Environmental Impact of Treated Wood in Service

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Abstract

Research is needed to address concerns about the potential environmental impacts of preservative-treated wood used for construction projects in sensitive environments. This report describes recent studies in this area conducted by the Forest Product Laboratory or its collaborators. The leaching and environmental impact of a wetland boardwalk constructed with chromated copper arsenate (CCA), ammoniacal copper zinc arsenate (ACZA), ammoniacal copper quat (ACQ-B), or copper dimethyldithiocarbamate (CDDC) treated wood is under investigation. All four types of treated wood have released detectable amounts of preservative components into the wetland soil and sediments. Mobility of these leached components appears greater in sediments than in soil, generally leading to higher concentrations in soil. Levels of preservative components detected in the sediments did not appear to adversely affect either the abundance or diversity of aquatic invertebrates. No significant difference was found in invertebrate populations before and after construction, or as a function of proximity to the treated wood. Bridges treated with CCA, creosote, or pentachlorophenol were evaluated to determine if sediments were contaminated and if invertebrate populations were affected. Bridges over slow-moving water were selected to allow for maximum accumulation of leached preservatives in the sediments. Some samples from sediments below the bridges did contain elevated levels of preservative components. However, these levels did not appear to have any measurable adverse effect on either the diversity or abundance of aquatic invertebrates living in those sediments.

In a separate study, soil adjacent to CCA-treated stakes that had been in test for 22 years in Mississippi and Wisconsin was analyzed for CCA components. Samples elevated in copper and arsenic were consistently detected within 50 mm laterally and 400 mm directly under the stakes, but were infrequently detected 150 mm laterally from the stakes. This finding confirms that leached CCA components have limited mobility in soil and can accumulate immediately adjacent to treated wood over extended exposures. Laboratory studies have found that rates of creosote and CCA release are influenced by factors such as preservative retention, amount of water movement around submerged wood, water temperature, and rate of rain-

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fall. Research continues to develop models for these release rates.

Introduction

In recent years questions have arisen about the appropriate use of treated wood in environmentally sensitive areas. The Forest Service and other government agencies often use pressure-treated wood for construction of highway bridges, foot bridges, wetland boardwalks, and other applications where the wood is placed in or over water. Treated wood is used for these types of applications because it is economical, blends well with the environment, arid is relatively easy to install. The wood is durable because the chemicals in the preservative are toxic to decay fungi and insects. However, these same chemicals that are beneficial in protecting the wood are also potentially toxic to aquatic organisms. This has caused some concern that chemicals might leach out of the wood and accumulate in the environment to harmful levels. Both field and administrative personnel are often asked to justify the choice of treated wood as a construction material, and there is sometimes pressure to reduce or eliminate the use of treated wood in favor of products that are perceived to be more environmentally acceptable. These issues were difficult to resolve because of the lack of data on leaching and biological impacts of wood preservatives, particularly under in-service conditions (9). The Forest Products Laboratory and Federal Highway Administration, under a cooperative National Timber Bridge Research Program, have funded research to address these environmental concerns. This paper summarizes the results of studies that have been completed and discusses the status and findings of studies in progress.

Several types of wood preservatives are commonly used to protect wood used outdoors. The most common of these are chromated copper arsenate (CCA), creosote, and pentachlorophenol. Because CCA is the most commonly used wood preservative, it has been the subject of the largest volume of research. However, research has also been conducted on other waterborne preservatives and on the oil-type preservatives creosote and pentachlorophenol.

Research on Water-Based Preservatives

One application that has drawn concern is the use of preservative-treated wood in wetland boardwalks. To address this concern, representatives from the Forest Service, Bureau of Land Management, Aquatic Environmental Sciences and industry partners cooperated to conduct a study of the leaching and environmental impacts of waterborne preservatives from wood used in construction of a wetland boardwalk (7). The construction project was considered “realistic worst case” because the site had high rainfall and large volumes of treated wood were used. Separate boardwalk test sections were constructed using either untreated wood or wood treated with ammoniacal copper quat Type B (ACQ-B), ammoniacal copper zinc arsenate (ACZA), chromated copper arsenate Type C (CCA-C), or copper dimethyldithocarbamate (CDDC). Surface soil, sediment, and water samples were removed before construction and at intervals after construction to determine the concentrations and movement of leached preservative elements. During the first year of the study, aquatic insect populations in the vegetation, sediments, and on artificial substrates were also monitored and related to environmental concentrations of leached wood preservative components. This aspect of the study was designed to assess changes in invertebrate communities under severe conditions: large surface areas of treated wood located in and adjacent to water of low hardness and alkalinity flowing very slowly over fine-grained sediments (3). The experimental variables were total species richness (total number of taxa), total sample abundance (number of organisms/sample), dominant sample abundance (>1% total specimens in vegetation, artificial substrate, and infaunal samples), and Shannon’s and Pielou’s indices.

