatives can protect wood from decay and stain fungi, insects and marine borers, thus prolonging the service life of wood for many years.

The affectiveness of preservative treatment depends on the chemical formulation selected, method of application, proportion of sapwood to heartwood, moisture content of the wood, amount of preservative retained, depth of chemical penetration and distribution. Sapwood of most commercial species accepts preservatives much better than heartwood, and softwood species are generally more receptive to impregnation than the hardwoods. Preservative treatment by pressure is usually required for most wood products used for structure and other applications exposed to high risk of attack by fungi, insects or marine borers.

**Type of Preservatives** —Wood preservatives fall into three broad categories:

- \* creosote and creosote solutions,
- \* oilborne preservatives, and
- \* waterborne preservatives.

*Creosote and Creosote Solutions* - Creosote, and oily byproduct of making coke from bituminous coal, is widely used as a preservative for such products as railroad ties, large timbers, fence posts, poles, and pilings.

### Advantages:

- \* toxic to wood-destroying fungi, insects, and some marine borers,
- \* low volatility,
- \* insolubility in water,
- \* ease of handling and application.

### Disadvantages:

- \* dark color,
- \* strong odor,
- \* oily, unpaintable surface,
- \* tendency to bleed or exude from the wood surface,
- \* should not be used in homes or other living areas because of toxic fumes.

*Oilborne Preservatives* - These chemicals are generally insoluble in water. They are usually dissolved in petroleum or other organic solvents in order to penetrate wood. Research developments have recently made available oilborne preservatives formulated as water- in -oil emulsions or dispersions in water.

### Advantages:

- \* toxic to fungi, insects and mold,
- \* can be dissolved in oils having a wide range in viscosity, vapor pressure and color,
- \* low solubility,
- \* can be glued depending on the diluent or carrier, and
- \* ease of handling and use.

### Disadvantages:

- \* can leave an oily, unpaintable surface, depending on the carrier,
- \* for some applications provides somewhat less physical protection to wood than creosote,



- \* should not be used in homes or other living areas because of toxic fumes, and,
- \* it's toxic and irritating to plants, animals and humans.

Pentachlorophenol (penta) is the most commonly used oilborne preservative. It is used to commercially treat poles, lumber, crossarms, timbers, and fence posts.

Penta is also used by do-it-yourselfers to treat a variety of wood products by nonpressure methods such as brushing, spraying and dipping. These superficial treatments can also temporarily preserve wood during shipping, storage or in low hazard situations such as millwork and siding. Penta is not recommended for marine installations, use inside buildings or use close to plants.

**Waterborne Preservatives** - This class of preservatives includes various metallic salts and other compounds. The principal compounds used are combinations of copper, chromium, arsenic and fluoride.

Waterborne preservatives have gained increasingly wider usage for lumber, plywood, fence posts, poles, pilings and timbers.

**Advantages:**

- \* treatment presents no hazard from fire or explosion.
- \* the wood surface is left clean, paintable and free of objectionable odors.
- \* safe for interior use and treatment of playground equipment.
- \* leach resistant.

**Disadvantages:**

- \* unless re-dried after treatment, the wood is subject to warping and checking,
- \* does not protect the wood from excessive weathering.

Wood treated with copper-8-quinolinolate has been approved for food contact uses such as for boxes, crates, pallets, truck decking and related uses involving the harvesting, storage and transportation of food.

# APPLICATION OF WOOD PRESERVATIVES

## Preparation of Wood for Treatment

For most of the commercial wood treatments in common use, wood must be prepared in some way before a preservative is applied. This preparation may include peeling, drying, conditioning, incising, cutting, and framing.

**Peeling** — The bark and cambium must be completely removed before treatment. This allows the preservative to penetrate into the wood. Bark obstructs penetration, resulting in exposed untreated wood.

**Drying** — In most treating methods, a high moisture content prevents or slows the entrance of the preservative into the wood cells. Drying the wood allows better penetration of the preservative, reduces product weight and shrinkage with its potential for warping and checking after treatment.

Kiln drying is one method for accelerating drying under controlled drying conditions.

**Conditioning** — Operators of pressure treating plants can use several other methods besides conventional drying to condition wood for treatment. In the steaming and vacuum process, green wood is steamed in a treating cylinder or retort for several hours and then subjected to a vacuum. The vacuum reduces the boiling point of the water in the wood and speeds its removal. Then the evaporated water can be replaced by the preservative, applied under pressure.

Another method of conditioning green wood is boiling under vacuum (Boulton method). The wood is placed in a treating cylinder and submerged in hot oil. Then a vacuum is applied, removing water from the wood. With this method, wood can be conditioned at a lower temperature. Consequently, it can be used to avoid damage to a wood species (such as a Douglas fir) which is sensitive to the higher temperatures of the steaming and vacuum process.

A third method of conditioning is known as vapor drying. In this process green wood is exposed to hot

vapors or an organic compound, such as xylene, which gradually vaporizes and removes the water.

**Incising** — Incising consists of making a series of narrow holes or slits in the wood about 1/2- to 3/4-inch deep. This allows preservatives to better penetrate impregnation-resistant wood species (such as Douglas fir). Incising makes possible a more uniform penetration to at least the depth of holes.

**Cutting and Framing** — Cutting, shaping or drilling wood after treatment can expose untreated wood. This exposure can be avoided by cutting, shaping or boring the wood for its intended use before the preservative treatment. The treated wood then can be used without further machining.

## Methods of Applying Wood Preservatives

There have been almost as many methods for applying wood preservatives as there are different preservatives. Only the ones in current use will be discussed. The treating method selected depends greatly on the ultimate use of the product. The two major types of treatment are pressure and non-pressure methods. Many variations of these methods are described in the standards and specifications of the American Wood Preservers Association (AWPA), the Federal Government, and other organizations.

**Pressure Processes** — We might expect wood to treat easily because of its porous structure, but wood is surprisingly resistant to deep penetration by preservatives. The basic principle of pressure processes involves the placement of wood materials in an airtight, steel cylinder or retort and immersing it in a preservative under pressure to force the preservative into the wood. Impregnation of preservatives by pressure is the most common method used in the commercial treatment of wood. It has several advantages:

- \*it gives a deeper and more uniform penetration,
- \*it allows better control over retention,
- \*wood can be preconditioned in the chamber,

- \*it is quicker and more reliable than non-pressure methods, and
- \*it can comply with the code regulations and engineered specifications.

There are two basic variations of the pressure treatment method: the full-cell process and the empty-cell process.

With either method, it is important to closely follow established standards on:

- \*preparation of the wood product to be treated,
- \*amount and duration of vacuum and of pressure,
- \*solution temperature (when critical),
- \* treating time,
- \*type of preservative, and
- \*concentration of the preservative.

**Non-Pressure Processes** — Non-pressure methods may be satisfactory where deep penetration, high levels of retention and precise treatment are not required. The effectiveness of non-pressure methods depends on the kind of wood, its moisture content, method and duration of treatment and the preservative used.

There are many methods of applying preservatives to wood without the use of pressure. Some of the more widely-used methods are described:

***Brushing, Spraying and Pouring Treatments*** -

With these methods, creosotes-oil-borne preservatives, or water-borne salts are applied to the surfaces of the wood product to be treated. The wood should be thoroughly air dried before treatment and, if oil-borne preservatives are used the wood should be warm enough to avoid congealing the oil. Penetration by dipping or spraying is superficial, resulting mostly from capillary action, so only limited protection is afforded. The preservative should be flooded over the wood surfaces and be allowed to soak in. Two applications are desirable, but the second should not be applied until the first has dried and soaked into the wood. Brushing, spraying or pouring treatments probably are most widely used for protecting areas of previously treated wood that have been cut or ma-

chined, thereby exposing untreated surfaces or joints.

