Using Treated Wood – Wood Preservation for Fresh Water Uses
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WOOD PRESERVATION FOR FRESH WATER USES

USING TREATED WOOD

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INTRODUCTION

MARINAS, DOCKS, WHARVES, and other wooden structures encircle the Great Lakes. But wood exposed to constant dousing is very vulnerable to decay. Consider wood preservation when building wooden structures to use near fresh water.

The four publications in this series describe fungi and insects that attack wood, and they provide information on preservatives and their application and how to use treated wood.

TO BE SURE wood is properly treated, look for assurances that it meets treatment specifications for retention and penetration. This booklet outlines these specifications and explains what treated wood looks like and the precautions and techniques to follow when using it (Fig. 1).

OBTAINING PROPERLY TREATED WOOD

Service Life

Service life is an important consideration when purchasing and using preserved wood and one that cannot be judged by outward appearance. A buyer expects treated wood to have increased service life over untreated wood.

Because of the almost limitless combinations of wood species, preservatives, preservative retention, treatment methods and uses, it is almost impossible to promise how long a specific kind of treated wood will endure.

The scientific and trade press report treated cross ties, poles, piling, timbers and other wood products lasting more than 50 years. But posts merely brushed with a preservative will not last much longer than un-

A Michigan marina built of all treated wood.

