Treated Wood Update

Today's treated wood is tough. But is it tough enough?

by Ted Cushman

When chromated copper arsenate (CCA) was withdrawn from the residential market in 2003, the chemical industry responded by introducing wood-treating formulas that still contained copper, but that replaced the arsenic and chromium with other, less-harmful active ingredients. These formulas have now had more than 10 years to prove themselves in the U.S. market—time enough for suppliers and builders to assess the performance of lumber treated with them. The good news? It performs pretty well, both in long-term scientific tests and on decks in the field. The bad news? There have been a few complaints and reported failures. Some users have reported premature decay, particularly in severe exposures or in ground-contact situations (**Figures 1, 2**).

According to some in the industry, the reported performance issues don't reflect a problem with the new formulas, which have all passed a long gauntlet of testing designed to establish their efficacy. Instead, the problem is one of "misapplication" by end users: Lumber that's treated—and only rated for—above-ground use is being put into contact with the ground. But at least one wood treater thinks the industry should make sure this can't happen—by treating most lumber to ground-contact retention levels, as was done with CCA.

Higher Retention Levels Proposed

Maine businessman Harold "Hal" Bumby is a third-generation wood treater. His

Figure 1. This deck was built in the mid-Atlantic area in 2005 using ACQ-lumber treated for above-ground use. The 5/4x6 cap rail shows clear signs of premature rot.

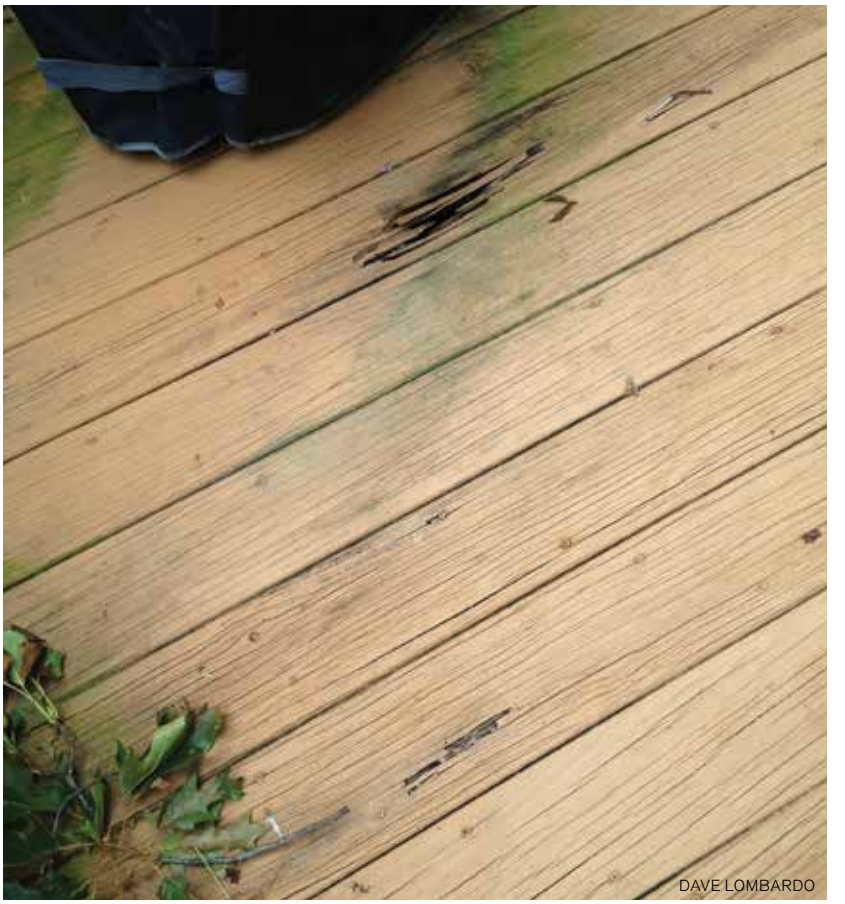

Figure 2. The same 5/4x6 ACQ stock that was used for the cap rail in the top photo was used for the decking, which also needed replacement.

father and grandfather ran a treating company in Minneapolis, Minn., and Bumby grew up in the family business. In the 1980s, he moved to Maine to start his own wood treating company, Maine Wood Treaters (mainewoodtreaters.com), in Mechanic Falls. Bumby treats southern pine and native Maine hemlock (he has, among others, the contract to treat the Maine Department of Transportation's 4x6 hemlock signposts).