***Dipping*** - Treatment by dipping consists of immersing wood in a preservative solution for several seconds or several minutes. As with brushing - type treatments, the wood should first be well dried before treatment. Although dipping is better than brushing for penetration of preservatives into the checks and cracks of wood surfaces, and may add 2 to 4 years of protection over untreated wood, dipping is unsatisfactory for uses subject to abrasion. Probably the principal use of dipping is for window frames employing an immersion of 3 minutes.

***Cold Soaking*** - Cold soaking is commonly used for treating round, fence posts and sawn timbers using pentachlorophenol or other viscous, **oil-borne** preservatives. The process involves the soaking of dried wood for 2-7 days in a vat containing the unheated liquid oil preservative. Cold soaking has been popular for farm use because of its simplicity and low cost.

***Steeping*** - The steeping process employs a water-borne salt preservative solution to either dry or green wood. It consists of submerging the wood in a tankful of the solution at atmospheric temperature for several days or weeks (heating the solution would speed up penetration). Absorption is rapid the first 3 days then continues at a decreasing rate almost indefinitely. When treating flat-sawn, wood products space should be provided between and around each piece of wood to permit complete exposure to the preservative material.

***Hot and Cold Bath (Thermal Process)*** - The hot and cold bath or thermal process, also called the boiling-and-cooling or open-tank treating method, is suitable with oil-based and water-borne preservatives. When used properly, the method provides a reasonably effective substitute for pressure impregnation. The process is quite simple involving the use of one or two tanks. With two tanks the wood product first is immersed into a hot solution usually of the preservative, itself, or even boiling water, followed by its immersion into a tank of cold solution. Most preservative absorption and penetration takes place during the cold bath. When one

tank is used, heating can be discontinued, allowing the wood and preservative to cool together.

**Double Diffusion** - Treatment by double diffusion is a two stage dispersing of a preservative liquid into a piece of wood. An example of the process would be to first soak a green wood product, such as a post, in a solution of copper sulfate. When a sufficient amount of the chemical has diffused into the wood, it is then immersed in a second solution consisting of sodium arsenate and sodium chromate. The purpose of double diffusion is to convert very leachable, chemical salt solutions into fixed and stable preservatives within the wood.

**Vacuum process** - In the vacuum process wood products are enclosed in an airtight container from which air is removed with a vacuum pump. The container then is filled with the preservative without additional pressure and without the air re-entering. The partial removal of air from the wood, by the vacuum, followed by addition of the preservative creates a slight pressure that drives the preservative into the wood. Vacuum treatment works well with penta and easily treatable woods and products like pine, window stock.

**Preservative Pads or Bandages (Treatment on Site)** - There are several variations of employing this treating concept: The preservative can be applied to the surfaces of the wood, can be injected into the wood or placed into holes drilled in the wood. The preservative used can be water-borne, solvent in oil or have a consistency of grease or mayonnaise.

This method is most often used to extend the life of standing poles that had previously been treated. Since treated poles are costly, consideration must be given to replacement costs, including treatment and installation, so a 5-year increase of service life would be a very worthwhile expenditure for preservative bandage treatment.

The major task of this treating process involves removal of soil from around the pole for a depth of about 18'. This part of the pole, below ground, and the part 12' above ground is the portion most vulnerable to decay and failure. All decayed wood and soil must be removed from the pole and the preservative should be applied thoroughly to the 'cleaned' portion of the pole.

This treated area should then be wrapped with a heavy duty, water resistant paper or plastic film to confine the preservative to the pole.

**Sapstain (Blue Stain) Prevention** - Sapstain fungi do not decay their wood host, but they degrade lumber and other wood products and lower their value. Also, sapstain fungi often precede the decay fungi because conditions favorable for attack (high temperatures and humidity) are comparable for both types of fungi.

To protect green logs, poles and other round timbers, they should be processed soon after trees are felled. If they cannot be processed promptly, the timbers should be stored submerged in water or be subjected to a continuous spray of water. When these storage methods are not feasible, protection for several months can be afforded by application of a chemical spray containing a solution of benzene hexachloride and penta in fuel oil. The entire log and especially the ends must be sprayed thoroughly soon after a tree is felled and bucked into logs.

With regard to lumber, during prolonged periods of warm, humid weather, the prospect of staining is almost inevitable in the sapwood of untreated, susceptible species such as the pines. Since stain can develop within 4 days, under favorable conditions, chemical treatment should be applied within 24 hours after sawing green logs. Sapstain preventing solutions are available under various trade names. Protection is usually provided at the sawmill by carrying the rough sawn, green lumber on the moving 'green chain' through a tank or through the treating solution. Stain treatments do not provide long-lasting protection. Consequently, after treatment, the lumber should be stickered and properly piled for rapid air-seasoning or kiln drying.



## Factors Influencing the Effectiveness of Wood Preservatives

Federal Specifications TT-W-571 and the Standards of the American Wood Preservers Association (AWPA) are commonly used by the wood preserving industry and consumers of treated wood to regulate the wood preserving process and better insure its suitability for specific applications.

**Penetration** — The effectiveness of a wood preservative depends on several treatment factors, one of which is the depth of its penetration into the wood. Inadequate chemical penetration may allow fungi and insects to enter through checks or cracks in the thin shell of treated wood in order to reach the inner, unprotected wood.

The depth of penetration attainable by a wood preservative depends on the wood species, the proportion of sapwood to heartwood and the treatment process used. The sapwood of most species is fairly easily penetrated when well-dried and pressure treated. The treatment of heartwood is much more variable than sapwood. For instance, the heartwood of southern yellow pine and maple can be impregnated to depths of about one-fourth to one-half inch. Red oak can be completely penetrated, whereas it is almost impossible to penetrate the heartwood of white oak or western red cedar with commercial pressure treating processes.

**Retention of Preservatives** — Even with the proper preservative penetration, good protection cannot be achieved unless enough preservative stays in the wood. For example, the minimum retention of creosote for lumber used in coastal (salt) waters is 25 lbs./cu. ft. (AWPA C-2), while for similar wood products in fresh water only 10 lbs. of creosote/ cu. ft. is required. By contrast, water soluble salt preservatives only require retentions of 0.2 lbs. to 2.25 lbs./cu. ft. depending on use.

**Selection and Conditioning of Wood** — Federal Specifications TT-W0571 and AWPA Standards identify the wood species that are acceptable for treatment for various uses. Selection of a species or grade of wood for a particular use should be based on

the applicable grading rules. These rules take into consideration such properties of the wood as knot sizes, warp, splits and grain which may limit some uses.

The drying and conditioning of wood before treatment significantly influences the effectiveness of the treatment, as discussed earlier in this chapter.

**Handling After Treatment** — Treated wood should be handled with sufficient care to avoid cutting or breaking through the treated area and exposing the underlying untreated wood.

Throwing, dropping or gouging treated wood may cause damage that expose untreated wood. When damaged in this way, the exposed wood should be retreated. This is usually done by in-place treatment (brushing). When treated wood is machined, thereby exposing untreated wood, such as by boring or cutting the ends of piles after driving a prescribed preservative should be applied to the exposed wood (AWPA M4 Standards).

**End Use** — Treated wood that is used for a purpose for which it was not intended may result in an unsatisfactory service life. For example, pilings treated to meet specifications for fresh water should not be used in marine waters.

Some end-uses will place a greater physical stress on treated wood than other uses and will result in a shorter service life. The cost of replacement for some end-uses may justify periodic retreatment of wood, on site, to prolong its service life.

# PROTECTING HUMAN HEALTH

## Introduction

Most chemicals used to protect wood from insects and decay are toxic in order to be effective. The goal is to select chemicals and methods that will control the pests without harming the applicator, the user, the public, or pets. It is the responsibility of the management of any wood preserving operation to ensure that the proper handling procedures, protective clothing and any necessary equipment (such as respirators) are supplied to workers in conformance with label instructions to protect their health.