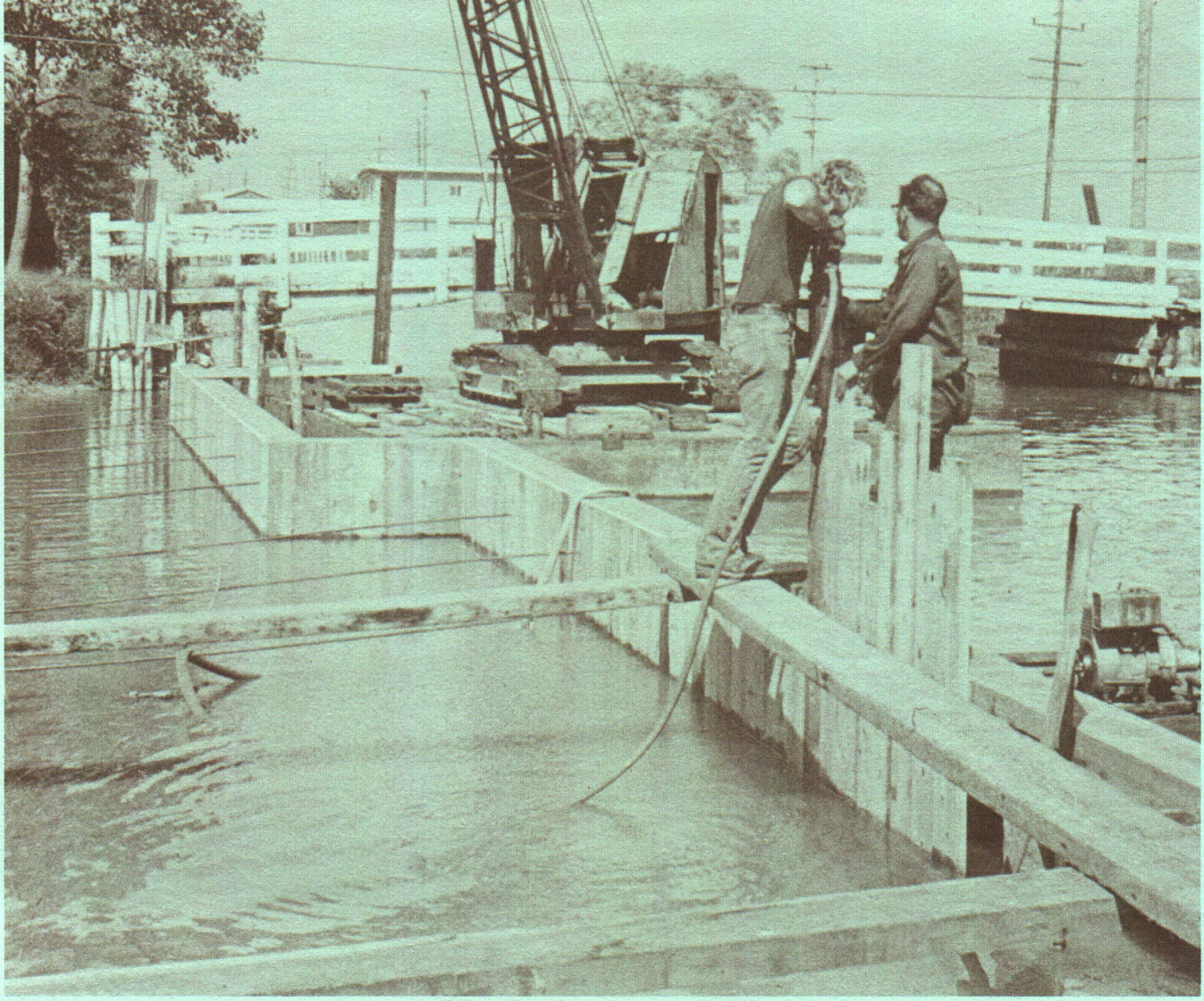

Fig. 1. Retaining walls along waterways need preserved wood.

treated ones. Sufficient preservative must penetrate well beyond the surface. Wood, adequately treated with an AWPA[1] standard preservative will outlast untreated wood several times.

HOW TO IDENTIFY

Preserved Wood

Much wood treated by commercial treating plants bears an identification brand, stamp or label. Large items such as poles and piles are usually branded with a hot iron (Fig. 2). The brand lists the kind of wood, preservative and retention, treating company and plant location. Some firms fasten a metal tag to a recess in the wood.

Lumber treated with waterborne salts according to AWPB specifications may bear an ink stamp with name of treater, preservative and specification number (Fig. 3).

Creosoted and PCP-treated lumber and timbers are not usually branded, but identified by surface color and odor. Chemical color tests show penetration depth of waterborne salts or PCP. Creosote is usually dark enough for detection without color tests.

Fig. 2. Brand on piling treated with CCA preservative.

CHARACTERISTICS

Surface Deposits and Wetness

Waterborne preservatives such as CCA or ACA are carried into wood with water. Before treated wood is used, most of the water is removed by air or kiln drying, leaving only a small quantity of powdery chemical on the surface. This disappears from rain or water washing. Both preservatives color wood green. Once treating water leaves such wood, it weighs about the same as untreated wood. It may darken with use.

Do not use waterborne, salt-treated wood for about 2 weeks after treatment to allow chemical changes to occur. This is usually no problem because more time than this elapses during shipment and storage prior to sale.

Creosoted wood may or may not have an oily, wet surface, depending on the wood and treating conditions.

[1] *American Wood Preservers' Association.*

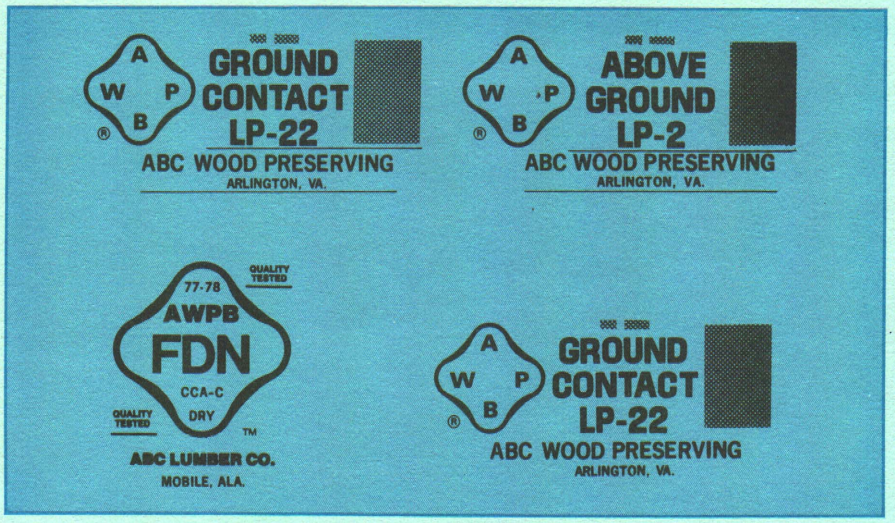

Fig. 3. Identification marks used on treated lumber.

