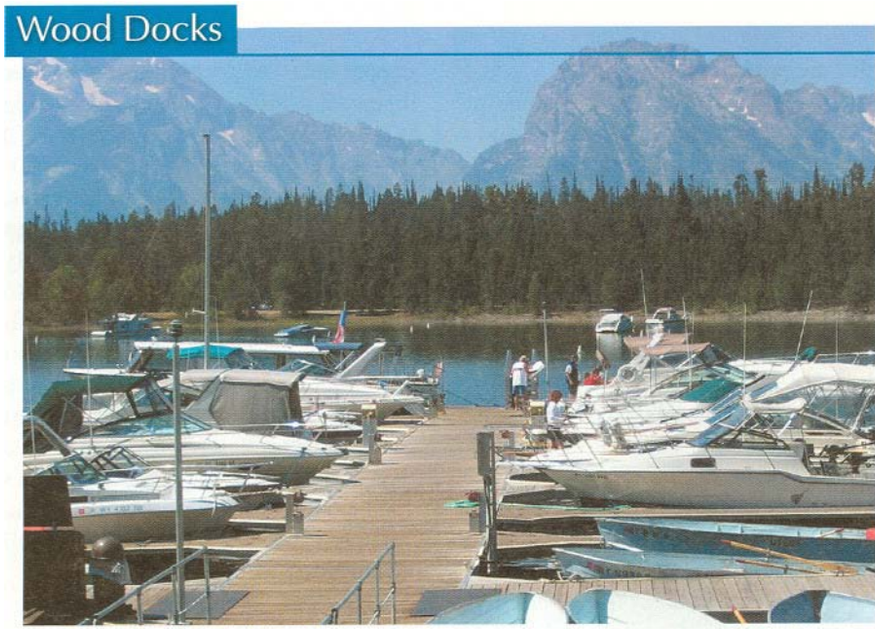

Untreated wood used outdoors can rot.

A primer on wood as dock construction material

BY STAN LEBOW

To be a successful marina owner and operator, it's important to understand all the facets of one's facility, including the intricacies of one part of the marina that most boaters take for granted: the docks. When it comes to dock construction, marinas have a wide-range of materials to choose from, with one of the most commonly used materials being preservative-treated wood. This article examines the role the government plays and the role marinas and contractors can play when using wood for construction purposes.

Characteristics

Wood has some unique characteristics as a dock construction material. One of the biggest advantages of wood is that it is typically less expensive to purchase and install than most other construction materials. It has a high strength-to-weight ratio, and can be easily worked with common tools and fasteners. The natural appearance of wood also lends itself to the aesthetics of a marina, especially in a natural setting.

It also has environmental benefits. Wood is a renewable resource that requires relatively little energy (thereby reducing greenhouse gas emissions) to manufacture. Wood is also biodegradable, but this potentially positive characteristic is also a disadvantage when wood is used outdoors. Untreated wood that is used above water can be degraded by decay fungi (rot), while untreated wood used in contact with the ground can be attacked by both decay and termites. In seawater, untreated wood can be attacked by several types of marine borers, although the type(s) of marine borers present varies with climate and salinity. Fortunately, this threat of attack by natural organisms can be overcome by pressure-treating wood with preservatives. The following paragraphs will discuss the factors to consider when using pressure-treated wood, including the types of preservatives available, choosing an appropriate type of treated wood, and minimizing environmental concerns.

Pressure forces

For long-term durability in dock construction, wood should be pressure-

Preservatives standardized for docks constructed in seawater and their corresponding treatment retentions (pounds preservative per cubic foot of wood)[1]

	Members Immersed in Saltwater				
	Round Piles				
Preservative	Northern[2]	Southern[2]	Lumber and timbers	Frequent Saltwater Splash	Above water or in ground contact
ACQ	Not Listed	Not Listed	Not Listed	0.60	0.40
ACZA	1.5	1.5	2.5	0.60	0.40
CA	Not Listed	Not Listed	Not Listed	0.31	0.21
CCA	1.5	2.5	2.5	0.60	Not Listed
Copper Naphthenate	Not Listed	Not Listed	Not Listed	0.075	0.06
Creosote	16	20	20	12	10
Pentachlorophenol	Not Listed	Not Listed	Not Listed	0.50	0.50
Oxine Copper	Not Listed	Not Listed	Not Listed	Not Listed	0.02
Dual Treat: ACZA or CCA	Not Listed	1.0	1.5	Not Listed	Not Listed
followed by Creosote		20	20		