The EPA-approved labeling on pesticide products, including wood preservatives, is the **primary** source of information on application methods, precautionary measures for workers, emergency first aid for high level exposures, and disposal instructions for used pesticide materials and containers. The label has the force of law, and it is the provisions of the label which are enforced by state regulatory agencies. Thus, the label for each formulated product used at a wood treatment operation should be readily available, and all responsible personnel should be familiar with their contents.

## Hazards to Applicators

All handlers of wood preservatives need to know about potential hazards and necessary precautions. Since risks are directly related to degree of exposure, most of the risks associated with wood preservatives comes from their application and the volatilization that occurs soon after treatment, rather than from use of the treated wood itself. The decision by EPA to classify three of the major wood preservatives, creosote, inorganic arsenicals, and pentachlorophenol, for restricted use was based on the potential human risk from chronic toxicity (exposure over a long period of time). Applicators as a group are the people most likely to be exposed over long periods, and consequently need to take precautions as a normal and routine part of working with wood preservatives.

Exposure to wood preservatives can occur in a variety of ways: during handling and mixing the chemicals, entering pressure- treatment cylinders,

working around spray or dip operations, handling freshly treated wood, cleaning/servicing equipment or disposing of wastes. Closed systems for handling the chemicals and mechanically handling treated wood help to reduce potential exposure, but do not eliminate the possibility of some routine or accidental exposure for workers.

Wood preservatives, like other pesticides, can enter the body in three ways.

\*oral

\*dermal

\*respiratory

Since many wood preservatives have a strong odor and taste, it is unlikely a person would swallow a dangerous amount. The more likely forms of exposure are dermal (skin) contact, or inhalation of vapors, dust or particles, particularly if protective clothing and other precautions are not observed.

## Toxicity

The decision by the Environmental Protection Agency to classify for restricted use the three principal wood treatment preservatives is based on evidence that:

1. creosote causes cancer in laboratory animals and has been associated with skin cancer in some workers occupationally exposed to creosote;
2. creosote and inorganic arsenicals also cause **mutagenic** effects (gene defects) in bacteria and laboratory animals;
3. arsenic has been shown in epidemiology studies to be associated with cancer in humans who either drank water contaminated with arsenic or who breathed air containing arsenic.
4. pentachlorophenol has produced defects to the offspring of laboratory animals; and
5. a dioxin contaminate (HxCDD) in pentachlorophenol has been shown to cause cancer in laboratory animals.

Because of the potential hazard of these preservatives, there are new EPA label requirements for their handling and end use. In addition to the potential hazards of chronic toxicity, a single or short term exposure can cause the following acute health effects.

## Creosote

\*can cause skin irritation; vapors and fumes are irritating to the eyes and respiratory tract; and prolonged and repeated exposure may lead to dermatitis.

## Pentachlorophenol:

\*Irritating to eyes, skin and respiratory tract.

\*Ingestion of penta solutions, inhalation of concentrated vapors or excessive skin contact may lead to fever, headache, weakness, dizziness, nausea, and profuse sweating. In extreme cases, coordination loss and convulsion may occur: high levels of exposure can be fatal.

\*Prolonged exposure can lead to an acne-like skin condition or other skin disorders, and may cause damage to the liver, kidneys or nervous system.

## Inorganic arsenicals:

\*exposure to high concentrations of arsenical compounds can cause nausea, headache, abdominal pain (if material was swallowed); extreme symptoms can progress to dizziness, muscle spasms, delirium and convulsion.

\*Prolonged exposure can produce chronic, persistent symptoms of headache, abdominal distress, salivation, low-grade fever, and upper respiratory irritation.

\*long term effects can include liver damage, loss of hair and fingernails, anemia and skin disorders.

## First Aid

Since accidents do happen, first aid information on the chemical(s) in use must be readily available. The product label gives basic first aid directions, as do Material Safety Data sheets supplied by chemical

manufacturers. The following general steps are applicable for accidental exposure to wood preservatives.

\*In cases of skin contact, first remove contaminated clothing that's in contact with the skin, immediately wash the affected areas with mild soap and water. Don't irritate the skin with vigorous scrubbing. Later, if you notice inflamed skin, redness or itching in the affected area, consult a doctor.

\*In cases of eye contact, immediately flush the eyes with running water. Lift the upper and lower eyelids for complete irrigation and continue for fifteen minutes, then see a doctor.

\* If accidental inhalation has occurred, move the victim to fresh air and apply artificial respiration as needed. Get medical help immediately.

If chemical preservative has been swallowed, call medical help immediately:

+ if creosote or penta was swallowed, first give one or two glasses of water, induce vomiting, then administer two tablespoons of 'USP Drug Grade' activated charcoal in water.

+ If an arsenical chemical has been swallowed, drink large quantities of water, or milk if available. Get professional medical help immediately.

\* Never attempt to give anything by mouth to an unconscious person.

\* Never induce vomiting in an unconscious person.

## Protecting the Applicator

### General

\* Good work habits are reflected in the general precautions included on all wood preservative labels. These basic, common-sense hygiene rules can significantly reduce risks of chronic exposure to wood preservative chemicals.

For example:

\* Don't eat, drink or smoke in the work area - worker's hands can transmit residues to what ever they touch.

\* Wash hands often, especially before using the restroom, smoking or eating.

- \* Remove gloves to handle paper work, phones or equipment which others may handle with unprotected hands.
- \* At commercial treatment plants, protective clothing must be left at the plant. If work clothes must be laundered at home, wash them separately from other laundry.
- \* Protective clothing requirements will be specified on the label. These will include use of impermeable gloves for applying the preservatives and in all situations where dermal (skin) contact is expected (e.g. handling freshly treated wood and manually opening pressure treatment cylinders). In certain situations such as spraying the chemicals and working around pressure treatment equipment, additional clothing may be required. Such clothing may include overalls, jackets, boots, respirators (properly fitting and maintained, approved by MSHA/NIOSH) goggles and head covering.
- Individuals who enter pressure treatment cylinders and other related equipment that is contaminated with the wood treatment solution (such as cylinders that are in operation or are not free of the solution) must wear protective clothing, including overalls, jacket, gloves, and boots, impervious to the wood treatment solution, and a respirator.

## Special Precautions

### Pentachlorophenol:

- \* For prilled, powdered or flaked formulations of pentachlorophenol: Until August 31, 1987, a closed emptying and mixing system must be used or protective clothing, including respirator, gloves, long-sleeved shirt and long pants or disposable coveralls, must be worn when emptying and mixing prilled, powdered or flaked formulations of pentachlorophenol. After September 1, 1987 a closed system must be used when emptying and mixing such formulations of pentachlorophenol.
- \* For the spray method of application, spray apparatus must (1) be operated so as to minimize overspray (i.e., no visible mist) and (2) be free of leaks in the system. Should there be a visible mist, spray applicators in the zone in which mist is visible must wear respirators and protective clothing (including overalls, jacket,

gloves, boots and goggles and head covering) impervious to the wood treatment formulation .

- \* Exposure to pentachlorophenol during pregnancy should be avoided.

### Arsenicals:

- \* All exposed arsenic treatment plant workers will be required to wear a respirator if the level of ambient arsenic is unknown or exceeds a Permissible Exposure Limit (PEL) of 10 micrograms per cubic meter of air (ug/m<sup>3</sup>) average over an 8 hour work day. This PEL is the same as the standard required by the Occupational Safety and Health Administration.
- \* Processes used to apply inorganic arsenical formulations shall leave no visible surface deposits on the wood. Small isolated or infrequent spots of chemical on otherwise clean wood shall be allowed.

## Limitations on Use

Recent EPA regulations on wood preservatives include some limitations on treating wood intended for certain uses, and on certain uses of treated wood. Be sure that the label allows you to use the preservatives for the specific use you intend. Not all of these limitations are the responsibility of commercial treaters, but these limitations should be known. The following is a summary of wood preservations use limitations.