Surface appearance varies greatly even between boards treated at the same time. Creosoted wood may "bleed" (exude liquid) especially when heated by the sun. This may continue off and on for a few years. Consider such surface changes when using this kind of treated wood in marinas or other constructions where people may touch it.

PCP-treated wood also presents a variety of surface conditions. The appearance depends in part, on the solvent used in the treating solution. For example, aromatic gas oils, used to treat poles, piling and posts, give them a medium brown color (Fig. 4). When millwork, building trim and the like are treated, no appreciable color change occurs because the solvents used are nearly colorless.

PCP-treated wood may also darken with age and exude preservative. This condition is aggravated by heartwood on the surface and high wood resin content as well as heat or intense sun.

PAINTING TREATED WOOD

Most creosoted wood cannot be painted satisfactorily, especially if pressure treated. The creosote paints on the market are not intended for use on creosoted wood. They contain some creosote for what little preservative effect they might provide.

Millwork treated by short immersion in a PCP water repellent solution can be painted. An occasional board may give trouble if it absorbs excessive preservative and the solvent is not allowed to evaporate completely before painting (Fig. 5). If pressure treated with PCP dissolved in aromatic gas oil, wood is difficult to paint with light colors. Latex paints give less trouble than solvent-thinned paint, but even then special care is needed. Several months of weathering may be necessary to attain a paintable surface.

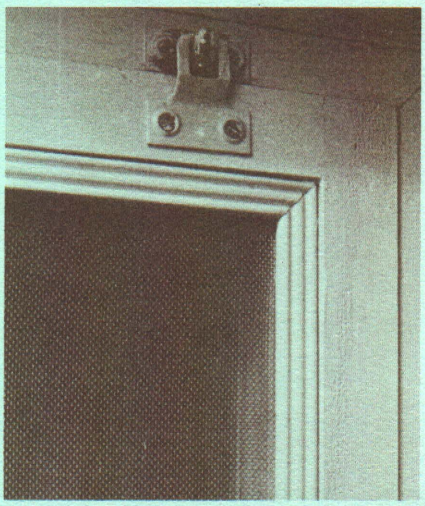

Fig. 5. Painting defects caused by excess absorption of preservative by screen sash.

Paint wood treated with LPG (Cellon® process) or other PCP solvent that completely evaporates the same as untreated wood. Most waterborne, salt-treated wood is paintable with a variety of paints (Fig. 6). Allow water added during treatment to evaporate before painting. Natural finishes, both pigmented and unpigmented, can also be used, but the natural greenish color of some treatments may alter the color of the applied stain or finish. No clear coating finishes give as good service in exterior use as paints. Often no finish at all is best.

Fig. 4. Color variation in pine posts treated with PCP in oil.

Odor and Color

Wood treated with waterborne salts such as CCA, CZC, ACA, FCAP or ACC has no additional odor once the liquid or gaseous part of the treating solution evaporates. These salts color wood somewhat, depending on the preservative, amount retained by wood and kind of wood. Shades of gray, tan or green are sometimes so intense that no stain is needed.

Creosote colors wood brown to black and adds a strong odor. The odor makes creosoted wood unsuitable for houses. Creosote used on in-

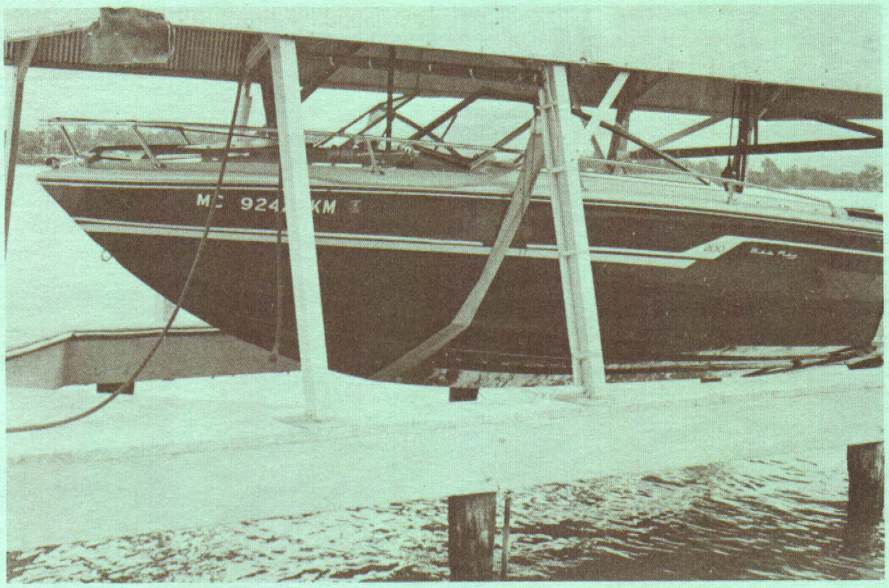

Fig. 6. This boat shelter made of CCA pressure-treated wood has been painted successfully for several years.