During the first year, each of the preservatives evaluated released measurable amounts of copper and/or chromium, zinc, or arsenic into rainwater collected from the wood (13). Analysis of the rainwater revealed that the highest rate of leaching occurred at the beginning of the study and declined substantially after 6 months. Each preservative also appeared to elevate levels of respective preservative components in the soil and/or sediment adjacent to the treated wood to varying degrees. In some cases this affect appeared to peak within the first year, while in other cases environmental levels continued to increase during the second year (Figs. 1 through 6). With few exceptions, elevated environmental concentrations of preservative components were confined to within close proximity of the boardwalk. Concentrations were generally more el-

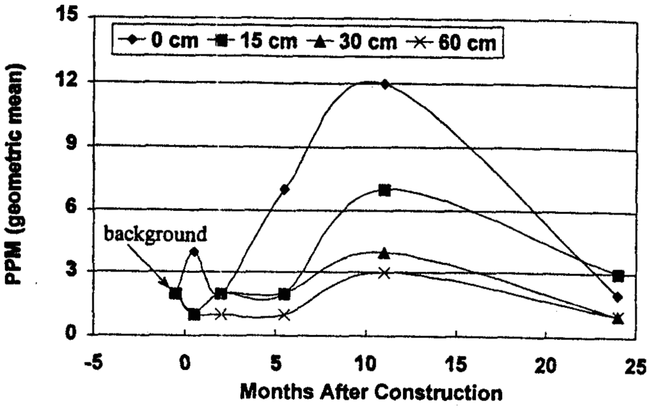

Figure 1.—*Arsenic levels in soil at four distances from section of boardwalk constructed with CCA-treated wood.*

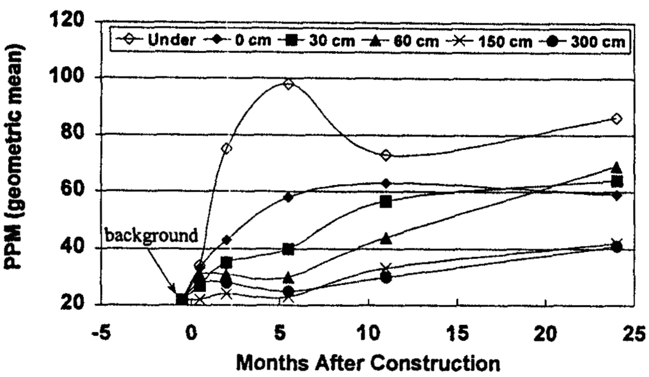

Figure 2.—*Copper levels in sediments at six distances from section of boardwalk constructed with CCA-treated wood.*

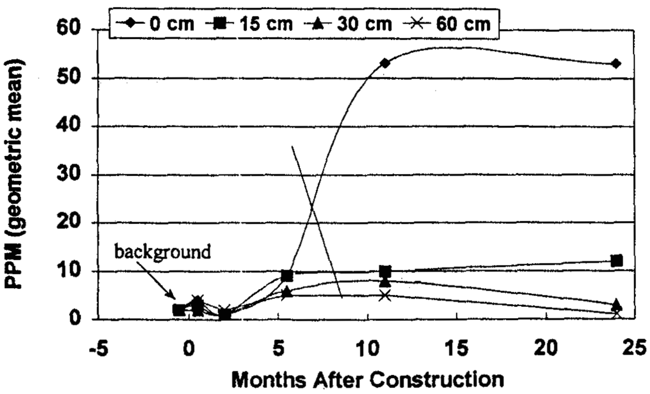

Figure 3.—*Arsenic levels in soil at four distances from section of boardwalk constructed with ACZA-treated wood.*

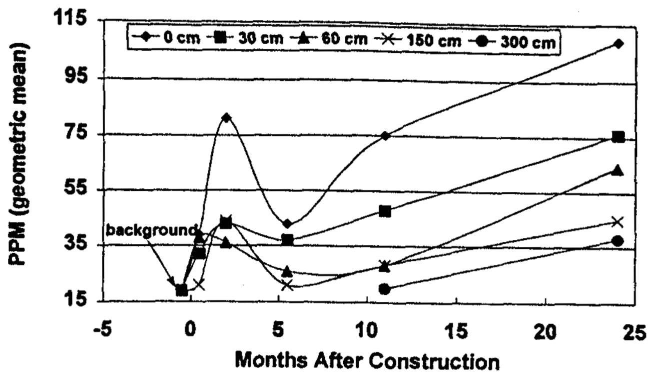

Figure 4.—*Copper levels in sediments at six distances from section of boardwalk constructed with ACZA-treated wood.*

