Treated wood in transition

A look at CCA and the candidates to replace it

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Wood is one of the most versatile and widely used buildingmaterials.

However, it is also biodegradable, and may be attacked by decay fungi or insects when used in some applications or geographic locations. Uses that allow the wood to frequently become wet, such as embedded posts or other exposed wood members, are familiar examples of applications where wood will degrade. Although moisture is the key to deterioration of wood, in some geographic locations there are insects that will even attack dry wood used indoors.

Because it is biodegradable, wood used in applications where it may be attacked by decay fungi or insects should be protected by pressure treatmentwithpreservativechemicals.Wood preservatives are broadly classified as either water-based or oil-type, depending on the chemical composition of the preservative and the carrier used during the treating process. The most common oil-type preservatives are creosote, pentachlorophenol, and copper naphthenate. The oil-type preservatives are commonly used for applications such as posts, poles, piles, and glue-laminated members. They are not usually used for applications that involve frequent human skin contact or inside dwellings because they maybe visually oily, oily to touch, or have a strong odor. Water-based preservatives have become more widely used in the recent years because the treated woodhas a dry, paintable surface, and no odor. The most common of these preservatives has been chromated copper arsenate. CCA-treated wood, commonly called “green-treated” wood has dominated the residential market for several decades and is sold at lumberyards under a variety of trade names. CCA-treated wood has also been widely used in post-frame building applications. However, as the result of the voluntary label changes submitted by the CCA registrants, the EPA labeling of CCA will permit the product to be used primarily for industrial applications. The label change is effective December 31, 2003, although suppliers will be allowed to sell existing stocks of CCA treated wood after that date. This recent development has raised questions about the availability of CCA treated wood and the properties of alternative types of treatments.

What types of applications are affected by the CCA restriction?

The label changes cite specific commodity standards listed in the 2001 edition of the American Wood- Preservers' Association standards. The changes were made as part of the ongoing CCA re-registration process, and in light .of the current and anticipated market demand for alternative preservatives for non-industrial applications. CCA treated wood, however, can be used in certain critical structural applications (Table 1). Many applications of sawn lumber and timbers are affected, while CCA will still be allowed for treatment of roundstock (poles, building posts, piles) and sawn structural supports. Examples of sawn products that may still be treated with CCA include:

- Lumber produced for permanent wood foundations
- Sawn structural piles used to support residential and commercial structures
- Sawn posts and poles used in building construction
- Wood used in highway construction, including lumber and timbers
- Utility pole cross-arms
- All dimensions used in salt water and subject to marine borer attack

Engineered wood products which may still be treated with CCA include:

- Glue laminated beams and columns
- Structural composite lumber
- Plywood for agricultural use, roof decking, subflooring, and boat construction

Alternatives to CCA preservative treatment

For decades CCA was used in a broad range of applications ranging from mild to very severe deterioration hazards. CCA was very much of a one-size-fits-all type of wood treatment. It has been difficult to develop low toxicity, inexpensive replacements for CCA that can protect wood in such a broad range of applications. As a result, the limitation on CCA has and will continue to cause changes in the way we will approach treated wood in the future. There will be more types of wood preservatives, and they will be more closely targeted toward certain types of applications.

In addition, because the CCA replacements are more expensive, there will be greater emphasis on using the minimum amount of preservative needed to protect the wood. For example, decking may be treated to a lower retention than the stringers, which may be treated to a lower retention than support posts.

Although CCA was also intended for treatment to range retentions for various applications, the difference in cost was small enough that many treaters did not produce wood with the lowest retention and many retailers only wanted to inventory one type of treated wood. With the CCA alternatives it will be more important to match the type of preservative, and its retention, with the intended

application.

Several arsenic-free preservative formulations have been standardized by the American Wood-Preservers' Association for use in many of the applications previously dominated by CCA. Currently, these alternatives all rely heavily on copper as their primary active ingredient. Depending on your location and intended use of the wood, one or more of these alternative types of treated wood may be available. Availability is expected to increase rapidly in the coming months.