dustrial floors is usually covered with a heavy coating to keep odor in the wood.

Pentachlorophenol-treated wood ranges from no color change to dark brown, depending on the solvent and moisture content of wood when treated. Most wood treated by pressure methods is dark. The solvent used to prepare PCP solutions also contributes to the odor of the treated wood. In fact, PCP odor is difficult to detect, but many solvents, which remain in wood, have persistent disagreeable odors. Some PCP-treated wood, therefore, should not be used in homes.

Corrosion of Fastenings

Corrosion of metals in creosoted wood is not influenced by the preservative. Any corrosion would likely have occurred in untreated wood as well (Fig. 7).

CZC-treated wood may corrode iron and steel. Wood treated with CCA can be used safely with galvanized metal in freshwater applications. Under high humidity, CCA may corrode aluminum.

PCP-treated wood does not corrode iron or steel any more than untreated wood, but use galvanized fastenings where water or dampness is present to minimize rust streaking and corrosion initiated by water. Copper or aluminum touching PCP-treated wood may discolor slightly but will not deteriorate.

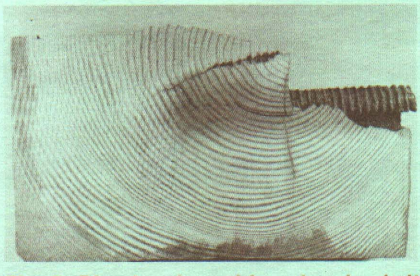

Fig. 7. Discolored wood from iron lag bolt in treated fir. This is a wood reaction not caused by preservative treatment.

PRESERVATIVE LOSSES

Freshly treated wood removed from the treatment cylinder or tank contains a quantity of preservative measured by analysis, gauge or by weight change. During storage or use, it may lose some preservative by evaporation or "bleeding" (Fig. 8). This is usually not serious unless treated wood did not originally retain enough preservative.

Once waterborne salt-treated wood dries, losses by evaporation or bleeding are nil; some such losses occur with creosote and PCP treatments. Leaching from rain water, wave action, or immersion in water can occur with all preservatives over an extended period.

Losses occur below the ground line from biological action and leaching by ground water with all preservatives. This is inevitable and accounts for treated wood having a definite life span rather than being permanent.

OTHER PROPERTIES

Freshly treated wood wet with oil or creosote is more flammable than untreated wood until the oil evaporates and the wood surface dries.

Wood treated with waterborne salt preservatives is more resistant to lighting by flame than wood treated with oily preservatives. However, wood ignited in a hot fire or by burning vegetation may glow and burn completely. This is a remote threat around marinas, but fire protection cannot be ignored.

Salt-treated wood hardens from the chemicals left in it. It may also be more electrically conductive than untreated or PCP- or creosote-treated wood when wet.

Wet wood is not as strong as dry wood. Neither creosote nor PCP decreases wood strength. Improperly controlled heat or steaming temperatures can reduce strength. These damaging treating conditions are not used on wood processed according to AWPA or AWPB specifications.