- \* Pentachlorophenol and creosote cannot be applied indoors.
- \* Pentachlorophenol-or creosote-treated wood must not be used where there may be contamination of feed, food, drinking or irrigation water.
- \* **Pentachlorophenol** cannot be applied **to wood intended for use in interiors**, except for millwork (with outdoor surfaces) and support structures which are in contact with the soil in barns, stables, and similar sites and which are subject to decay or insect infestation. **A sealer must be applied in those instances.**
- \* **Creosote** cannot be applied to wood intended to be used in interiors except for those support structures which are in contact with the soil in barns, stables, and similar sites and which are



subject to decay or insect infestations. Two coats of a sealer **must be applied**.

- \* The application of pentachlorophenol to logs for construction of **log homes is prohibited**.
- \* If creosote or pentachlorophenol is applied to wood intended to be used where it will be exposed to body contact, sealants must be applied.

## Material Safety Data Sheet (MSDS)

Material Safety Data Sheets are available from the manufacturers and distributors of the wood preservatives they sell. These sheets contain information on such topics as toxicity and first aid, personal protection and controls, storage and handling precautions, spill-leak disposal practices, transportation, physical data and reactivity data.

You should have a MSDS on file for each different formulation that you use. Some states may have 'right-to-know' laws that will require you to do this.

## Voluntary Consumer Awareness Program

In order to apprise the consumer of the proper uses of treated wood and the proper precautionary measures to take when using such wood, the treated wood industry has developed a voluntary Consumer Awareness Program (CAP). The treated wood industry is committed to the implementation of the CAP and the education of the consuming public.

The treated wood industry will develop a model Consumer Information Sheet (CIS) containing use site precautions and safe working practices for each of the three types of preservatives. The CIS will serve as the main vehicle for conveying information about treated wood to consumers. The focus of the CAP will be on ensuring the dissemination of the CIS at the time of sale or delivery to end users.

The individual wood treater's CIS will, at a minimum, contain the language agreed to by AWPI, SAWP, NFPA, and EPA on the model CIS to the extent it applies to the wood preserver's product.

Wood treaters will be free to add other information to their CIS's such as the member's name, address,

and logo; but in all cases, the use site precautions and the safe handling practices information will be separate, legible, and prominent.

The primary responsibility for ensuring that the CIS is disseminated to the consuming public will reside with the wood treaters. This voluntary program may be modified by EPA at a later date.

## Inorganic Arsenical Pressure-Treated Wood

The following wording will appear on the Consumer Information Sheet (CIS) for inorganic arsenical pressure-treated wood:

### *Consumer Information*

This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing creosote to protect it from insect attack and decay. Wood treated with creosote should be used only where such protection is important.

Creosote penetrates deeply into and remains in the pressure-treated wood for a long time. Exposure to creosote may present certain hazards. Therefore the following precautions should be taken both when handling the treated wood and in determining where to use the treated wood.

### *Use site Precautions for Inorganic Arsenical Pressure-Treated Wood*

Wood, pressure-treated with waterborne arsenical preservatives, may be used inside residences as long as all sawdust and construction debris are cleaned up and disposed of after construction.

- Do not use treated wood under circumstances where the preservatives may become a component of food or animal feed. Examples of such sites would be structural or containers for storing silage or food.
- Do not use treated wood for cutting-boards or countertops.
- Only treated wood that is visibly clean and free of surface residue should be used in patios, decks and walkways.
- Do not use treated wood for construction of those portions of beehives which may come into contact with the honey.

Treated wood should not be used where it may come into direct or indirect contact with public drinking water, except for uses involving incidental contact such as docks and bridges.

### ***Handling Precautions for Inorganic Arsenical Pressure-Treated Wood***

Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with State and Federal regulations.

Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.

### **Creosote Pressure-Treated Wood**

The following wording will appear on the Consumer Information Sheets (CIS) for creosote pressure-treated wood:

**Consumer Information** - This wood has been preserved by pressure treatment with an EPA-registered pesticide containing creosote to protect it from insect attack and decay. Wood treated with creosote should be used only where such protection is important.

Creosote penetrates deeply into and remains in the pressure treated wood for a long time. Exposure to creosote may present certain hazards. Therefore the following precautions should be taken both when handling the treated wood and in determining where to use the treated wood.

### ***Use Site Precautions for Creosote Pressure-Treated Wood***

Wood treated with creosote should not be used where it will be in frequent or prolonged contact with bare skin (for example, chairs and other outdoor furniture) unless an effective sealer has been applied.

Creosote-treated wood should not be used in residential interiors. Creosote-treated wood in interiors of industrial buildings should be used only for industrial building components which are in ground contact and are subject to decay or insect infestation, and for wood block flooring. For such uses, two coats of an appropriate sealer must be applied. Sealers may be applied at the installation site.

Wood treated with creosote should not be used in the interiors of farm buildings where there may be in direct contact with domestic animals or livestock which may crib (bite) or lick the wood.

In interiors of farm buildings, where domestic animals or livestock are unlikely to crib (bite) or lick the wood, creosote-treated wood may be used for building components which are in ground contact and are subject to decay or insect infestation, if two coats of an effective sealer are applied. Sealers may be applied at the installation site.

Do not use creosote treated wood for farrowing or brooding facilities.

Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such use would be structures or containers for storing silage or food.

Do not use treated wood for cutting-boards or countertops.

Only treated wood that is visibly clean and free of surface residues should be used for patios, decks and walkways.

Do not use treated wood for construction of those portions of beehives which may come into contact with the honey.

Creosote-treated wood should not be used where it may come into direct or indirect contact with public drinking water, except for uses involving incidental contact such as docks and bridges.

Do not use creosote-treated wood where it may come into direct or indirect contact with drinking water for domestic animals or livestock, except for uses involving incidental contact such as docks and bridges.

### ***Handling Precautions for Creosote Pressure-Treated Wood***

Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers, because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with State and Federal regulations.

Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.

Avoid frequent or prolonged skin contact with creosote-treated wood. When handling the treated wood, wear longsleeved shirts and long pants and use gloves impervious to the chemicals (for example, gloves that are vinyl-coated).

When power-sawing and machining, wear goggles to protect eyes from flying particles.

After working with the wood, and before eating, drinking, and use of tobacco products, wash exposed areas thoroughly.

If oil preservative or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing.

Coal tar pitch and coal tar pitch emulsion are effective sealers for creosote-treated wood-block flooring. Urethane, epoxy and shellac are acceptable sealers for all creosote-treated wood.

### **Pentachlorophenol Pressure-Treated Wood**

The following wording will appear on the Consumer Information Sheets (CIS) for pentachlorophenol pressure-treated wood:

#### ***Consumer Information -***

This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing pentachlorophenol to protect it from insect attack and decay.

Wood treated with pentachlorophenol should be used only where such protection is important.

Pentachlorophenol penetrates deeply into and remains in the pressure-treated wood for a long time. Exposure to pentachlorophenol may present certain hazards. Therefore, the following precautions should be taken both when handling the treated wood and in determining where to use and dispose of the treated wood.

**Use Site Precautions for Pentachlorophenol Pressure-Treated Wood** - Logs treated with pentachlorophenol should not be used for log homes.

Wood treated with pentachlorophenol should not be used where it will be in frequent or prolonged contact with bare skin (for example, chairs and other outdoor furniture), unless an effective sealer has been applied.

Pentachlorophenol-treated wood should not be used in residential, industrial, or commercial interiors except for laminated beams or building components which are in ground contact and are subject to decay or insect infestation and where two coats of an appropriate sealer are applied. Sealers may be applied at the installation site.

Wood treated with pentachlorophenol should not be used in the interiors of farm buildings where there may be direct contact with domestic animals or livestock which may crib (bite) or lick the wood.