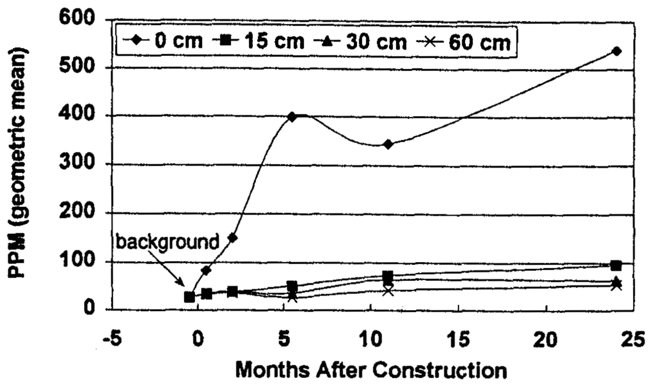

Figure 5.—*Copper levels in soil at four distances from section of boardwalk constructed with ACQ-B-treated* wood.

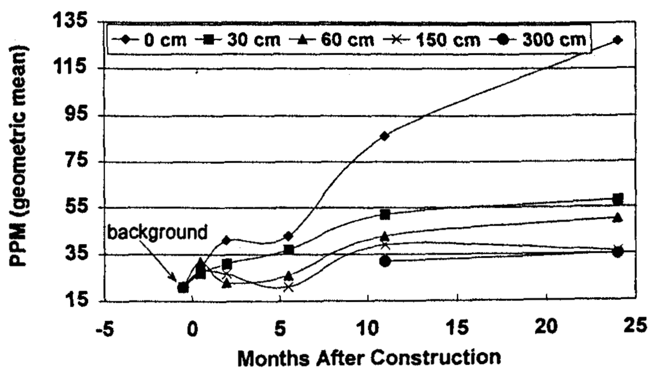

Figure 6.—*Copper levels in sediments at four distances from section of boardwalk constructed with ACQ-B-treated wood.*

evated in soil than sediment samples, although relatively little accumulation of CCA-C components was detected in soil surrounding that portion of the boardwalk. Although the four preservatives used in

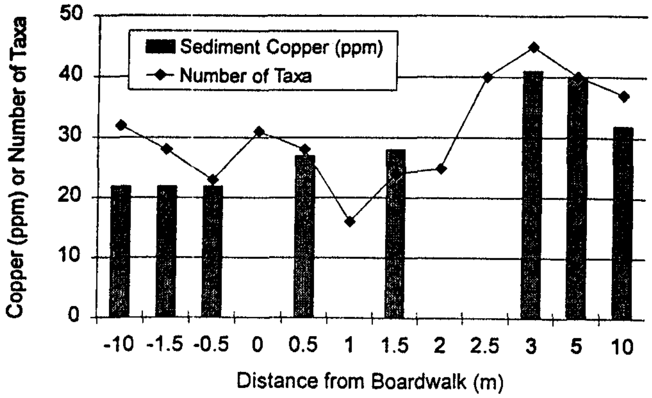

Figure 7.—*Levels of copper and number of invertebrate taxa in wetland sediments adjacent to the CCA-treated boardwalk 1 year after construction.*

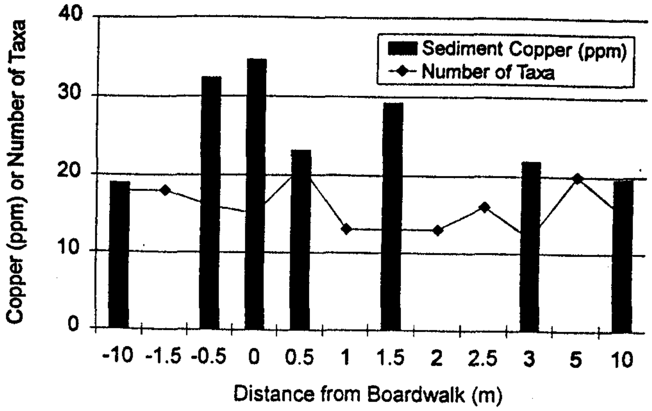

Figure 8.—*Levels of copper and number of invertebrate taxa in wetland sediments adjacent to the ACZA-treated boardwalk I year after construction.*

this study showed great differences in the rates of release and environmental accumulation of their components, direct comparisons between these preservatives are inappropriate. The exposure times and conditions were not identical, different wood species were used, and preservative penetration, preservative retention, and post-treatment conditioning varied. Monitoring of preservative accumulation in the wetland surrounding the treated wood is continuing. Although the rate of leaching from the wood has declined, it is probable that accumulated levels, especially those in soil, will remain elevated for many years because the elements are bound to the soil.