Although this publication concerns freshwater use of treated wood, first a word about saltwater uses. PCP-treated wood is unsatisfactory in salt water where marine borers are active. Creosoted wood and wood treated

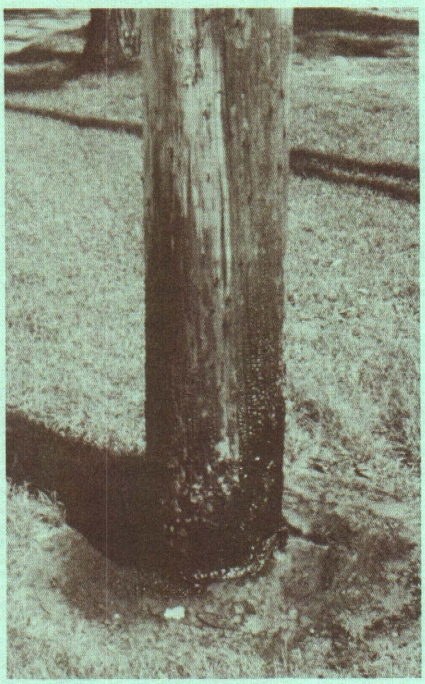

Fig. 8. Bleeding poles like this result in preservative loss from upper parts but service life is probably not decreased if not moved. If used as a spring pile some surface oil on water could result.

with CCA or ACA can be used in salt water if treated to high enough retention. In some warm water and tropical waters, creosote alone is not enough. Wood must also be treated with CCA or ACA.

SPECIFICATIONS

Commercial wood-treating firms usually treat wood to conform to specifications of American Wood Preservers' Bureau (AWPB), American Wood Preservers' Association (AWPA) or U.S. Government. All are virtually alike and describe preservatives permissible for a variety of woods and uses and specify preservative amounts (also called retention) to be used as well as how deeply they must penetrate wood (Fig. 9).

These specifications, if followed, insure that a purchaser of preserved wood will get a satisfactory product. Ask suppliers if the treated wood they sell conforms to the specifications of one of the above agencies. Some treated wood bears such markings.

The kind and quality of preservative treatment is distinct from grade of lumber. Higher and lower grades of softwoods might be treated with the same wood preservative and the same amount.

Southern pine grades most often found on 2-inch thick lumber are No. 1, 2 and 3 and dense structural 86, 72, 65. The first listed in each group is the best grade. Consider grade when buying treated lumber, especially where strength is important.

West Coast grades for 2-inch lumber are Construction, Standard, Utility and Economy. Timbers 5 inches and thicker are classed as Beams and Stringers or Posts and Timbers with grades: Select Structural, No. 1 Structural, Standard and Utility. Again, the first grade in both groups is best, and the last is poorest.

Each piece of graded lumber should be stamped with a grade marking.

Retention

Retention is the amount of preservative per volume of wood; **absorption** also means the same thing. In the United States, pounds per cubic foot (pcf) is the usual unit of retention, although kilograms per cubic meter (Kg/M³) will eventually be adopted.

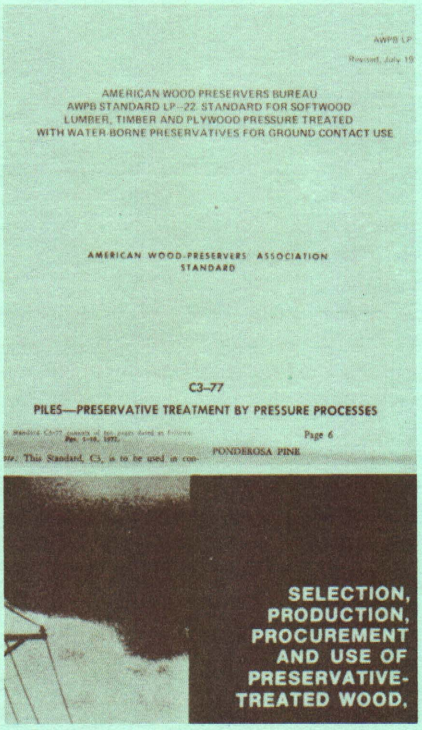

Fig. 9. Specifications and aids often used to order and purchase treated wood.

The retention needed depends on kind, shape and size of wood, preservative and use. Most of these items are found in the specification. For example, if you buy round southern pine or red pine piling to support a dock in fresh water, Federal Specification TT-W-00571J indicates the treatment needs to retain 0.8 pcf CCA or ACA. If PCP is to be used, 0.60 pcf is indicated or 12 pcf creosote. If red pine in the form of lumber is to be treated, 0.5 pcf ACC or 0.4 pcf CCA or ACA are shown in the specification. Pressure treatment is necessary to attain most retentions called for.

Wood used above ground requires less preservative than wood touching fresh water or soil. Wood used in salt water needs the highest retention.