In interiors of farm buildings where domestic animals or livestock are unlikely to crib (bite) or lick the wood, pentachlorophenol-treated wood may be used for building components which are in ground contact and are subject to decay or insect infestation and where two coats of an appropriate sealer are applied. Sealers may be applied at the installation site.

Do not use pentachlorophenol-treated wood for farrowing or brooding facilities.

Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such sites would be structures or containers for storing silage or food.

Do not use treated wood for cutting boards or countertops.

Only treated wood that is visibly clean and free of surface residue should be used for patios, decks and walkways.

Do not use treated wood for construction of those portions of beehives which may come into contact with the honey.

Pentachlorophenol-treated wood should not be used where it may come into direct or indirect contact with public drinking water, except for uses involving incidental contact such as docks and bridges.

Do not use pentachlorophenol-treated wood where it may come into direct or indirect contact with drinking water for domestic animals or livestock, except for uses involving incidental contact such as docks and bridges.

#### ***Handling Precautions for Pentachlorophenol Pressure-Treated Wood -***

Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial

incinerators or boilers rated at 20 million BTU/hour or greater heat input or its equivalent in accordance with State and Federal regulations.

Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing or machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.

Avoid frequent or prolonged skin contact with pentachlorophenol-treated wood; when handling the treated wood, wear long-sleeved shirts and long pants and use gloves impervious to the chemicals (for example, gloves that are vinyl-coated).

When power-sawing and machining, wear goggles to protect eyes from flying particles.

After working with the wood, and before eating, drinking and use of tobacco products, wash exposed areas thoroughly.

If oily preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing.

Urethane, shellac, latex epoxy enamel and varnish are acceptable sealers for pentachlorophenol-treated wood.

## **PROTECTING THE ENVIRONMENT**

### **Waste Disposal**

Waste from preservative treating operations can kill plant life and harm aquatic life if allowed to enter waterways. Oils and organic solids damage aquatic life by reducing oxygen supplies.

Some treating plants discharge their wastes into approved municipal sewer systems for processing along with municipal wastes. Many plants use closed chemical and wastewater recovery systems to contain wastes that could be harmful. Recovered solutions may be used again. If they are contaminated, they can

be filtered to remove solid wastes. Liquid waste materials may be diverted to settling ponds.

Door sumps should be used under pressure-chamber doors and under hard-surfaced drainage areas. They will channel into the waste or recovery system any excess chemicals that drip or are rinsed from freshly treated material. It is also important to contain the runoff from areas where toxic chemicals are used to protect stored logs, poles, or lumber before processing or during seasoning.



The U.S. Environmental Protection Agency requires treatment facilities to meet certain disposal standards and to obtain permits for discharge of excess chemicals. Compliance with these regulations should assure proper environmental protection. Remember to read the label carefully for disposal information for the products you are using.

## Storage and Disposal of Containers

Packaged chemicals should be stored in a dry, well-ventilated, security locked area. Keep them in well-sealed containers whenever possible. Protect liquid storage against tank rupture.

Whenever spills, leaks, or flooding could occur, be sure that runoff will drain into a recovery or disposal system (Safeguard concrete vats from freezing, cracking and spillage).

Containers should be thoroughly rinsed and emptied into storage or treating tanks before disposal. Bury the containers in an approved landfill or dispose of them by other approved means. Be particularly careful not to contaminate streams or ground water.

Be sure to read and follow label requirements and safety data sheets for each preservative. If you are in doubt about how to safely store a product or dispose of the empty containers, contact the supplier and follow his recommendations.

## Spills

Correct cleanup procedures depend on the chemical involved. Treating plant personnel should know what chemicals are being stored and used and should have an advance plan for handling spills. All workers who might be involved should know what help is available and who to notify in case of a major spill.

## Environmental Exposure

### Penta

Penta is not uncommon in the aquatic environment. Circumstantial evidence, including the identification of penta in rain water, indicates that penta may occasionally be present in ambient air. Low levels of this compound have been detected in both wastewater and surface water. While the source of these residues is often unclear, it has been suggested

that, in addition to direct contamination of water by penta, degradation of other organic compounds or chlorination of water may result in the chemical production of the compound.

Penta is moderately persistent in the aquatic environment. It was reportedly detected in lake water and fish 6 months after an accidental spill. The prevailing use patterns of penta, primarily as a wood preservative, should preclude significant contamination of water as long as spills and industrial accidents are avoided.

Penta is moderately persistent in the soil. Published data reports that persistence ranges from 21 days to 5 years. Under most conditions, penta will seldom persist in the soil for periods exceeding 9 months and its half-life will frequently be far less than this. Numerous studies have identified soil microorganisms capable of degrading penta, but the extent of their distribution is unknown. Since the major use of penta (wood preservative) does not involve application to the soil, the likeliest source of soil contamination is the leaching or bleeding of the preservative from treated wood. Such phenomena may result in low levels of penta contamination in the immediate vicinity (within several inches) of the treated wood.

Available data indicate that penta is not readily translocated by plants and that the compound is rapidly eliminated by mammals following exposure. Significant accumulation in plants and mammals is not likely to occur.

## Arsenicals

No problems have been found in the literature as to the effects of arsenical wood preservatives on the environment. Arsenate, the form present in aerobic soils, is bound tightly to the soil components and becomes unavailable for plant uptake or leaching.

## Creosote

There are no recorded reports of wild or domestic animals being injured by creosote. The amount of creosote as a liquid that enters the environment is relatively small. The fate of creosote in the environment is not known, but most of its components are quickly biodegraded.

## STUDY QUESTIONS

1. The basic wood cell is often referred to as a fiber or a longitudinal tracheid.
  - A. True
  - B. False
2. Cell walls of wood fiber are made up of:
  - A. Small bits of cellulose
  - B. A matrix of hemicellulose
  - C. Thin layer of lignin
  - D. All of the above
3. The pits in wood cell structures are important for:
  - A. Water movement in living trees from cell to cell
  - B. Movement of water in drying lumber
  - C. Movement of chemical solutions in impregnation of wood
  - D. All of the above
4. All wood species have small tissues called rays that weave their way between the longitudinal fibers from the bark toward the pith.
  - A. True
  - B. False
5. Sapwood is:
  - A. Wood that is located near the cambium layer
  - B. Made up of inactive cells
  - C. More dense and drier than heartwood
  - D. All of the above
6. Heartwood:
  - A. Consists of inactive cells
  - B. Includes waste material which darkens wood
  - C. Is more dense and drier wood
  - D. All of the above
7. Fungi, which are a simple type of non-chlorophyll containing plants, cause wood decay.
  - A. True
  - B. False

1. **Correct Answer: A**

Explanation: Even though wood may seem to be a solid material, it is a plant material made up of plant cells. The basic wood cell is often referred to as a fiber or longitudinal tracheid.

2. **Correct Answer: D**

Explanation: All of the above are components of a wood cell's wall. The walls are made up of small bits of cellulose imbedded in a matrix of hemicellulose. All of this is cemented together by a layer of lignin.

3. **Correct Answer: D**

Explanation: All of the above are important. The cavities between cells are interconnected by passageways called pits. Pits are important passageways for water to move from cell to cell in living trees. These passageways are also important in processes such as drying wood and impregnation of wood with chemical solutions.

4. **Correct Answer: A,**

Explanation: The answer is true. The rays help conduct sap rapidly across the grain.

5. **Correct Answer: A**

Explanation: Sapwood is located near the cambium layer and is involved in the storage of nutrients for the tree as well as in the mechanical transportation of water from the root system to the crown.

6. **Correct Answer: D**

Explanation: Heartwood is a disposal site for waste products of respiration carried on in other parts of the tree. Rays seem, to be a means of transporting these products into the heartwood. Heartwood is made up of inactive cells that have been changed either chemically or physically, from their sapwood cell origin. These changes cause the cells not to be able to conduct sap. These cells will sometimes contain deposits of various materials which will cause the heartwood to have a much darker color.

