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 lumberyards as "green treated" wood. The target concentrations of chromium, copper, and arsenic in CCA-treated wood depend on its intended use. The most common CCA treatment retention, 6.4 kg/m^3 (0.4 lb/ft^3), is applied to wood intended for use in contact with the ground. Chromium, copper, and arsenic in CCA-treated wood are bonded to the wood through chemical reactions, but a small percentage of these elements gradually leaches 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 (FPL). Researchers purchased 38- by 140-mm (nominal 2- by 6-in.) Southern Pine lumber that had been commercially treated with CCA to a retention of 6.4 kg/m^3 (0.4 lb/ft^3). Four matched 250-mm- (10-in.-) long specimens were cut from each board. Because these short specimens have a higher proportion of end grain than does lumber used in service, they were expected to exaggerate leaching.

One of the four specimens from each board was left uncoated (control); each of the other three specimens was brushed with either latex primer followed by one coat of outdoor latex paint, oil-based primer followed by one coat of oil-based paint, or two coats of a penetrating oil water-repellent deck stain. Each coating combination was replicated seven times.

Specimens were placed horizontally in individual trays with a wide face of the specimen facing up. The trays were equipped with drains so that water running off each specimen could be collected. Specimens were supported so that they did not contact standing water in the tray.

To simulate the wetting and drying of rainfall episodes, specimens were sprayed with a fine mist of de-ionized water for 7.5 hours per day, 4 days per week, over a period of 3 weeks. Specimens were exposed to the equivalent of 813 mm (32 in) of rain, which approximates the national average annual rainfall. Water running off each specimen was collected and periodically analyzed for preservative components. Average amounts of chromium, copper, and arsenic leached from samples are summarized in the table.

All the coatings evaluated were effective, reducing the leaching of arsenic, chromium, and copper by over 99% in comparison to uncoated specimens. None of the water collected from specimens coated with latex or oil-based paint contained detectable levels of CCA elements. In some cases, water collected from specimens coated with the water-repellent deck stain contained detectable levels of copper and arsenic. However, the highest individual sample concentration of arsenic detected was only 4 μg/L above the allowable level (10 μg/L) set by the Environmental Protection Agency 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. Other types of coatings that prevent wetting of 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, may not be desirable for this type of application. The frequency of reapplication needed for any of these coatings will depend on the amount of wear they receive.

Results of this study demonstrate that applying common exterior wood coatings is an effective means of reducing the amount of copper, chromium, and arsenic leached 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,* a Forest Products Laboratory finishing factsheet (available online at www.fpl.fs.fed.us/documnts/finlines/knaeb95b.pdf).

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Average amount leached and rate of release of arsenic, chromium, and copper from uncoated and coated specimens

	Average total amount leached (mg)			Average leaching rate (μg/m^2/mm of rainfall)[a]		
Type of coating	Arsenic	Chromium	Copper	Arsenic	Chromium	Copper
Uncoated[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 simulated 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 water samples collected from any of the specimens. The detection limits of the method were 5 μg/L for arsenic and 2 μg/L for chromium and copper.