These requirements are considered in AWPB specifications. They are commonly followed for salt-treated softwood lumber and are stamped on the wood. LP-2 is their standard for wood to be used above ground and calls for a retention of 0.25 pcf (oxide basis) of CCA, ACA, FCAP, while LP-22 for softwood to be used in soil contact requires 0.4 pcf CCA and ACA.

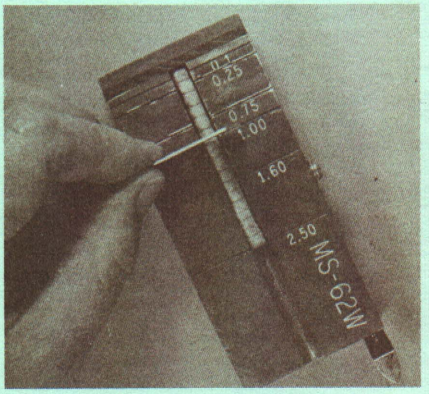

Fig. 10. Boring jigs like this are used for sectioning samples for analysis to determine amount of preservative in wood.

Retentions are determined by analysis of treated wood or by plant gauge measurements (Fig. 10).

Penetration

Even if retention requirements are met, inadequately treated wood could result. For example, most wood preservative will penetrate into ends of a pile, but the critical air-water zone might absorb little preservative (Fig. 11). This occurs because some woods are far more permeable from ends than sides. Because of this difference, a penetration requirement is part of treated wood specifications (Fig. 12).

Piles having a thick sapwood like southern or red pine need a minimum of 85 to 90% penetrated at a depth of 2.5 or 3.5 inches. Lumber and timbers have different requirements, depending on kind.

Borings for measurement of penetration are taken well away from ends of treated woods to avoid end penetration effects. Southern or ponderosa pine lumber is bored on a sapwood face; other pines, western hemlock,

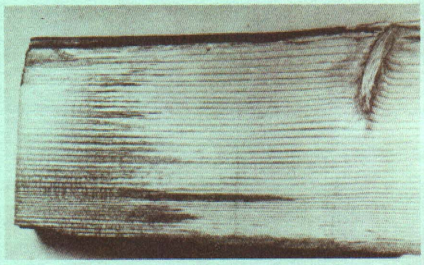

Fig. 11. A creosoted Douglas fir heartwood timber from a 25-yr-old bridge sawed open to reveal penetration of preservative. Side grain penetration is a fraction of end penetration but sufficient to protect a timber if no checks develop through the treated layer.

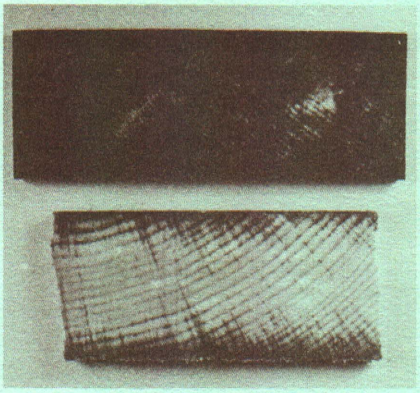

Fig. 12. Adequate and inadequate penetration in two ponderosa pine 2-in. planks cut at the center. A chemical indicator shows copper in CCA-treated wood.

larch and Douglas fir are bored on a heartwood face. Of the hardwoods, only the gums and oaks are included as lumber but 10 hardwoods appear in cross tie specifications. Spruces, too difficult to treat, are omitted. Table 1 shows penetrability of wood commonly used for construction.

Table 1 — North American woods arranged by ease of penetration of heartwood

Softwoods	*Hardwoods*
Easily penetrated	
Ponderosa pine	Red oaks
	White ash
	American elm
	Birch
Moderately difficult to penetrate	
Douglas fir, coast	Maple
White pine, sugar pine	
Southern pines, jack & red pines	
West coast hemlock	
Difficult to very difficult to penetrate	
Douglas fir, mountain	White oaks
Tamarack and western larch	Red gum
Spruces	
E. hemlock	
True firs	

This table is for heartwoods. Sapwoods are more penetrable than heartwoods but some are also difficult to treat, namely spruces, cedars, some Douglas firs, eastern hemlock and true firs.