Be aware that the various suppliers may sell the same type of treated wood by different names, and that you may need to ask the supplier for more information to determine the preservative used. Also, some manufacturers incorporate colorants or water-repellents into some of their preservative treatments. These treatments may also have a different trade name. Most importantly, do not assume that all "green-treated" wood is equal. The type of preservative, retention, and quality of treatment are critical to performance.

This publication only describes preservatives that have been evaluated and standardized by the American Wood-Preservers' Association', which is the primary standard-setting body for pressure treated wood. To become standardized by the AWPA, preservative treated wood must undergo a series of rigorous tests to ensure its durability.

The results of these tests are reviewed by AWPA members who represent government agencies, universities, commercial chemical suppliers, and treaters. Be wary of purchasing wood that has been treated with a preservative that has not been standardized for that application by either the AWPA or some other major standard setting body, such as ASTM.

Acid Copper Chromate (ACC): ACC has been used sporadically as a wood preservative in Europe and the U.S. since the 1920s. In the last few decades it has been primarily used for the treatment of wood used in cooling towers. ACC contains 32 percent copper oxide and 68 percent chromium trioxide. The treated wood has a light greenish-brown color, and little noticeable odor.

Tests on stakes and posts exposed to decay and termite attack indicate that ACC provides acceptable average service life, but that wood used in ground contact may suffer occasional early failures from attack by copper tolerant fungi. ACC is listed in AWPA standards for treatment of a wide range of softwood and hardwood species used aboveground or in ground contact.

However, in critical structural applications such as highway construction, its AWPA listings are limited to sign posts, handrails and guardrails, and glue-laminated beams used above ground. It may be difficult to obtain adequate penetration of ACC in some of the more refractory wood species such as white oak or Douglas-fir. This is because ACC must be used at relatively low treating temperatures and because rapid reactions of chromium in the wood can hinder further penetration during longer pressure periods. The high chromium content of ACC, however, has the benefit of preventing much of the corrosion that might otherwise occur with an acidic copper preservative.

Alkaline Copper Quat (ACQ): Alkaline copper quat is one of several wood preservatives that has been developed in recent years as an alternative to CCA. The fungicides and insecticides in ACQ are expressed as copper oxide (67 percent) and a quaternary ammonium compound (quat, 33 percent). Multiple variations of ACQ have been standardized or are in the process of standardization. ACQ type B is an ammoniacal copper quat formulation, ACQ type D is an amine copper quat formulation, and ACQ type C is formulated with either ammonia or amine, and a slightly different quat compound. ACQ-B treated

Type of end-use still allowed under agreement	AWPA Standard U1 Standard	C-Standard
Lumber and timbers used in seawater	G	C2
Land, fresh water, and marine piles	E	C3
Utility poles	D	C4
Plywood	F	C9
Wood for highway construction		C14
Round. half-round. and quarter round fence posts	B	C16
Poles, piles. and posts used as structural members on farms	B,D	C16
Wood used in marine construction (including above the water)	G	C18
Lumber and plywood for permanent wood foundations	A,F	C22
Round poles and posts used in building construction	B,D	C23
Sawn timbers (over 5 inches thick) used to support residential and commercial structures	A	C24
Sawn cross arms	A	C25
Structural glue-laminated members	F	C28
Structural composite lumber (parallel strand or laminated veneer lumber)	F	C33
Shakes and shingles	A	C34

Table 1. Products that may still be treated with CCA under conditions of the new label language.

1 Book of Standards. American Wood Preservers Association, Selma Ala.

wood has a dark greenish brown color that fades to a lighter brown, and may have a slight ammonia odor until the wood dries.

Wood treated with ACQ-D has a lighter brown color and little noticeable odor, while wood treated with ACQ-C varies in appearance between that of ACQ-B and ACQ-D, depending or the formulation. The ACQ formulations are listed in AWPA standards for a range of applications and many softwood species, although the ACQ-C listings are limited because it is the most recently standardized. Minimum retentions of 4.0 kilograms/meter^3 (0.25 pounds/foot^3) or 6.4 kilograms/meter^3 (0.4 pounds/foot^3) are specified for wood used above-ground and in ground contact, respectively. A retention of 9.6 kilograms/meter^3 (0.6 pounds/foot^3) is specified for critical structural members placed in ground contact.