1 This summary table only; for a more detailed presentation of preservative specifications and wood species refer to the AWPA Book of Standards.
2 Refers to north or south of New Jersey on the East Coast and San Francisco Bay on the West Coast

Source: AWPA Book of Standards, 2006

treated. In pressure treatment, the wood is placed into a large pressure vessel and a preservative is forced into the wood under pressure (usually between 150 and 200 psi). Depending on the preservative, wood species, and size of the wooden members, the pressure period may last from less than an hour to many hours. The goal is to get as much of the wood as possible penetrated with the preservative. This is important because untreated wood that is exposed by construction activities, i.e., cutting or drilling, or just by cracks caused by shrinking and swelling, may still be attacked by wood degrading organisms.

Types of preservatives

Wood preservatives are commonly classified as either waterborne or oil-type, based on their chemical composition and the carrier used during the treating process. They can also be grouped by the type of application or environment in which they are expected to provide long-term protection. Some preservatives have sufficient leach resistance and broad spectrum efficacy to protect wood that is exposed directly to soil and water. Other preservatives have intermediate toxicity or leach resistance that allows them to protect wood fully exposed to the weather, but not in contact with the ground. Only a few types of preservatives are classified as being able to protect wood against the marine borers that are present in seawater.

Oil-type preservatives are some of the oldest and most effective wood treatments. The most common are creosote, pentachlorophenol and copper napththenate. Another oil-type preservative, oxine copper, is sometimes used to treat wood used above-ground or above water.

Oil-type preservatives resist leaching because of their low water solubility, and the oil has the advantage of making the wood less susceptible to cracking and checking. Wood treated with oil-type preservatives tends to have a slightly oily surface, and it may have a noticeable odor (especially on hot days). Because of this, oil-type preservatives are usually used in applications where there will not be a lot of hand or skin contact. This is especially true for creosote because it can be a skin sensitizer. However, for wood that is used in above-the-water uses, such as decking, a lighter type of oil can be used with pentachlorophenol and copper naphthenate treatments to minimize the risk of creating an oily surface. Similarly, oxine copper is sometimes used for treatment of decking and railings because it has low mammalian toxicity.

Waterborne preservatives react with or precipitate in the wood substrate so that they are "fixed" and resistant to leaching. The most common waterborne preservatives are ammoniacal copper zinc arsenate (ACZA), alkaline copper quat (ACQ), chromated copper arsenate (CCA), and copper azole (CA). Acid copper chromate (ACC) and copper xyligen (CX) are also available in some areas of the United States.

Because waterborne preservatives leave a dry surface and are essentially odorless, they are commonly used to treat decking and other dock member that are expected to have frequent human contact. And, they will effectively protect piles and other support members as well. It is important to note that water-based wood preservatives can increase susceptibility to corrosion, so it is especially important that all metal fasteners be corrosion resistant.

The transition

Prior to 2004, CCA was by far the most commonly used waterborne preservative. However, its uses have been greatly restricted because of an agreement between preservative suppliers and the Environmental Protection Agency. In freshwater docks, CCA can only be used for treatment of vertical support members, i.e. piles, or composite wood products, such as glue-laminated beams or plywood.

These same restrictions apply in marine applications for members that are above salt-water splash. Any members that are immersed in or frequently splashed by seawater can still be treated with CCA.