The levels of environmental accumulation detected in the wetland did not appear to have any measurable biological impact (3). A total of 86,144 invertebrates were identified in the study. The aquatic invertebrate community included a total of 149 taxa in 97 distinct genera or families. The infaunal samples contained the largest mean number of animals and the highest total taxa richness. A comparison of the invertebrate community present during baseline sampling with that observed post construction during spring and summer sampling indicated that no taxa were excluded or significantly reduced in number by any boardwalk treatment. Because of its aquatic toxicity, copper was considered to be the element of primary concern with all of the preservatives evaluated. However, there appeared to be little if any correlation between sediment copper levels and the number or diversity of aquatic invertebrates (Figs. 7 through 9). In most cases preservative levels detected were below those that might be ex-

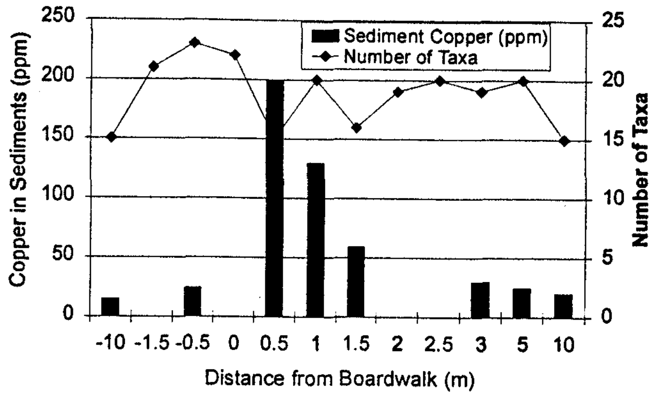

Figure 9.—*Levels of copper and number of invertebrate taxa in wetland sediments adjacent to the ACQ-B treated boardwalk 1 year after construction.*

pected to impact aquatic life, but in a few samples the copper sediment concentrations did approach levels of concern. Brooks hypothesized that the lack of impact in those cases was related to the type 'of invertebrate present. He noted that invertebrates that live in sediments associated with slow, stagnant water tend to be more robust and less sensitive to pollutants than those living in areas with rapidly moving water. Because leached preservative components generally only reached elevated levels in the sediments of slow-moving water, if at all, it appears unlikely that elevated preservative levels and highly pollutant sensitive invertebrates would be found in the same location.

Using similar methodology, Brooks subsequently evaluated the environmental impacts of two CCA-C treated bridges in Florida, one over a saline bay and the other over a freshwater marsh

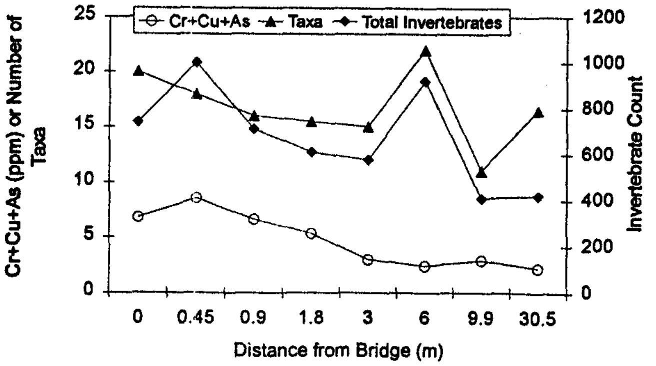

Figure 10.—*Combined levels of chromium, copper, and arsenic in sediments compared to number of invertebrate taxa and total number of invertebrates adjacent to a CCA-treated bridge.*

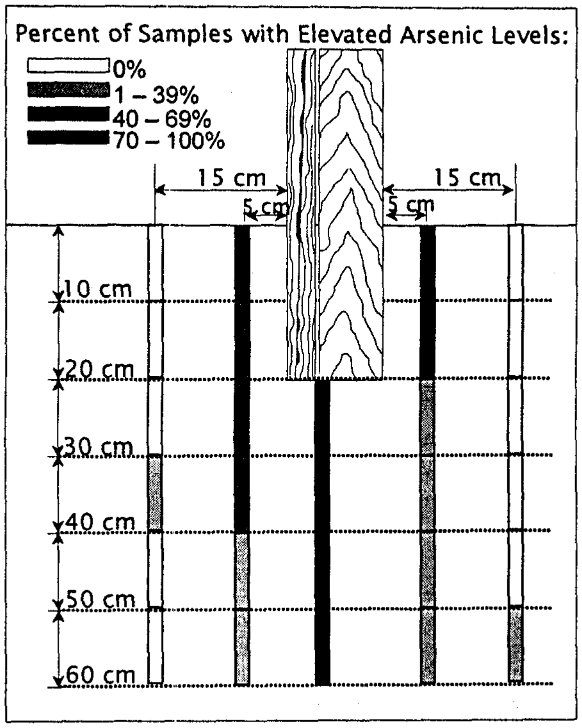

Figure 11.—*Percent of soil core sample segments with elevated arsenic content at locations beside and below CCA-treated stakes exposed for 22 years in Mississippi.*