At a meeting of the American Wood Protection Association (AWPA; awpa.com) Technical Committee in Portland, Maine, in September 2014, Bumby raised the issue of reported failures of treated wood. He suggested that the industry take the same approach his father and grandfather took: Stop treating wood for above-ground use and treat all wood—posts, dimensional framing lumber, and decking included—for ground contact. While that idea didn't fly with the committee, they did agree to form a task group to study a more modest proposal to change the treating standards so that all lumber sized 2x8 and wider would be treated to ground-contact levels. This would ensure that the lumber that's commonly placed in critical structural applications would carry enough treating chemical to stand up to harsh conditions.

"Don't get me wrong. There aren't many problems—there are very few," Bumby told me after the meeting. "But with CCA, there used to be none. That's because we only sold one product, and it was a general-use product: ground-contact-rated lumber. I don't want there to be a few problems. I want there to be none."

While executives at the treating-chemical suppliers are reluctant to talk on the record about failure issues, privately many of them support Bumby's idea. In

Supplier Shake-Up

If you're trying to understand treated wood, it doesn't help that all the major companies have changed ownership since 2010. Many treated wood products have also been re-branded, appearing on the market with new names. On the other hand, some brands that have been around for decades now contain different active ingredients from those they contained 20 years ago. So these days, you can't tell the players without a scorecard.

Currently, there are three top suppliers of treated wood: Lonza (a global firm that purchased the wood-treating business of Arch Chemicals in 2011, a decade after Arch acquired U.K.-based Hickson in 2000); Koppers Performance Chemicals (formed in 2014 when the global firm Koppers, based in Pittsburgh, Pa., purchased Osmose); and Viance, which is still called Viance even though the company's ownership has changed. (Viance was formed in 2006 as a joint venture between Chemical Specialties Inc., or CSI, and the global chemicals and coatings firm Rohm and Haas. CSI was a wholly owned subsidiary of a holding company called Rockwood. The Dow Chemical Co. bought Rohm and Haas in 2009, and then Rockwood sold its half of the venture to another company, Huntsman, in 2013. So today, Viance is a 50-50 joint venture between Huntsman and Dow.)

Despite the corporate shake-ups, however, the same management personnel and the same technical experts are mostly still in place at the major companies that supply wood-treating chemicals. (All those managers and experts know each other, by the way, because they all participate in the same industry-wide groups that create codes and standards for the industry.) And despite all the new marketing buzz, the treated wood you can buy today is not much different from the treated wood that you could buy in 2004. There have been a few tweaks and improvements, and some brands have gained or lost market share, but since CCA was phased out and the new varieties appeared, the main chemicals and the treatment levels have not changed. So you'd never know it, but if you're building decks today, you're getting pretty much the same lumber, from pretty much the same people, as you were in 2004.

Here's a look at the basic offerings for framing lumber and decking:

- **Viance** (treatedwood.com)
  Preserve ACQ, Preserve CA, and EcoLife II (EL2)
- **Lonza** (wolmanizedwood.com)
  Wolmanized Outdoor (in both CA-C and μCA-C versions) and EraWood (PTI)
- **Koppers** (koppersperformancechemicals.com)
  NatureWood (ACQ), NatureWood CA (CA-C), MicroPro/LifeWood (μCA-C), and NexWood (PTI)

fact, insiders say there's a good chance that a rule requiring all framing lumber 2x8 and wider to be treated for ground-contact use is likely to pass the AWPA by spring and be fully implemented by 2016.

What's in That Wood?