7. **Correct Answer: A**

Explanation: Wood decay is caused by the growth of fungi. Fungi are extremely small plant-like organisms that normally can not be seen without the aid of a microscope, except where there may be extensive growth on the surface of wood. Fungi can not produce its own food; therefore, it relies on the sugars of the wood cell wall for its survival. In the process of getting the sugars, it breaks down the cell wall.

8. Fungal growth starts from tiny airborne spores. To continue growth fungi need:
- A. Cold temperatures
  - B. 15-15-15 fertilizer
  - C. High nitrogen fertilizer
  - D. Low levels of zinc
  - E. None of the above
9. The germinating fungal spores cause damage to wood by:
- A. Making water circles in the wood
  - B. Developing microscopic, root-like threads, called hyphae
  - C. Allowing insects to chew into the wood
  - D. All of the above
10. There are two major groups of wood inhabiting fungi. Based on the type of damage they cause: wood-destroying and wood-staining.
- A. True
  - B. False
11. The characteristics of decay fungi (wood destroying fungi) are:
- A. Both sapwood and heartwood can be affected
  - B. Fungi may grow in the interior of the wood or appear on the wood surface as fan-shaped patches
  - C. The color of these growths range from white through light brown
  - D. The decay will stop when temperatures are either too hot or cold and moisture level too dry or wet
  - E. All of the above
12. Which fungi are able to break down the cellulose component of wood for food?
- A. Brown rot
  - B. White rot
  - C. Soft rot
  - D. None of the above
13. The final stage of wood decay by brown rot can be identified by:
- A. The dark brown color of the wood
  - B. Excessive shrinkage
  - C. Cross-grain cracking
  - D. The ease with which the dry wood substance can be crushed to powder
  - E. All of the above



8. **Correct Answer: E**

Explanation: Fungus is a form of plant life. Growth is initiated by movement of the airborne spores by the wind. The spores germinate like other plant seeds. Continued growth depends on favorable environment such as warm temperatures and moist conditions. Cold temperature and dry wood prevent the growth of fungi.

9. **Correct Answer: B**

Explanation: Fungi develops microscopic root-like threads which penetrate the wood and allow enzymes to break the cell wall of the wood cells.

10. **Correct Answer: A**

Explanation: There are only two types of fungi that affect wood; wood-destroying (decay fungi) and wood staining (sapstaining fungi, mold fungi).

11. **Correct Answer: E**

Explanation: Wood destroying fungi will attack both the sapwood and heartwood of most trees. The fungi may grow in the interior of the wood and produce fan-shaped patches of fine threadlike, cottony growths or as rootlike shapes. The colors of these growths may appear white, yellow or dark brown. Finally, temperatures and moisture will affect the growth as well.

12. **Correct Answer: A**

Explanation: Brown rot is able to break down cellulose for food, leaving a brown residue of lignin.

13. **Correct Answer: E**

Explanation: All of the above are part of the final stages of wood decay by brown rot.

14. Which rot can break down both lignin and cellulose and have a bleaching effect (causing the wood to appear whiter than normal)?
- A. Brown rot
  - B. White rot
  - C. Soft rot
  - D. Gut rot
15. Which rot attacks green wood?
- A. Brown rot
  - B. White rot
  - C. Soft rot
  - D. Foot rot
16. The fungi which cause wood-staining are:
- A. Sap staining fungi
  - B. Brown rot
  - C. Mold fungi
  - D. White rot
  - E. Both A & C
17. Sapstaining fungi:
- A. Have little effect on the strength of the wood
  - B. Destroy the woods appearance for such things as siding and furniture
  - C. Can be established in sapwood of standing trees, sawlogs, lumber and timbers as soon as they are cut.
  - D. All of the above
18. What are some of the differences between ants and termites?
- A. Ants do not eat wood, termites do
  - B. Ants have elbow antennae, termites do not
  - C. Ants have narrow waists, termite bodies are broad
  - D. All of the above
19. The subterranean termite colony produces winged males and females that begin a new colony in the soil.
- A. True
  - B. False
20. What are some of the ways subterranean termite presence can be noted?
- A. The swarming of winged, ant-like insects and the discarded wings
  - B. The earthen shelter tubes built over masonry or other foundations to source of wood
  - C. The presence of white workers when shelter tubes are broken
  - D. The hollowed-out condition of badly infested wood products
  - E. All of the above

14. **Correct Answer: B**

Explanation: Gut rot is what happens when you eat your own cooking. The correct answer is white rot. White rot fungi will break down both the lignin and cellulose. White rot also bleaches the wood, causing the wood to take a white appearance.

15. **Correct Answer: C**

Explanation: Soft rot attacks green wood (undried wood which contains sap). This rot causes a gradual softening from the surface inward and thus resembles brown rot.

16. **Correct Answer: E**

Explanation: The two wood staining fungi are sapstaining and mold fungi. Sapstaining fungi penetrate and discolor the wood, particularly the softwood species. Mold fungi first appear as green, brown, or black, fuzzy or powdery growths on the wood surface. Either of these molds affect the strength of the wood but do open the door for possible attack from decay fungi.

17. **Correct Answer: D**

Explanation: Sapstain fungi have little affect on the strength of wood but can destroy its appearance.

18. **Correct Answer: D**

Explanation: Some of the flying ants and termites look very similar. But there are some differences that can distinguish them apart. Ants do not eat wood; termites do. When looking at the head of an ant, they have elbow antennae where termites do not. Ants appear constricted or pinched in the waist compared to a termite's broad body.

19. **Correct Answer: A**

Explanation: Subterranean termites reproduce this way. The winged adults are only produced at certain times of the year. They swarm, mate, lose their wings and begin a new colony in the soil.

20. **Correct Answer: E**

Explanation: All of the items listed are ways to determine presence of termites.

21. Dry wood termites attack dry wood without direct contact with the soil.
- A. True
  - B. False
22. Damp wood termites require moist wood.
- A. True
  - B. False
23. Carpenter ants use wood for shelter, not for food.
- A. True
  - B. False
24. Signs of damage being done by powderpost beetles are:
- A. Small round 1/16" holes made in surface of wood
  - B. Fine powder that falls from the wood
  - C. The presence of white workers
  - D. Both A and B
25. Moisture content of living trees is approximately 500 percent.
- A. True
  - B. False
26. The main reasons that moisture must be removed from green wood are:
- A. To prevent stain and decay
  - B. To reduce damage by insects
  - C. To reduce shrinkage
  - D. To reduce weight and increase strength
  - E. All of the above
27. For storing timber or logs for a long time before processing and protecting them from fungi and insects, logs should be:
- A. Stacked on dry lots very tightly
  - B. Sprayed with fuel oil
  - C. Debarked
  - D. Submerged in a pond of water
  - E. None of the above
28. For seasoning or drying, the most efficient and widely used system is kiln drying.
- A. True
  - B. False

21. **Correct Answer: A**  
Explanation: The ability of the dry wood termite to live in dry wood without contact with the soil make it more menacing. However, it reproduces slowly and does not destroy wood as quickly as the subterranean termite.
22. **Correct Answer: A**  
Explanation: Damp wood termites are a serious pest along the Pacific Coast. These termites do not require soil but need wood which is high in moisture content.
23. **Correct Answer: A**  
Explanation: Carpenter ants cause a lot of damage as they burrow tunnels in soft or decaying wood. They can damage poles, structural timbers, damage wood in trees, and around window frames, as they make galleries for their homes.
24. **Correct Answer: D**  
Explanation: The powder post beetles attack fresh cut wood or seasoned hardwood and softwoods. The adult beetle lays eggs in the wood pores and larvae burrow through the wood, making tunnels from 1/16 to 1/12 inch in diameter. As the adults emerge from the surface of the wood, they leave small (1/16) inch size exit holes and a fine powder falls from the holes.
25. **Correct Answer: B**  
Explanation: Moisture content may range from about 30% to more than 200%.
26. **Correct Answer: E**  
Explanation: Moisture content of living trees must be dried to remove the environment for the different fungi and insects which attack the timber. Removing moisture also reduces shrinkage and weight of the timber and prepares the wood for chemical treatment.
27. **Correct Answer: D**  
Explanation: Logs being stored for a long period of time before they will be processed need to be either submerged in a pond of water or under constant water spray. This helps reduce the oxygen content and temperatures necessary for fungi growth.
28. **Correct Answer: A,**  
Explanation: Kiln drying is the widely used system for seasoning lumber because it offers better control of air movement, temperature and drying rates.