Researchers are trying to overcome resistance of many woods to penetration by preservatives. Incising is most frequently used. Chisel-shaped teeth are pushed into the wood surface, cutting open areas of end grain. This is more permeable than side grain. Poles are incised only at the ground line of a resistant wood such as red cedar. Lumber and cross ties of a resistant species are incised over all side grain faces. Federal specifications require Douglas fir, larch, western hemlock, and heartwood pine (other than ponderosa or southern) lumber to be incised.

INSPECTION

When treated lumber is purchased from an unknown source without identification or quality assurance, customers might want to check it themselves.

If creosoted, cut a piece of lumber well away from the end, and observe how far the creosote has penetrated. Itinerant haulers have been known to sell "treated lumber and posts" from a truck. However, the "treated" wood has only been soaked in a dark oil with a creosote odor and is not preserved at all.

So-called treated cross ties or timbers, usually of aspen, are sold through nursery and garden supply outlets. They are often treated without much drying and absorb little preservative. Be suspicious if the wood seems excessively heavy. The weight may be due to water left in the wood.

Detection of waterborne salt penetration requires use of chemical sprays which react to form distinctive colors.

If oil used in PCP treatments is dark enough, penetration can be seen, but if not, special methods are needed beyond the scope of this bulletin.

If large quantities of treated lumber are being purchased, commercial agencies will inspect the lumber for a fee.

USE OF TREATED WOOD

In and Near Water

How and when should preserved wood be used instead of untreated wood? This question is often asked by builders and owners of marinas and waterfront structures. Any wood intermittently wet may decay either indoors or out. If the structure is built to last, then naturally durable or treated wood should be used (Fig. 13). Temporary structures are more economically built of untreated wood.

Where water drains well from wood, and wood is not kept moist, it may not need treatment. Wood touching soil or water should be treated (Figs. 14, 15 and 16). Wood in soil contact in such cold places as Alaska and Northern Canada will eventually rot if untreated.

Even though treated wood costs perhaps 30 to 50% more than untreated lumber of the same species, size and grade, it lasts so much longer that the extra cost is well worth it. In some cases, treated pine costs less than redwood or heart Douglas fir.

There are some places where treated wood should not be used (see Bulletin E-1248, Chemical Preservatives). Also, where a light treatment will suffice — building trim, fence boards, sash, doors and other items installed away from soil and water — pressure-treated lumber may not be needed and may introduce painting problems.

Construction Methods

Treated wood is handled about the same as untreated wood unless it is surface damp with oil. Construction people working with such wood should wear vinyl-impregnated gloves and should not smoke. Wipe off tools with a clean cloth wet with paint thinner to remove oil or preservative left on the metal. Bury such cloths when they are too soiled.

Handle waterborne, salt-treated wood with vinyl coated gloves when recently treated. And, wear a respirator that will filter out wood and chemical dust when sawing and machining treated wood.

After working with oily treated lumber, a thorough washing of the body is recommended. Clothing worn when working with any treated wood should be laundered when soiled.

Fig. 13. Marinas are built with preserved wood for long life.

If treated lumber is cut or drilled, exposing untreated areas, apply a solution of preservative liberally to these areas (Fig. 17). Suppliers of treated wood may also sell preservatives for this purpose. Follow instructions furnished with preservative. It is especially important to treat trimmed pile ends that will be exposed to rain and wave. Notched timbers, posts or piles are also vulnerable if not given secondary treatment. Keep this preservative from skin contact. (See also Bulletin E-1249, Treatment Methods.)

Disposal

During construction, treated wood scraps — cutoff ends of lumber, boring scraps, pile cutoffs — are produced. These scraps contain potentially toxic chemicals and should not lie around or be burned as untreated wood.

Fig. 14. Board walks of salt-treated wood are worthwhile additions to waterfront parks.