The multiple formulations of ACQ allow some flexibility in achieving compatibility with a specific wood species and application. When ammonia is used as the carrier, ACQ has improved ability to penetrate into difficult to treat wood species such as Douglas-fir. However, if the wood species is readily treated, such as southern pine, an amine carrier can be used to provide a more uniform surface appearance.

The number of pressure treatment facilities using ACQ is increasing. In the western U.S., the ACQ-B formulation is used because it allows better penetration in difficult to treat western species. Treating plants in the remainder of the country generally use the ACQ-D formulation or the more recently standardized ACQ-C formulation.

Ammoniacal Copper Citrate (CC): Ammoniacal copper citrate is a recently developed wood preservative that utilizes copper oxide (62 percent) as the fungicide and insecticide, and citric acid (38 percent) to aid in the distribution of copper within the wood structure. The color of the treated wood varies from light green to dark brown. The wood may have a slight ammonia odor until it is thoroughly dried after treatment. CC is listed in AWPA standards for treatment of a range of softwood species and wood products.

The minimum CC retention is 4 kilograms/meter^3 (0.25 pounds/foot^3) or 6.4 kilograms/meter^3 (0.4 pounds/foot^3) for wood used above ground or in ground contact, respectively. As with other preservatives containing ammonia, CC has an increased ability to penetrate into difficult to treat wood species. Few treating plants currently use CC, and wood treated with this product may not be readily available in most areas.

Ammoniacal Copper Zinc Arsenate (ACZA): ACZA has been used commercially for two decades, primarily in western North America for treatment of Douglas-fir. ACZA is a refinement of an earlier formulation, ACA, which is no longer available in the U.S.

ACZA contains copper oxide (50 percent), zinc oxide (25 percent) and arsenic pentoxide (25 percent). The color of the treated wood varies from olive to bluish green. The wood may have a slight ammonia odor until it is thoroughly dried after treatment. ACZA is listed in AWPA standards for treatment of a range of softwood and hardwood species and wood products. The minimum ACZA retentions are 4.0 kilograms/meter^3 (0.25 pounds/foot^3) or 6.4 kilograms/meter^3 (0.4 pounds/foot^3) for wood used above ground or in ground contact, respectively. A slightly higher retention, 9.6 kilograms/meter^3 (0.6 pounds/foot^3), is required for wood used in critical structural components. As with other preservatives containing ammonia; ACZA has an increased ability to penetrate into difficult to treat wood species. Treating facilities using ACZA are currently located in western states, where many of the native tree species are difficult to treat with CCA.

Copper Azole (CBA-A and CA-B): Copper azole is another recently developed preservative formulation that relies primarily on amine copper, but it also includes a co-biocide to further protect wood from decay and insect attack.

The first copper azole formulation developed was copper azole -Type A (CBA-A), which contains 49 percent copper, 49 percent boric acid, and 2 percent Tebuconazole. More recently, the copper azole - Type B (CA-B) formulation was standardized. CA-B does not contain boric acid, and is comprised of 96 percent copper and 4 percent Tebuconazole. Wood treated with either copper azole formulation has a brownish-green color and little or no odor. The formulations are listed in AWPA standards for treatment of a range of softwood species.

Minimum retentions of CBA-A are 3.3 kilograms/meter^3 (0.20 pounds/foot^3) and 6.5 kilograms/meter^3 (0.41 pounds/foot^3) for wood used above-ground, or in-ground

contact, respectively. A retention of 9.8 kilograms/meter^3 (0.61 pounds/foot^3) is specified for critical structural members placed in ground contact. Minimum retentions of CA-B are 1.7 kilograms/meter^3 (0.10 pounds/foot^3) or 3.3 kilograms/meter^3 (0.21 pounds/foot^3) for wood used aboveground or in-ground contact, respectively. A retention of 5.0 kilograms/meter^3 (0.3 1 pounds/foot^3) is specified for critical structural members placed in ground contact.