(4). The bridge over the bay was in the final stages of construction and bridge over the marsh was 2 years old. Some samples of sediments removed within 3 m (10 ft.) of the newly constructed bridge did contain elevated levels of copper, chromium, and arsenic. Brooks noted mats of drill shavings in the sediments under the bridge that he attributed to the drilling of' 1,568 holes, each 19 mm (0.75 in.) in diameter and 0.35 m (14 in.) in length, for attachment of bolts. The observation of the wood chips, combined with the patchy nature of the elevated samples and the ratio of Cr:Cu:As in the sediments led the author to suspect that at least a portion of the elevated samples contained treated wood sawdust. Despite the elevated levels of CCA detected in the sediments, no adverse biological affects were observed. Slightly elevated copper, chromium, and arsenic levels were also noted in sediments within 3 to 6 m (10 to 20 ft.) of the 2-year-old bridge, but again no adverse biological effects were observed (Fig. 10). In this case, the population and diversity of aquatic insects actually appeared to be higher in close proximity to the bridge.

One challenge in evaluating in-service leaching and environmental mobility is obtaining long-term data. This can be addressed to some extent by environmental sampling around older, in-service, structures, but the value of this data is limited because the original treatment retention and charge conditions are usually unknown. In addition there is often little historical data to indicate whether the site was previously exposed to other sources of contamination that might be confused with that originating from the treated wood. In an effort to overcome these challenges, researchers at the Forest Products Laboratory sampled soil around CCA-C-treated test stakes placed at exposure sites in Harrison Experimental Forest (near Gulfport, Mississippi) and at the Valley View exposure site near Madison, Wisconsin. The 38 by 89 by 457 mm (1.5 by 3.5 by 18 in.) stakes had been in place for 22 years at each site. Original charge data, including CCA-C retention (based on solution uptake) was available for each stake. Soil cores were removed to a depth of 600 mm (24 in.) at distances of 50 mm (2 in.) and 150 mm (6 in.) from the narrow and wide faces of each stake and to a depth of 400 mm (16 in.) directly under each stake. Control soil cores were also removed from an undisturbed location nearby. The soil cores were divided into successive 100 mm (4 in.) increments before analysis.

These soil analyses indicate that the stakes do release CCA components into the soil immediately around the stakes. Samples elevated in copper and arsenic were consistently detected immediately below the stakes and within 50 mm (2 in.) on either side of the stake. However, relatively few samples were elevated 150 mm (6 in.) away from the stakes at the Harrison Site (Fig. 11). At the Valley View

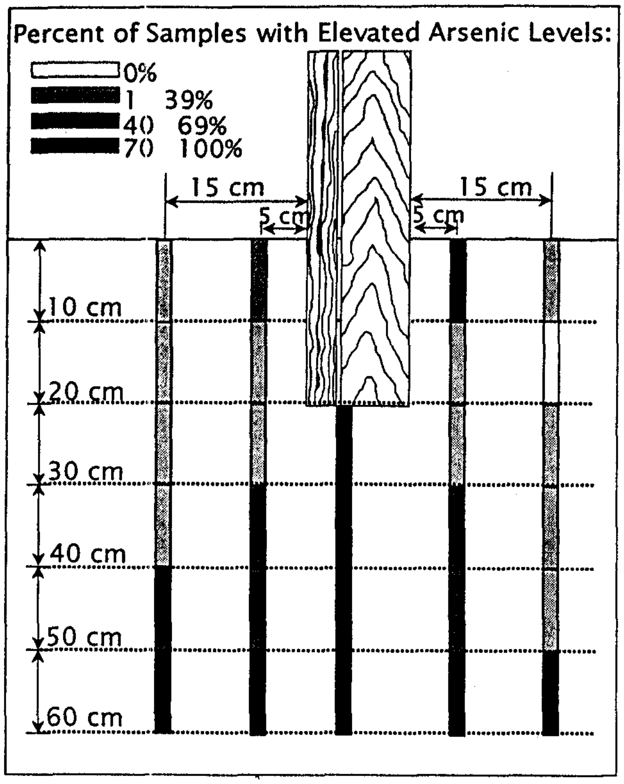

Figure 12.—*Percent of soil core sample segments with elevated arsenic content at locations beside and below CCA-treated stakes exposed for 22 years in Wisconsin.*

