Forest Products Lab. Techline

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Coatings Minimize Leaching from Treated Wood

Chromated copper arsenate (CCA) is a commercially applied preservative that is widely used to protect wood from attack by decay fungi and insects. CCA treated wood is commonly sold at lumber yards as "green treated" wood. The concentration of chromium, copper and arsenic in CCA treated wood depends on its intended use. The most common CCA treatment retention, 6.4 kg/m^3 (0.4 lb/ft^3), is applied to wood that is intended for use in contact with the ground. The chromium, copper and arsenic in CCA treated wood are bonded to the wood through chemical reactions, but a small percentage of these elements do gradually leach out of the wood over time. People are sometimes concerned about this leaching when CCA treated wood is used in playground equipment and decks. One way to reduce leaching and alleviate these concerns is by coating the treated wood.

The ability of coatings to reduce leaching from CCA treated wood was recently verified by researchers at the Forest Products Laboratory. Researchers purchased 38 mm thick and 140 mm wide (2 in. by 6 in. nominal) Southern pine lumber that had been commercially treated with CCA to retention of 6.4 kg/m^3 (0.4 lb/ft^3). Matched 250 mm (10 in.) long specimens were cut from the boards. Because these short specimens have a higher proportion of end-grain than lumber used in service, they were expected to exaggerate leaching. One specimen from each board was brushed with one of the following coating combinations: 1) uncoated, 2) latex primer followed by one coat of outdoor latex paint, 3) oil-based primer followed by one coat of oil-based paint, or 4) two coats of a penetrating oil water repellent deck stain. Each coating combination was replicated seven times. The specimens were then individually placed horizontally in trays with a wide face pointing up. The trays were equipped with drains so that the water running off of each specimen could be collected and the specimens were supported so that they did not contact any standing water in the bottom of the tray. To simulate the wetting and drying of rainfall episodes, the specimens were sprayed with a fine mist of deionized water for 7.5 hours per day, 4 days per week, over a period of three weeks. The specimens were exposed to the equivalent of 813 mm (32 in.) of rain, which approximates the national average annual rainfall. The water running off of each specimen was collected and periodically analyzed for preservative components. The average amounts of chromium, copper and arsenic leached from each type of coating are shown in Table 1.

Table 1. Average amounts and rates of release of arsenic, chromium and copper from uncoated and coated specimens.

Type of Coating	Average Total Amount Leached (mg)			Average Leaching Rate (ug/m^2/mm of rain) [a]		
	Arsenic	Chromium	Copper	Arsenic	Chromium	Copper
Not Coated [b]	13.77 (1.94) [c]	6.88 (1.63)	12.57 (1.36)	188.3 (22.5)	94.6 (23.5)	173.0 (21.5)
Latex Primer and Paint	ND [d]	ND	ND	ND	ND	ND
Oil-based Primer and Paint	ND	ND	ND	ND	ND	ND
Water Repellent Deck Stain	0.05 (0.06)	ND	0.40 (0.32)	0.53 (0.70)	ND	4.48 (3.95)

a. Calculated as micrograms released per square meter of surface area during each millimeter of rainfall.
b. Because of the high proportion of exposed end-grain in these specimens, this rate of release is higher than would be expected from treated lumber used in typical residential applications.
c. Numbers in parentheses represent one standard deviation from the mean.
d. Element was not detected in any of the rainwater samples collected from any of the specimens. The detection limits of the method were 5 ug/l for arsenic and 2 ug/l for chromium and copper.

All of the coatings evaluated in this study were very effective, reducing the leaching of arsenic, chromium and copper by over 99% in comparison to the uncoated specimens. None of the water collected from specimens coated with latex or oil-based paint contained any detectable levels of CCA elements. In some cases, water collected from the specimens that were coated with water repellent deck stain did contain detectable levels of copper and arsenic, but the highest individual sample concentration of arsenic detected was only 14 ug/l, which is below the Environmental Protection Agency's allowable level for arsenic in drinking water. The coatings evaluated in this study were probably effective because they limited the movement of water into and out of the treated wood, and other types of coatings that prevent wetting of the wood are likely to have the same effect. However, coatings that are likely to blister and peel and subsequently require sanding or scraping, such as varnish, would not be desirable for this type of application. The frequency of reapplication needed for any of these coatings will be dependent on the amount of wear that they receive. The results of this study demonstrate that the application of common exterior wood coatings is an excellent recommendation for consumers who want to reduce leaching of copper, chromium, and arsenic from CCA treated wood. For more information on selection and application of coatings for exterior wood products, see "The Finish Line: Paint, Stain, Varnish or Preservative? It's Your Choice" also published by the Forest Products Laboratory.