Although listed as an amine formulation, copper azole may also be formulated with an amine-ammonia formulation. The ammonia may be included when the copper azole formulations are intended for treatment of refractory species. Recent studies have demonstrated the ability of such a formulation to adequately treat Douglas-fir. The inclusion of the ammonia, however, is likely to have slight affects on the surface appearance and initial odor of the treated wood.

Wood treated with copper azole formulations has become increasingly available in recent months.

Copper Dimethyldithiocarbamate (CDDC): Copper dimethyldithiocarbamate is a reaction product formed within the wood after treatment with two different treating solutions. It contains copper and sulfur compounds.

CDDC is standardized for treatment of Southern Pine and some other pine species at copper retentions of 1.6 kilograms/meter^3 (0.1 pounds/foot^3) or 3.2 kilograms/meter^3 (0.2 pounds/foot^3) for wood used above ground or in ground contact, respectively. CDDC-treated wood has a light brown color and has little or no odor. CDDC was introduced several years ago, but because plant conversion may be more expensive with CDDC, it is not currently commercially available.

Copper HDO (CX-A): Copper HDO is an amine copper based preservative that has been used in Europe and was recently listed in AWPA standards. The active ingredients are copper oxide, boric acid, and copper-HDO (Bis-(N-cyclohexyldiazeniumdioxy) copper). The appearance and handling characteristics of wood treated with Copper HDO are similar to the other copper-based treatments. CX-A has been evaluated in a range of exposures, but at this time has only been standardized for uses aboveground. At the time of this publication EPA registration of CX-A was pending.

Borates: Borate preservatives are sodium salts such as sodium octaborate, sodium tetraborate, and sodium pentaborate that are dissolved in water. Borate preservatives have received considerable attention in recent years because they are inexpensive and have low mammalian toxicity. Borate-treated wood is also odorless, colorless, and may be painted or stained. Borates are effective preservatives against decay fungi and insects. Borate preservatives are diffusible, and with appropriate treating practices they can achieve excellent penetration in species that are difficult to treat with other preservatives. However, the borate in the wood remains water soluble and readily leaches out in soil or rainwater. Borate preservatives are standardized by the AWPA, but only for applications that are not directly exposed to liquid water. Borate-treated wood should be used only in applications where the wood is kept free from rainwater, standing water, and ground contact. An example of such a use is framing lumber in areas of high termite hazard.

Sources of supply

Information on companies that manufacture or distribute preservatives listed in the AWPA standards can be found on the AWPA web site (www.awpa.com/faq/faq4.htm), or at the websites of other associations such as the Southern Pine Association (www.southernpine.com/produce.htm) or Western Wood Preservers Institute (www.wwpinstitute.org).

Will I notice a difference with the CCA alternatives?

From a practical, end-use basis there is little difference between CCA and the recently developed alternatives. The appearance, strength properties, and handling characteristics are very similar to CCA. The alternatives are slightly more expensive however, and the cost difference increases at higher preservative retentions.

With the possible exception of ACC, the alternative treatments may be somewhat more corrosive to metal

fasteners than is CCA[2]. In-service corrosion with the CCA alternatives is difficult to evaluate because of the absence of long-term service data, but major fastener and preservative manufacturers are working to minimize corrosion concerns. The use of stainless steel fasteners or fasteners treated with a high quality hot-dip galvanization process is generally recommended, but the formulations continue to evolve and the preservative suppliers are the best source of up-to-date information on suitable fasteners.

Because the treatments contain copper, direct contact of the treated wood with building components that contain aluminum should be avoided.

Specifying preservative treatments

Wood preservatives, and their various retentions, are generally classified or grouped by the type of application or exposure environment in which they are expected to provide long term protection. Some preservatives have sufficient leach resistance and broad spectrum efficacy against decay and insects to protect wood that is exposed directly to soil and water.

These preservatives will also protect wood exposed above ground, and may often be used in those applications at lower retentions. 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. Other preservatives lack the permanence or toxicity to withstand continued exposure to precipitation, but may be effective with occasional wetting. Finally, there are formulations that are so leachable that they can only withstand very occasional, superficial wetting.

To guide selection of the types of preservatives and loadings appropriate to a specific end-use, the AWA recently developed Use Category System standards. The UCS standards simplify the process of finding appropriate preservatives and preservative retentions for specific end uses. They categorize all treated wood applications by the severity of the deterioration hazard (Table 2).