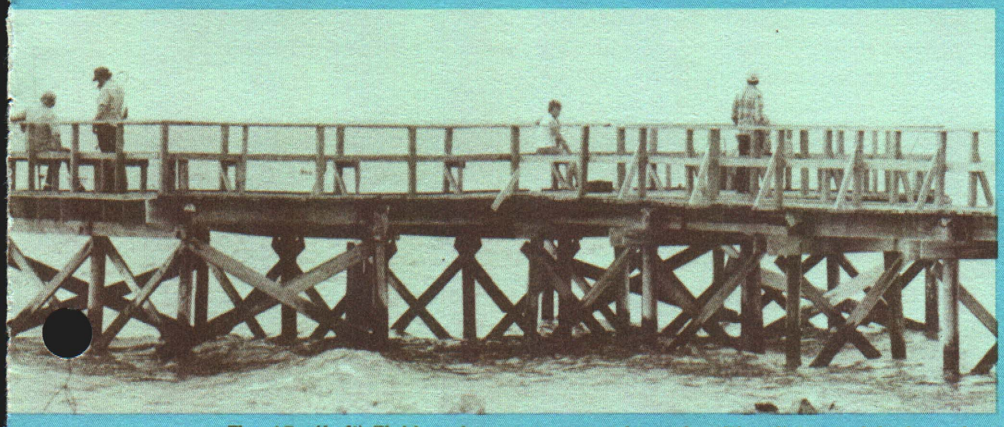

Fig. 15. (Left) Fishing piers are commonly made with salt-treated decks and creosoted or PCP-treated piling in fresh water. Fig. 16. (Right) Buildings such as this restaurant are supported on treated piles.

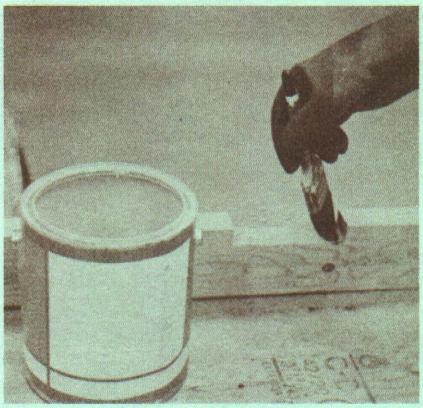

Fig. 17. When treated wood is cut, the sawed surfaces should be well brushed with preservative.

Creosoted and PCP-treated wood produce black smoke when burned and should not be used in stoves or fireplaces. Never use treated scraps in barbecue fires. Bury scraps away from homes, wells and slopes near water, or haul to sanitary landfills. They can be burned in municipal incinerators where high temperatures and regulated air decompose potentially harmful chemicals and minimize smoke.

Waterborne salt-treated wood scraps can also be buried. According to some British studies there is no great harm done in burning the small quantities of scraps in an open, hot fire provided people or animals close to the fire do not breathe the smoke. Wood treated with CZC might leave corrosive residues and should not be burned in iron equipment. Because it may be impossible to identify treated from untreated wood, do not store salt-treated wood waste where it will be mistaken for untreated wood.

Availability

PCP- or CCA-treated wood is widely distributed and available from lumber and building materials suppliers (Fig. 18). Large quantities may be available from treating plants in the vicinity. The list of suppliers changes frequently, but a supplementary list of treaters in the Great Lakes area is available from county extension and marine offices.

If treated wood is purchased from a plant that has no quality control, ask for assurance that the lumber or piles have the retention, penetration and preservative you require.

SIZE	8 FT.	10 FT.	12 FT.	14 FT.	16 FT.	18 FT.	20 FT.
2"x4"	1.95	2.47	3.51	4.23	5.18	6.21	7.01
2"x6"	3.30	3.65	5.10	5.95	7.78	9.86	11.40
2"x8"	3.74	4.86	7.56	8.06	9.36	11.70	14.40
2"x10"	4.48	5.84	8.97	11.43	12.52	14.62	16.50

SIZE	8 FT.	10 FT.	12 FT.	14 FT.	16 FT.	20 FT.
2"x12"	7.62	9.66	12.09	12.94	15.68	23.40
4"x4"	4.66	5.92	7.10	8.39	9.63	12.96	15.24
4"x6"	6.99	8.75	10.50	12.24	13.90	18.44	21.59
6"x6"	10.50	13.12	15.74	18.37	20.84	27.67	32.39

Fig. 18. Treated wood is stocked in many sizes and treatments by lumber and building supply stores.

ALWAYS USE WOOD PRESERVATIVES ONLY AS DIRECTED ON THE LABEL

The United States Environmental Protection Agency is currently reviewing the safety and registration of pentachlorophenol, arsenicals, and creosote/coal tar. These products can continue to be sold and used as wood preservatives until a final decision is made. In some cases that could be 4 years away.

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