The most widely available alterna-

Preservatives standardized for docks construction in freshwater and thier corresponding treatment retentions (pounds of preservative per cubic foot of wood)1

	Round Piles		Sawn {o;es	Lumber and Timber Supports	Decking and Railings
	Pine	Douglas Fir			
ACC	Not Listed	Not Listed	Not Listed	0.50	0.25
ACQ	0.80	Not Listed	0.60	0.40	0.25
ACZA	0.80	1.0	0.60	0.40	0.25
CA	0.41	Not Listed	0.31	0.21	0.10
CCA	0.80	1.0	0.60	Not Allowed2	Not Allowed
CX	Not Listed	Not Listed	Not Listed	Not Listed	0.21
Copper Naphthenate	0.10	0.14	0.075	0.06	0.04
Creosote	12	17	10.0-12.0	10	8.0
Pentachlorophenol	0.60	0.85	0.50	0.50	0.40
Oxine Copper	Not Listed	Not Listed	Not Listed	Not Listed	0.02

1 This summary table only; for a more detailed presentation of preservative specifications and wood speciies refer to the AWPA Book Standards.
2 There may be exceptions. For more a more detailed discussion of allowable uses of CCA- treated wood refer to the EPA's Web site at: *www.epa.gov/oppad001/reregistraition/cca*

Source: AWPA Book of Standards, 2006

An end tag is used to reveal if wood has been treated to standard specifications.

tives for CCA are ACQ and CA. They can be used for all members in freshwater docks, but are not approved for seawater immersion. The appearance of wood treated with these newer copper-based preservatives is similar to that of CCA, and in most ways these preservatives are interchangeable. There is some concern, however, that these new copper-based formulations are more corrosive to metal fasteners than CCA. These corrosion concerns have been lessened by changes in the formulation of ACQ, but it is still necessary to either use stainless fasteners or specify hot-dipped galvanized fasteners and connectors meeting ASTM A153 and ASTM A653 Class GI85 sheet. respectively.

Selecting a treatment

Not all preservatives are appropriate for all dock applications. The best source for determining which preservatives will be effective, along with their associated treatment specifications, is the *American Wood-Preservers Association (AWPA) Book of Standards*. The "AWPA Use Category System" places wood products into use categories based upon biodeterioration hazard and expected product performance. The preservatives most pertinent for dock construction are summarized in the tables on pages 51 and 52.

Preservatives listed in the AWPA standards have been evaluated for the intended application, and independent experts have reviewed the results of those evaluations. However, because the AWPA Standards are focused on durability, they generally do not consider factors such as color, odor, or surface

properties. For example, while creosote will effectively protect wood used in hand-rails, it is not ideal for this application because of its surface properties.

Quality assurance

The performance of any wood preservative depends on the quality of pressure treatment. When specifying preservative-treated wood, it is important to require that it be treated in accordance with AWPA Standards, which list both a minimum depth of penetration and minimum retention. User specification does not require an in-depth understanding of the treatment standards. Usually it is enough to just specify that a commodity (for example, piles) be treated with a preservative (for example, creosote) according to current AWPA standards for an intended end use (for example, freshwater).

It is also important that the pressure treater subscribes to an accredited third-party inspection program. The U.S. Department of Commerce, American Lumber Standard Committee (ALSC), accredits third-party inspection agencies for treated wood products. Updated lists of accredited agencies can be found on the ALSC Web site (*www.alsc/.org*). The easiest way to know if wood has been treated to standard specifications is to look for the quality mark or symbol of an ALSC-accredited agency on the wood's stamp, brand, or end tag.

Environmental concerns

All types of treated wood contain chemicals that are potentially toxic to aquatic organisms. However, research indicates that in most situations the concentrations of chemical released from the wood are too low to cause environmental impacts. The situations most likely to reach levels of concern are those involving large volumes of treated wood and small volumes of water. The Western Wood Preservers Institute has developed models to help determine if the conditions of a specific project rise to a level for environmental concern (see *www.wwpi.org).*

Regardless of the project however, it is always prudent to take steps to minimize environmental concerns with treated wood. Purchasers should specify and require assurance that the material they buy has been produced in compliance with "Best Management Practices for the Use of Treated Wood in Aquatic Environments," USA Version, revised January 2006, a publication of the Western Wood Preservers Institute and the Canadian Institute for Treated Wood (WWPI, 2006). Although these practices have not yet been adopted by the industry in all regions of the United States, purchasers in other areas can specify that these practices be followed. It is also important to use responsible specification and construction practices. To the extent that is practical, sawdust and scraps generated during construction should be collected, and not allowed to enter the water. **0**

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