The lowest category, Use Category 1 is for wood that is used in interior construction and kept dry, while UC2 is for interior wood, completely protected from the weather but occasionally damp. UC3 is for exterior wood used above-ground, while UC4 is for wood used in ground-contact in exterior applications. At the other end of the spectrum is UC5, which encompasses applications that place treated wood in contact with seawater and marine borers. To use the UCS standards, one needs only to know the intended end-use of the treated wood. A table in the UCS standards lists most types of applications for treated wood, and lists the appropriate Use Category and Commodity Specification. The Commodity Specification lists all the preservatives that are standardized for that Use Category, as well as the appropriate preservative retention and penetration requirements. The user needs only specify that the product be treated

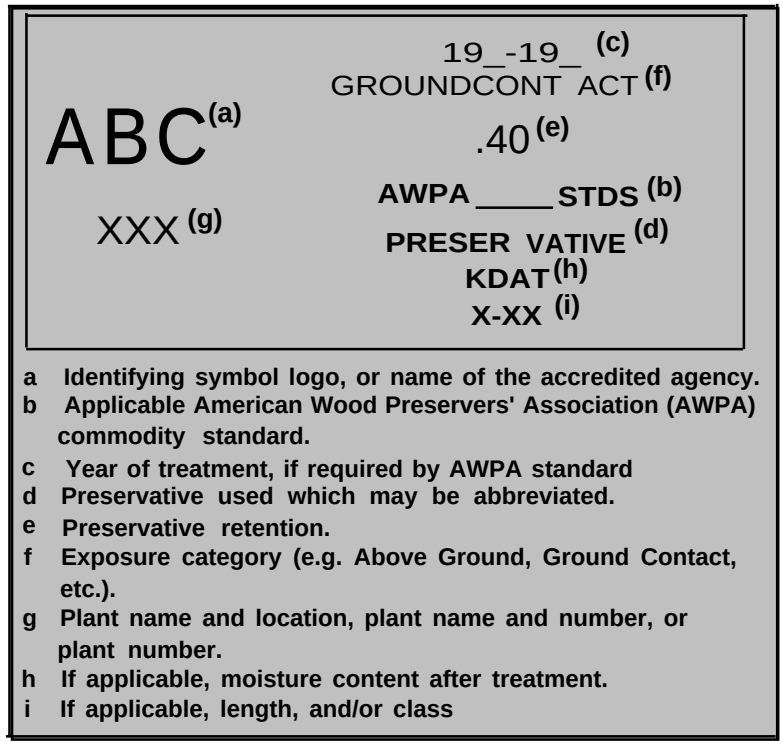

Figure 1. Typical quality mark for preservative treated lumber to conform to the ALSC accreditation program.

2 Cushman, T. 2003. New wood treatments may be more corrosive. Journal of Light Construction, September, 2003.

according to the appropriate Use Category.

Quality assurance

With the rapid changes taking place in the treating industry it is more important than ever to ensure that wood is being treated to standard specifications. The U.S. Department of Commerce American Lumber Standard Committee accredits third-party inspection agencies for treated wood products. Quality control overview by ALSC-accredited agencies is preferable to simple treating plant certificates or other claims of conformance made by the producer without inspection by an independent agency.

The ALSC Treated Wood Program currently has eight accredited independent third-party agencies headquartered throughout the United States and Canada. Updated lists of accredited agencies can be obtained from the ALSC website at www.alsc.org.

Look for a quality mark or stamp of an ALSC accredited agency on the wood (Figure 1). The used of treated wood with such third party certification may be mandated by applicable building code regulations. In addition to identifying information on the producer, the stamp indicates the type of preservative, the retention level of the preservatives and the intended exposure conditions. The retention levels are pounds of preservatives per cubic foot of wood. Retention levels are specific to the type of preservative, species and intended exposure conditions.