Brand names mean a lot to the marketing departments of the companies selling the wood (see "Supplier Shake-Up," left). And the treatments' ingredients mean a lot to the chemical companies that make them and to the small local or regional companies that use them to treat wood. But to deck builders? Not so much. As one deck builder put it, "I don't ask what's in it, and I don't know who makes it. I go to the lumberyard and ask, 'You got any treated wood? What's the price?'" For most contractors in the field, availability comes first, price comes second, performance comes third, and nothing comes fourth.

It's reasonable enough to put performance last and not to worry too much about the brand name or the ingredients. After all, every brand is code-listed—meaning that they all have proven that they've met a minimum performance standard. And they all come with some type of guarantee.

But guarantees are limited: A company won't back up the wood's structural performance unless you install it according to certain specifications. And while the different treating formulas have to meet the same generic standards, they're not all the same. The chemicals don't all work the same way, and the treated wood might not behave exactly the same way in use. So it's worth taking a closer look at what the different treating formulas contain, and how they act to protect the wood.

Main ingredients. Generally speaking, treated-wood formulas have four main elements. There's a carrier—the fluid used to get the active ingredients into the wood. There's a primary active ingredient (generally copper, which is deadly to most fungi and wood-eating insects).

There's a "co-biocide" or two—additional active ingredients designed to kill copper-resistant fungi. And finally, there's a fixative, included in the mix because it helps bind the other ingredients into the wood so they won't leach out if the structure gets wet.

In the old CCA, copper was the primary biocide; arsenic was the highly effective back-up bug and fungus killer; and chromium, besides being deadly to bugs and fungi, was the fixative that locked the copper and arsenic into the wood's molecular structure.

With a few exceptions, the new treatments still use copper as the big gun. But the secondary biocide can't be arsenic any more. Instead, some formulas use "azoles," complex carbon-based molecules that have been around a long time and are well-known in agriculture, where they are sprayed on fruit and vegetable crops to combat fungi. Other formulas use a "quaternary" compound ("quat" for short), which is basically a strong soap or detergent. Quat, like azole, is a well-known agricultural pesticide; but in wood treating, quat also acts as a binder, helping to lock the other chemicals into the molecular matrix of the wood cell walls, and as a soapy surfactant that helps the copper penetrate the wood (**Figure 3**).

Dissolved or micronized? To complicate matters further, there are two ways of preparing the main-line copper ingredient and forcing it into the wood. One class of formulas uses copper dissolved in an alkaline solution of water (that list includes Viance's Preserve and Preserve CA, as well as Koppers' NatureWood ACQ and NatureWood CA and one version of Lonza's Wolmanized Outdoor wood). The other approach, typified by Koppers' MicroPro/LifeWood and by most of Lonza's Wolmanized wood, uses "micronized" copper—solid copper that is ground into very small granules, and suspended, not dissolved, in the water-based carrier fluid (**Figure 4**).

Figure 3. Each stick of treated lumber has a label that identifies the chemical formulation that it has been treated with. Retention levels for different formulas and different uses are established by the AWPA or by code evaluation reports, such as ICC-ES reports.

Common Wood Preservatives

Code	Preservative Name	UC3B	UC4A	UC4B
ACQ	Alkaline Copper Quaternary (Type B or C)	0.25	0.40	0.60
ACQ	Alkaline Copper Quaternary (Type A or D)	0.15	0.40	0.60
ACZA	Ammoniacal Copper Zinc Arsenate	0.25	0.40	0.60
CA-B	Copper Azole, Type B	0.10	0.21	0.31
CA-C	Copper Azole, Type C	0.060	0.15	0.31
CuN-W	Waterborne Copper Naphthenate	0.070	0.11	---
CX-A	Copper HDO	0.206	---	---
EL2	DCOI-Imidacloprid-Stabilizer	0.019	---	---
PTI	Propiconazole-Tebuconazole-Imidacloprid	0.018	---	---
PTI	PTI plus Stabilizer	0.013	---	---
µCA-C*	Micronized Copper Azole	0.05	0.14	0.23

Figure 4. For ground-contact use, CA-C is the most widely-used AWPA treatment. Most East Coast treaters have phased out ACQ, though it's still popular with Western treaters working with Douglas fir. Micronized copper azole—sometimes referred to as MCA—is widely used, but not standardized by AWPA.