29. In storing lumber, one management practice is to locate air-drying yards and sheds on a well-drained site with good air circulation.
- A. True
  - B. False
30. Rotted wood should be removed from the storage yard because it can harbor insect and fungal pests.
- A. True
  - B. False
31. Which of the following tree species have a natural resistance to an attack by decay fungi?
- A. Maple
  - B. Ash
  - C. Black Locust
  - D. White Pine
  - E. Boxelder
32. To determine the effectiveness of a chemical treatment on wood, you should consider the:
- A. Age of the tree
  - B. Chemical formulation selected
  - C. Moisture content of the wood
  - D. B & C above
  - E. None of the above
33. Wood preservatives can fall into the following categories:
- A. Creosote
  - B. Oilborne preservatives
  - C. Organic carbon preservatives
  - D. All of the above
  - E. None of the above
34. Creosote is often called coal tar because of its close relationship to which compounds?
- A. Toluene
  - B. Benzene
  - C. Tar
  - D. All of the above
35. Creosote gives off vapors which produce a sunburn-like rash on human skin.
- A. True
  - B. False

29. **Correct Answer: A**  
Explanation: Storage of cut lumber in a well-drained site with good air movement will help keep wood in good shape.
30. **Correct Answer: A**  
Explanation: Practice good sanitation by removing debris and rotten wood (which serve as sources of fungal infection and insects).
31. **Correct Answer: C**  
Explanation: Black Locust is highly resistant to decay.
32. **Correct Answer: D**  
Explanation: Chemical formulation and moisture content of the wood are just a few of the possible factors affecting the success of the treatment.
33. **Correct Answer: B**  
Explanation: The three broad categories of wood preservatives are: creosote, oilborne preservatives and waterborne preservatives.
34. **Correct Answers: D**  
Explanation: Creosote is often called coal tar creosote because of its close relationship to toluene, benzene and tar. In the process of making coke from coal for the steel industry, benzene, toluene, tar and creosote are produced. Creosote is the fraction that condenses within certain temperature limits set by the American Wood Preservers Association.
35. **Correct Answer: A**  
Explanation: Freshly creosoted poles and timbers will give off vapors which have strong odors, and cause sunburn-like rashes on some humans. These vapors will last up to several years. This becomes a real disadvantage for creosote.

36. What characteristics make creosote a popular preservative for the railroad and utility companies?
- A. It is unpaintable
  - B. It is toxic to decay
  - C. It will not leach
  - D. It is toxic to insects
  - E. Both B and D
37. Penta, which can be equal to creosote as a preservative, can be made by dissolving 5 percent penta salt in:
- A. Water
  - B. Alcohol
  - C. Liquid fat
  - D. Petroleum oil
  - E. Benomyl
38. Penta may be used to treat wood to be used as:
- A. Food crates
  - B. Utility poles
  - C. Feed troughs
  - D. None of the above
39. The only preservative approved for wood which is to directly come in contact with human food is:
- A. Copper naphthenate
  - B. Zinc naphthenate
  - C. Acid copper chromate
  - D. Copper-8 quinolinolate
  - E. None of the above
40. What is a disadvantage of waterborne preservatives?
- A. They leave an oily, unpaintable surface
  - B. They are toxic and irritating to plants and animals
  - C. They have dark color
  - D. They do not protect the wood from excessive weathering
  - E. None of the above
41. Wood must be prepared properly before a preservative is applied.
- A. True
  - B. False
42. The bark and cambium layers must be completely removed before thorough penetration of the preservatives can occur.
- A. True
  - B. False

36. **Correct Answers: E**

Explanation: Creosote's toxic effect to both insects and decaying fungi make it beneficial for both the railroad and utility companies. In addition, rain and groundwater will not leach creosote from the wood, so it is very permanent.

37. **Correct Answer: D**

Explanation: Pentachlorophenol (Penta) can be produced by dissolving penta salt in petroleum oil. It is relatively insoluble in water. Because of the oil carrier, it leaves an unpainted (natural look) to the wood surface.

38. **Correct Answer: B**

Explanation: Penta is recommended for use on utility poles, fence post, crossarms and timbers. Penta may not be used around food or feed products. Note!! Because of environmental and health concerns, penta has been replaced with waterborne preservatives.

39. **Correct Answer: D**

Explanation: Only copper-8 quinolinolate has been approved for food contact uses such as for boxes, crates, pallets, truck decking and related uses involving the harvesting, storage and transportation of food.

40. **Correct Answer: D**

Explanation: One of the disadvantages of waterborne preservatives is that they do not protect wood from excessive weathering.

41. **Correct Answer: A**

Explanation: The wood needs to be prepared properly before any commercial wood treatments can be applied. Some of the preparation that needs to be done include peeling, drying, conditioning, incising, cutting, and framing.

42. **Correct Answer: A**

Explanation: The bark and cambium layers must be removed before treatment. This allows the preservative to be able to penetrate the wood.

43. Preservative treatments are more effective if the wood is dried prior to treatment because:
- A. There is more space in wood cells for preservatives
  - B. Checks form before treatment, facilitating penetration of preservative into the wood
  - C. The chance of checks occurring after treatment exposing untreated wood is much less
  - D. All of the above
44. With the non-pressure method of brushing, spraying and pouring treatments, one of the major concerns with the wood is:
- A. The wood must be dry
  - B. The wood must be high in moisture content
  - C. The wood must be immersed in oil prior to the treatment
  - D. All of the above
45. With the non-pressure treatment of brushing, spraying and pouring, the second application should be applied before the first coat is dry.
- A. True
  - B. False
46. The treatment of dipping consists of immersing wood in a preservative solution for several seconds to several minutes.
- A. True
  - B. False
47. Cold soaking is commonly used for treating round fence posts and sawn timbers using which preservatives?
- A. Creosote
  - B. Copper-8-quinolinolate
  - C. Oil-borne preservatives
  - D. All of the above
48. The steeping process involves which preservatives?
- A. Water-borne preservatives
  - B. Oil-borne preservative
  - C. Creosote preservative
  - D. None of the above
49. One of the methods of extending the life of standing poles that have been previously treated is called:
- A. Steeping
  - B. Cold soaking
  - C. Dipping
  - D. Preservatives pads



43. **Correct Answer: D**

Explanation: It is important for the wood to be properly seasoned (dried) before applying preservatives. Drying the wood removes water from the cell cavities to allow space for preservatives. Drying also allows for some checking in the wood which allows better penetration of the preservative.

44. **Correct Answer: A**

Explanation: The wood must be completely air dried before treatment, and if oil-borne preservatives are to be used, the wood should be warmed enough to avoid congealing the oil.

45. **Correct Answer: B**

Explanation: Before applying the second coat of either creosote-oil-borne preservatives or water-borne salts the first coat must be dry.

46. **Correct Answer: A**

Explanation: The definition of dipping as a non-pressure treatment is immersing the wood in a preservative solution for several minutes.