The appropriate treated wood will depend on whether the intended applications are above ground, ground contact, fresh water, marine (salt water) or in a Permanent Wood Foundation. Detailed specifications on the different treatments can be found in the applicable standards of AWPA and the American Society for Testing and Materials.[3] The ASTM specifications for pressure treatment of timber products are listed in ASTM D 1760. There is also an ongoing effort to develop Best Management Practice type standards to ensure that treated wood it is produced in a way that will minimize environmental and handling concerns.

The Western Wood Preservers Institute4 has developed guidelines for treated wood used in aquatic environments and the AWPA has active task forces working to develop fixation guidelines for waterborne preservatives. As these BMP-type standards become more developed it will be important to include them in specifications of treated wood products.

3 ASTM. 2002. Specification for Pressure Treatment of Timber Products. D1760. Philadelphia, Pa. American Society of Testing and Materials. Vol. 04.09.
4 WWPI. 1996. Best Management Practices for The Use of Treated Wood in Aquatic Environments. Western Wood Preservers Institute, Vancouver, Wash.

USE CATEGORY	SERVICE CONDITIONS	USE ENVIRONMENT	COMMONAGENTSOF DETERIORATION	TYPICAL APPLICATIONS
UC1	Interior construction, dry, above ground	Continuously protected from weather or other sources of moisture	Insects only	Interior construction and furnishings
UC2	Interior construction, damp, above ground	Protected from weather, but subject to sources of moisture	Decay fungi and insects	Interior construction
UC3A	Exterior construction, coated, above ground	Coated. Exposed to all weathercycles. Rapid water runoff	Decay fungi and insects	Coated millwork
UC3B	Exterior construction, above ground	Exposed to all weather cycles and prolonged wetting	Decay fungi and insects	Decking, deck joists, railings, fence pickets
UC4A	Ground contact or fresh water	For normal ground or fresh water contact. Exposed to all weather cycles	Decay fungi and insects	Privacy fence posts, structural lumber and timbers, guardrail posts, utility poles in regions of low decay potential
UC4B	Ground contact, fresh water, or important construction components	Severe ground contact or salt water splash. Difficult replacement. Exposed to all weather cycles	Decay fungi and insects with increased potential for biodeterioration	Permanent wood foundations, utility poles in regions of moderate to severe potential for decay or economic loss, building poles, horticultural posts.
UC4C	Ground contact, fresh water, or critical structural components	Very severe ground contact. Exposed to all weather cycles. Critical structural components	Decay fungi and insects with high potential for biodeterioriation	Land or fresh water piling. Foundation piling. Utility poles with a severe potential for decay
UC5A	Salt or brackish water and adjacent mud zone	Continuous marine (salt water) exposure	Salt water organisms. Limnoria quadripunctata	Piling, Bulkheads, Bracing
UC5B	Salt or brackish water and adjacent mud zone	Continuous marine (salt water) exposure	Salt water organisms. Limnoria tripunctata	Piling, Bulkheads, Bracing
UC5C	Salt or brackish water and adjacent mud zone	Continuous marine (salt water) exposure	Salt water organisms. Marteisa, Sphaeroma	Piling, Bulkheads, Bracing
UCFA	Fire protection as required by codes. Above ground interior construction	Continuously protected from weather or other sources of moisture	Fire	Roof sheathing, roof trusses, studs, joists, paneling
UCFB	Fire protection as required by codes. Above ground exterior construction	Wetting	Fire	Vertical exterior walls, inclined roof surfaces, or other types of construction which allows water to drain quickly from surface.

Table 2. Summary of Use Categories for treated wood developed by the American Wood-Preservers' Association.

Summary

The treated wood industry is undergoing a major transition as the production of CCA is phased out for many applications. CCA treated wood can still be used for most structurally critical members such as poles and support columns. CCA alternatives have been developed, and will become more widely available in the coming months.

In the future there is likely to be a wider range of types and retentions of wood preservative for different end uses.

During this transition it is more important than ever to: 1. Use only preservative systems that have been evaluated and accepted by a national standard-writing organization such as AWA or ASTM, 2. Use only treated products that have been produced under the review of an ALSC-accredited third party quality assurance program, and 3. Recognize that not all CCA alternatives are suitable for all end-uses.

The AWPA Use Category Standards assist in this selection process by categorizing preservative systems and retentions based on the type of end-use. ■