Micronized treatments use less total copper and a less corrosive carrier. The ground-up copper bits sit in the wood and slowly release their copper into it, helping to extend the treatment's effective life. Micronized treatments have taken over the bulk of the market, especially for easy-to-treat southern yellow pine lumber. But dissolved formulas are still important, particularly on the West Coast and in Canada, where much of the commonly available Douglas fir, spruce, hemlock, and western pine lumber is harder to treat and won't absorb micronized copper. Dissolved formulas are also used to treat eastern hemlock, another hard-to-penetrate wood, for use as landscape ties. (You'll know if you're looking at one of those "refractory" species, by the way, because you'll see telltale razor marks where the wood has been incised to allow deeper penetration of treating

chemicals and to help limit cracking of the wood after treatment.)

Carbon-based options. Koppers, Viance, and Lonza all offer wood treated with non-copper preservatives, too. Agricultural pesticides like imidacloprid and tebuconazole don't lock into the wood fibers as readily as copper, however, so products that use it, like EcoLife II, EraWood, and NexWood, are limited to above-ground use.

If you're buying treated wood off the shelf, and if you're not looking too closely at the label, you might be getting dissolved copper with quat, dissolved copper with azole, micronized copper with quat, micronized copper with azole, or—in the case of Lonza's new "BARamine" Wolmanized wood—either dissolved or micronized copper with two kinds of azole plus quat: the whole candy store in one bag. As for the wood, if you're building in the eastern U.S., the treated wood is probably southern yellow pine (SYP), but if you're building out West, the lumber could be any of a half-dozen different conifers.

The Science and the Code

So ... does it work? That's the question the building code asks, too—and to get code recognition, treated-wood makers have to demonstrate that the answer is yes.

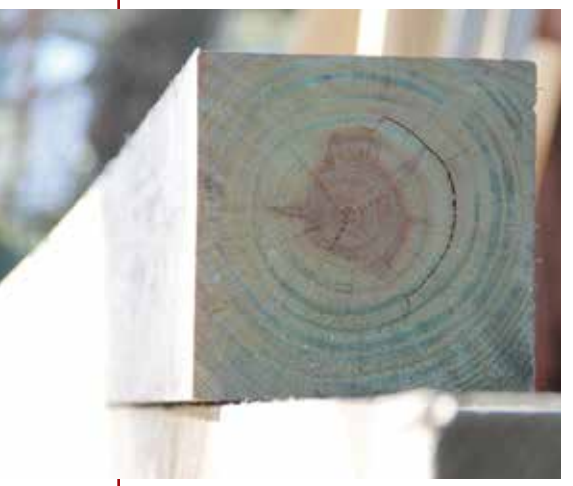

Figure 5. Sapwood accepts preservatives more readily than heartwood at the center of a log.

There are two ways that a method for pressure-treating lumber can be accepted by the building code. One way is to pass a whole battery of tests developed by the American Wood Protection Association (AWPA); the other is to run a similar gauntlet called an "Acceptance Criteria," established by the International Code Council (ICC) with compliance verified by the council's Evaluation Service, ICC-ES. The ICC-ES process requires tests to be performed by accredited third-party laboratories, while the AWPA lets applicants do their own qualification testing in-house. But the AWPA process is no rubber stamp: Applicants need to win a two-thirds vote of approval from the AWPA membership, which includes their competitors. In the ICC-ES process, the standards are approved by a nine-member committee of state and local building officials (competitors can't vote, but they can speak at the hearings).

Under either regime, AWPA or ICC-ES, a proposed treating method needs to perform acceptably in laboratory testing as well as in an outdoor, years-long field exposure called a "stake test." The lab testing is unrealistically harsh on the wood: Pieces of wood are placed directly in contact with moist soil that is inoculated with wood-destroying fungi and maintained at the ideal growing conditions for the rot to take hold. Samples are also subjected to "forced feeding" challenges in containers full of termites. But the outdoor stake test is the high hurdle in terms of time, as well as money; stakes pounded into the ground in the woods or jungle must hold up for at least three years, and usually for longer, in the most severe tropical exposures.