site, samples removed 150 mm (6 in.) from the stakes frequently contained elevated levels of copper and arsenic in depths greater than 300 mm (12 in.) below the soil surface (Fig. 12). In Harrison, the contaminated soil tended to form a funnel-shape around the stakes, while at Valley View the contaminated soil tended to form a cone below the stake. Very few samples at Valley View contained elevated levels of chromium, even directly under the stakes. Elevated chromium levels were more common at the Harrison site, but were still much less frequently detected than copper or arsenic. No relationship was detected between the original retentions of the stakes and the levels of CCA components detected in the soil around them. Generally, these results indicate that long-term leaching of CCA-treated wood can lead to elevated levels of CCA components in the soil immediately adjacent to the stakes. In most cases the leachate is confined to below the stakes or to within 50 mm (2 in.) of the side of the stakes. However, it is evident that the patterns of leachate dispersion were affected by differences between the two exposure sites.

While ground contact applications may be expected produce severe leaching conditions, the vast majority of CCA-treated wood in the United States is used aboveground, where it is not exposed to soil components or continuous standing water. To allow more accurate prediction of the amount of leaching that will occur from a treated wood structure, it is important to develop data on the rate of release aboveground, and on factors that affect aboveground leaching. Research in progress at the Forest Products Laboratory has been evaluating the effect of treatment and exposure conditions on leaching from CCA-treated decking. End-matched decking specimens cut from boards 38 mm thick by 140 mm wide (2 by 6 in. nominal dimensions), were treated to retentions of 3.2, 6.4, or 12.8 kg/m^3 (0.2, 0.4, or 0.8 $lb./ft.^3$) and placed horizontally in individual trays with a wide face of the specimen fating 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 fine droplets of de-ionized water at flow rates of 2.5, 8.3, or 25 mm/hr. (0.1, 0.33, or 1.0 in./hr.) over a period of 3 weeks. The amount of spray time was adjusted so that all specimens were exposed to the equivalent of 813 mm (32 in.) of rain, which approximates the national average annual rainfall. Rainwater running off each specimen was collected and periodically analyzed for preservative components.

This study has revealed that both original treatment retention and rate of rainfall have strong effects on leaching of CCA components. Leaching of arsenic was greatest at the lowest retention of 3.2 kg/m^3 (0.2 $lb./ft.^3$) and least at the highest retention of 12.8 kg/m3 (0.8 $lb./ft.^3$) (Fig. 13). Although this finding may appear to be the opposite of what one would expect, other researchers have noted that the percentage of leachable arsenic decreases with increased retention (1,5). The effect appears to be similar to increasing the proportion of chromium in the original treating solution. At high retention levels, increased amounts of chromium may be available to react with arsenic because a lower proportion of the total chromium is adsorbed to wood components (1). It has also been suggested that higher retention levels provide more water repellency to the wood, thus limiting leaching (5). These results indicate that lowering the retention of CCA may not be beneficial

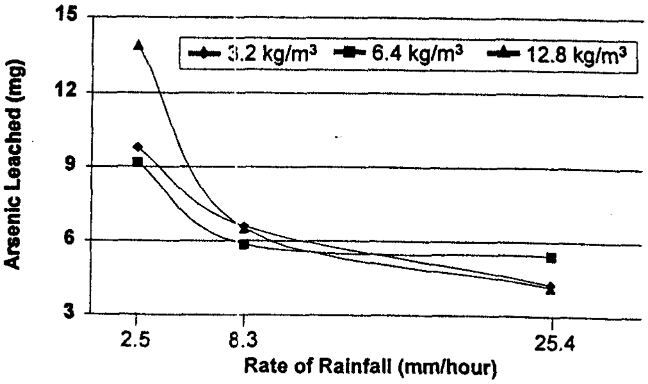

Figure 13.—*Effect of CCA retention and rate of rainfall on leaching of arsenic from decking specimens exposed to artificial rainfall.*