47. **Correct Answer: C**

Explanation: Pentachlorophenol or oil-borne preservatives are used. The process involves soaking the dried wood in a vat containing the unheated oil preservative for 2-7 days.

48. **Correct Answer: A**

Explanation: The process can be used on either green or dried wood. The process involves submerging the wood in a tankful of solution at atmospheric temperature for several days or weeks.

49. **Correct Answer: D**

Explanation: This process becomes an economical decision on whether to replace the poles or to extend the life of the pole by the process of preservative pads. The process involves removal of the soil around the pole to a depth of 18 feet. The treatment then involves treating that portion as well as 12 feet above the ground level as that is where most of that damage occurs. After the treatment there must be a plastic coating placed around the treated area before the soil is returned.

50. Wood preservatives can enter the body through:
- A. Mouth
  - B. Skin
  - C. Lungs
  - D. All of the above
51. The more likely forms of exposure are dermal contact and inhalation of vapors or dust particles.
- A. True
  - B. False
52. Creosote vapors can cause:
- A. Skin irritations
  - B. Eye watering
  - C. Respiratory problems
  - D. All of the above
53. Pentachlorophenol not only irritates the eyes, skin and respiratory tract, but also:
- A. Causes weakness
  - B. Causes nausea
  - C. Causes skin disorders
  - D. May cause damage to liver, kidneys or nervous system
  - E. All of the above
54. The long term effects of inorganic arsenicals are liver damage, loss of hair and fingernails, anemia and skin disorders.
- A. True
  - B. False
55. If creosote or penta was swallowed you would first have the victim drink large quantities of milk.
- A. True
  - B. False
56. Pentachlorophenol and creosote can be applied indoors.
- A. True
  - B. False
57. Pentachlorophenol or creosote treated wood may be used around animal feed, food, drinking or irrigation water supplies.
- A. True
  - B. False

50. **Correct Answer: D**  
Explanation: The four routes through which wood preservatives can enter the body are dermal, oral, respiratory and eyes.
51. **Correct Answer: A**  
Explanation: Because wood preservatives have such a strong odor and taste, it is unlikely a person would swallow any. Therefore, dermal or inhalation are the only logical ways wood preservatives could enter the body.
52. **Correct Answer: D**  
Explanation: Creosote vapors can cause all of the listed problems.
53. **Correct Answer: E**  
Explanation: Pentachlorophenol causes all of the listed reactions.
54. **Correct Answer: A**  
Explanation: Long term exposure to inorganic arsenical can include liver damage, loss of hair, and finger nails, anemia and skin disorders.
55. **Correct Answer: B**  
Explanation: First administer one or two glasses of water, induce vomiting, then administer 2 tablespoons of 'ISP Drug Grade' activated charcoal in water. If there is any question call medical help immediately.
56. **Correct Answer: B**  
Explanation: Under the limitation use section, penta or creosote should not be applied indoors. It is always important to take time to read the label.
57. **Correct Answer: B**  
Explanation: Pentachlorophenol or creosote can not be used in such applications. Be sure to always read and follow the label.

58. Creosote cannot be applied to wood intended to be used in interiors except for those supporting structures which come in contact with the soil, in which of the following structures:
- A. Log homes
  - B. Restaurants
  - C. Barns
  - D. Hospitals
  - E. All of the above
59. According to CIS, inorganic arsenical pressure-treated wood can not be used for which of the following:
- A. Food storage
  - B. Cutting boards
  - C. Burning in fireplace
  - D. Silage
  - E. All of the above
60. Inorganic arsenical pressure-treated wood has been preserved by pressure-treatment with an EPA-registered pesticide.
- A. True
  - B. False
61. To be able to use creosote pressure-treated wood for outdoor furniture an effective sealer must be applied.
- A. True
  - B. False
62. Creosote-treated wood should not be used in:
- A. Residential interiors
  - B. Farm buildings
  - C. Water troughs
  - D. All of the above
63. Creosote treated wood can be burned in open fires, stoves and fireplaces.
- A. True
  - B. False
64. You do not need to worry about washing after working with creosote-treated wood.
- A. True
  - B. False
65. Urethane, epoxy and shellac are acceptable sealers for all creosote-treated wood.
- A. True
  - B. False

58. **Correct Answer: C**

Explanation: Creosote can not be applied to wood intended to be used in interiors except for those support structures which are in contact with the soil in barns, stables, and similar sites.

59. **Correct Answer: E**

Explanation: All of the above are areas where inorganic arsenical pressure treated wood may not be used. Inorganic arsenical pressure-treated wood can be used for patios, decks and walkways if it is visibly clean and free of surface residue. Inorganic arsenical pressure-treated wood may not be used around food for humans or feed for animals.

60. **Correct Answer: A**

Explanation: This is how the (CIS) Consumer Information Sheet lists inorganic arsenical pressure treated wood.

61. **Correct Answer: A**

Explanation: Wood treated with creosote should not come in contact with bare skin; therefore, the need of an effective sealer.

62. **Correct Answer: D**

Explanation: Creosote should not be used in the interiors of residential buildings, industrial buildings, or farm buildings. In commercial or farm buildings it can be used for building components which are in ground contact and are subject to decay. It should never be used in connection with drinking water.

63. **Correct Answer: B**

Explanation: Creosote treated wood should never be burned in open fires, wood stoves or fireplaces because of the possible toxic chemicals that may be produced as smoke and ashes.

64. **Correct Answer: B**

Explanation: It is vitally important to wash after working with creosote-treated wood before eating, drinking or using tobacco products. Be sure to use other protective equipment, such as a dust mask to prevent breathing dust particles and use goggles to protect the eyes.

65. **Correct Answer: A**

Explanation: Urethane, epoxy and shellac are accepted sealers for creosote treated wood.



66. Logs treated with pentachlorophenol may be used for log homes.
- A. True
  - B. False
67. Avoid frequent or prolonged skin contact or inhalation of sawdust from pentachlorophenol treated wood.
- A. True
  - B. False
68. Oils and organic solids from wood preservatives damage and kill aquatic life by reducing the oxygen in the water.
- A. True
  - B. False
69. The U.S. Environmental Protection Agency requires treatment facilities to meet certain disposal standards and obtain permits for discharge of excess chemicals into the environment.
- A. True
  - B. False
70. A pesticide storage area should:
- A. Have a designated shelf for storing protective clothing and equipment.
  - B. Be well-insulated and ventilated.
  - C. Not have any type of constructed floor—in case of a spill or leak, a pesticide will be absorbed most efficiently by the soil itself.
  - D. All of the above.

66. **Correct Answer: B**

Explanation: Pentachlorophenol treated wood should never be used for log homes.

67. **Correct Answer: A**

Explanation: You need to take extra care when working around pentachlorophenol treated wood. Be sure to have the right protective equipment, long sleeved shirts and long pants, eye protection, dusk mask, and vinyl coated gloves.

68. **Correct Answer: A**

Explanation: Oils and organic solids cause damage to the aquatic environment by reducing oxygen levels in the water. Therefore, the need to keep spills and discharges out of streams and other bodies of water.

69. **Correct Answer: A**

Explanation: Before releasing any chemical residues into the environment, proper permits need to be obtained from the U.S. EPA.

70. **Correct Answer: B,**

Explanation: Pesticides should be stored in a dry, well ventilated, secured area.

# WOOD PEST CONTROL

## SCORE CARD

# OF CORRECT ANSWERS	% CORRECT	EVALUATION
63-70	> 90%	<b><u>Excellent</u></b> You have a very good understanding of wood pest and their control.
56-62	> 80%	<b><u>Good</u></b> Be sure you understand those questions that you missed. It may help to read the references again, and re-answer the questions you missed.
49-55	> 70%	<b><u>Poor</u></b> Your score indicates a borderline level of expertise. Be sure to re-read the cited references again and re-answer the questions you missed.
0-48	< 70%	Re-read the recommended references and work through the workbook again.