Formulas on the market today have all been through seven or more years of stake testing in warm, moist environments like Florida, Mississippi, Hawaii, New Zealand, and Indonesia. Generally, the stake test results show that every formula on the market today—alkaline copper quaternary, copper azole, micronized copper quaternary, and micronized copper azole—holds up well enough to get approved by the code. The stake tests also illustrate the importance of chemical treatment levels. Typically, stakes treated with high concentrations of chemical tend to hold up indefinitely, while stakes treated with lesser levels begin to slowly deteriorate after a few years in service.

Mileage may vary. The test conditions are certainly tougher than what a typical deck experiences—test sites are chosen because they have active fungi and foraging termites in the soil, and untreated "control" stakes typically crumble into the dirt in a matter of months.

On the other hand, the treated test stakes aren't representative of the treated wood product you're likely to find at the lumberyard. Typically, stakes for the tests are made with southern yellow pine, a species that readily accepts treatment. At the lumberyard, at least in the western U.S., you'll find other, harder-to-treat wood that might not be fully penetrated with chemicals. And test stakes are all sawn from sapwood, the newer-growth wood from the outer rings of a tree. Heartwood from the center of any log, including southern yellow pine, is resistant to penetration by chemicals (**Figure 5**). Treated wood standards allow heartwood to be in the board, and they don't require the heartwood to contain any treating chemicals.

Just as the wood in the stake tests is different from typical treated lumber, so also are the chemical treatment levels. When stakes are treated for a stake test, they're checked to make sure that they've been fully treated to the intended retention level. But in actual lumber, only 85% of the sapwood is required to be treated. And given the natural variability of wood, that means not every stick you buy gets the exact concentration of chemical that's listed on the label.

Variability in the treating process is a real problem. Lumber is treated from

Figure 6. Check your lumber's end tag or ink mark to avoid inadvertently cutting stair stringers from PT stock that is only rated for above-ground use, and treat all cuts with copper naphthenate.

Figure 7. Ground-contact lumber should always be used for deck joists, beams, and other framing that is in close proximity to the ground.

the outside in. To get the chemicals into the wood, treaters roll small rail-car loads of lumber into big vats, fill the vats with treating solution, seal the vats, and create a vacuum to draw moisture and air out of the wood. Then the vacuum is released and pressure is applied, and the chemicals in the vat are forced into the wood. In practice, this means that outer parts of the wood get more chemical than inner parts. And other factors, including wood moisture content, grain direction, and wood density, also affect the uptake and retention of the treating chemicals—so even on the edge of the board, the treating may not be uniform.

Treating companies and third-party quality-control verifiers check to make sure that wood coming out of the treating vats has reached the specified level of treatment—on average. But treaters check their loads of treated wood by drilling out multiple samples, grinding the samples up, mixing the samples, and testing the mixed samples all at once for chemical content. That's efficient, but it doesn't pick up on any variability in the treated load. And in reality, loads can vary a lot. If a load of lumber is sampled in 20 spots and the samples are mixed and tested, the load may average out at the required retention, but typically, some parts of some boards may have double the required treatment level, while other spots may have only half—and even if that's the case, the whole car-full passes the test.

Play It Safe

You don't know which part of which stick has been treated to above-average or below-average levels. But you do know that heartwood is resistant to treatment, so avoid putting exposed heartwood into a wet or dirty situation. You also know that the outer part of the wood has likely received more chemical than the inner part. So if you cut the wood, always treat the exposed cut by soaking it well with a 2% copper naphthenate solution (easy to buy in cans at any lumberyard). If you cut out a stair stringer, treat the cuts (**Figure 6**). If you cut the end of a post, treat the cut end. If you notch out a deck post to make a seat for a girder, treat the notch.

And while you know that retentions in a clip of wood may vary from the average in one spot or another, you also know that lumber that's rated for ground contact has a higher average retention than lumber that's rated for above-ground use only. So if you're placing wood into service in a tough situation, it's a safer bet to get lumber that's rated to ground contact—even if that requires you to pay more and wait for delivery (**Figure 7**).

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