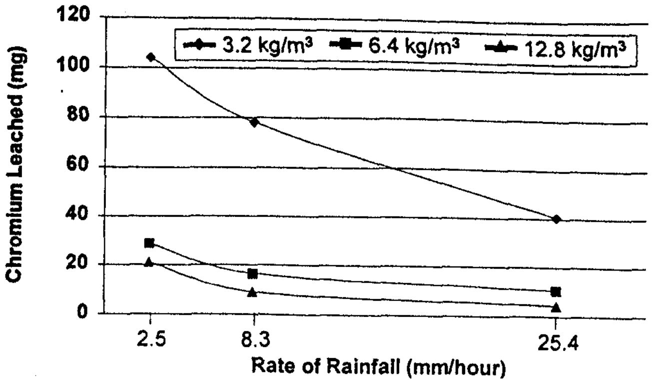

Figure 15.—*Effect of CCA retention and rate of rainfall on leaching of chromium from decking specimens exposed to artificial rainfall.*

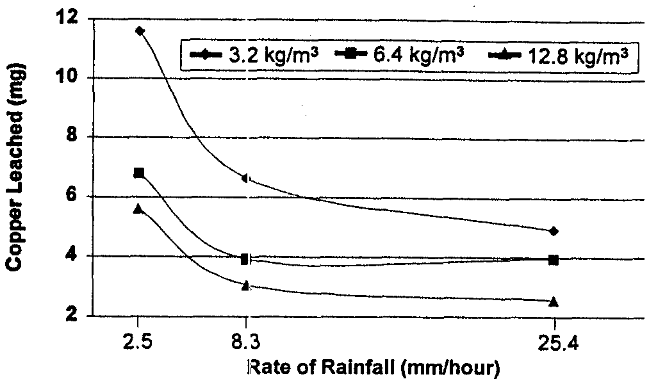

Figure 14.—*Effect of CCA retention and rate of rainfall on leaching of copper from decking specimens exposed to artificial rainfall.*

in lowering the amount of arsenic leached from the wood. This finding also suggests that rates of arsenic release from commercially treated lumber could be lower than those determined in this study because commercial treating facilities tend to use higher solution concentrations and shorter treatment times. The rates of release of copper and chromium were not as strongly affected by retention (Figs. 14 and 15).

The effects of rate of rainfall were more predictable, as leaching of all CCA components was greatest at 2.5 mm/hr. (0.1 in./hr.), the slowest rate of rainfall. At the higher rainfall rates there is less time for the water to diffuse into the wood and for leachable components to move to the wood surface. This indicates that, based on a equivalent amount of annual rainfall, leaching is likely to be greatest in climates where slow, steady rainfall is typical, and least in climates where rain comes in short, heavy, showers. When adjusted for surface area, this study indicates that the rate of arsenic loss from decking treated to 6.4 kg/m^3 (0.4 lb./ft.^{3}) would be in the range of 0.02 to 0.05 ug/mm^2 surface area/mm of rainfall during the first 813 mm (32 in.) of rainfall. As previously mentioned, this range may be somewhat higher than for commercially treated wood because commercial plants tend to use higher solution concentrations. Commercially treated decking may be better represented by the 12.8 kg/m^3 (0.8 lb./ft.^{3}) retention group, from which arsenic was released in the range of 0.007 to 0.03 ug/mm^2 surface area/mm of rainfall.

As an extension of the decking leaching study, the ability of coatings to reduce leaching from CCA-treated wood was recently evaluated (8). Researchers purchased 38-mm-thick by 140-mm-wide (2- by 6-in. nominal) southern pine lumber that had been commercially treated with CCA to a target 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 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. The specimens were sprayed with a fine mist of de-ionized water for 7.5 hr./day, 4 days per week, over a period of 3 weeks, which achieved the equivalent of 813 mm (32 in.) of rainfall. The water running off of each specimen was collected and periodically analyzed for preservative components.

All of the coatings evaluated were very effective, reducing the leaching of arsenic, chromium, and copper by over 99 percent in comparison to the uncoated specimens (Fig. 16). 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 specimens coated with the water-repellent deck stain contained detectable levels of copper and arsenic. The highest individual sample concentration of arsenic detected, however, was only 4 micrograms above the allowable level (10 micrograms per liter) set by the Environmental Protection Agency for arsenic in drinking water.

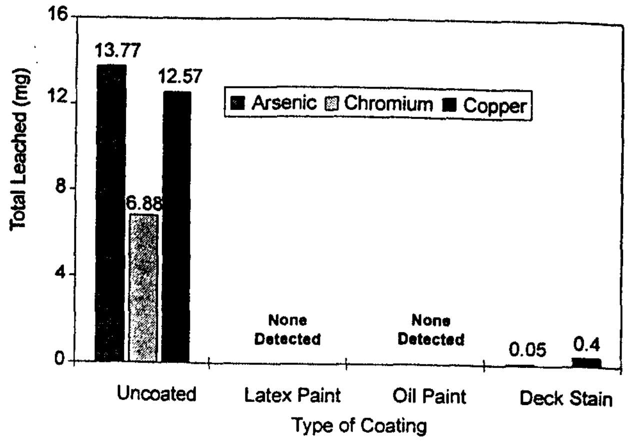

Figure 16.—*Effect of coatings on leaching of arsenic, chromium, and copper from CCA-treated decking specimens.*

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, might 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 they receive.

Results of this study demonstrate that the application of common exterior wood coatings is an excellent recommendation for treated wood users who want to reduce leaching of copper, chromium, and arsenic from CCA-treated wood.

Oil -Type Wood Preservatives

The two primary oil-type preservatives, creosote and pentachlorophenol, have been used extensively for many decades for the treatment of timber, ties, poles, and piling. These preservatives are often selected by engineers because of their proven track record, broad wood species compatibility, and because they help impart dimensional stability to the wood. Such uses often include the piling, glulam beams, and timbers used to construct bridges or other structures in or over water. In part because any release of these oil-type preservatives into standing water is readily visible, aquatic applications for these preservatives have drawn increasing criticism in recent years.

To address these concerns, the environmental impact of pentachlorophenol and creosote treated wood in timber bridges was recently evaluated as part of a research program funded by the Federal Highway Administration. Brooks evaluated two creosote treated bridges located in agricultural areas in Indiana; one had been in service for approximately 2 years, and the other for approximately 17 years (4). Sediment samples were removedin transects starting 23 m (76 ft.) above the bridge and continuing to 10 m (33 ft.) downstream from each bridge. Aquatic invertebrates were also collected, identified, and counted at each sampling location. At both bridges, elevated levels ofthe polyaromatic hydrocarbons (PAH's) naphthalene, acenaphthylene and phenanthrene were detected in sediments within 1.8 to 3 m (6 to 10 ft.) downstream from the bridges, and these levels approached levels of concern for the newer bridge. However, no significant effect on invertebrate populations was noted downstream from the newer bridge, in comparison to the upstream samples (Fig. 17). There did appear to be a reduction in the population and diversity of aquatic invertebrates approximately 6 m (20 ft.) downstream from the older creosote-treated bridge, but the author postulates that this trend was caused by the deposition of maple leaves in this area and was not a response to released PAH's. This hypothesis is supported by the finding that sediments removed from that area did not adversely affect an aquatic invertebrate population in a laboratory bioassay.

Using similar methodology, Brooks also evaluated two pentachlorophenol-treated bridges located in forested areas of Washington state and Oregon (4). Two sediment samples removed down-

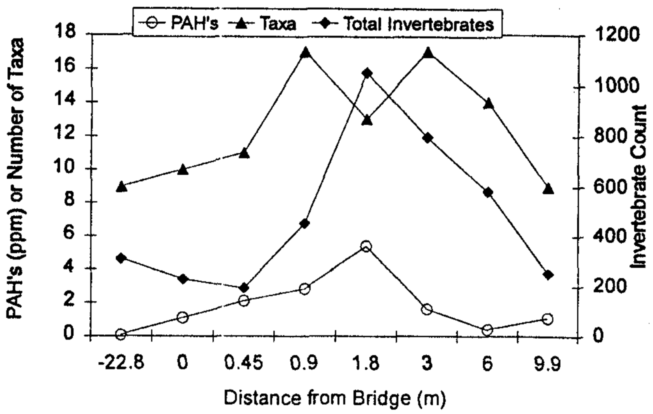

Figure 17.—*PAH levels in sediments compared to number of invertebrate taxa and total number of invertebrates adjacent to a creosote-treated bridge.*

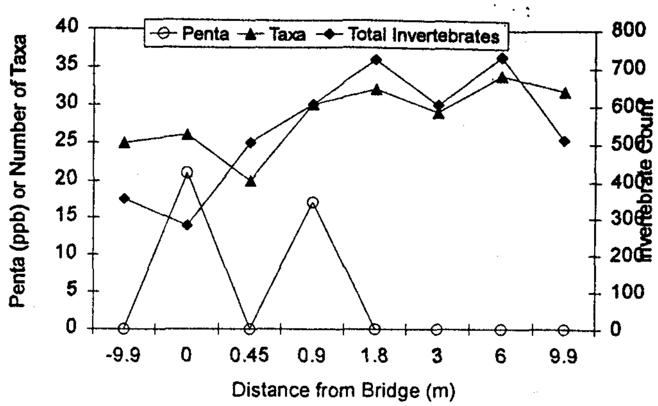

Figure 18.—*Pentachlorophenol levels in sediments compared to number of invertebrate taxa and total number of invertebrates adjacent to a pentachlorophenol-treated bridge.*

stream from the bridge in Washington state appeared to contain low levels of pentachlorophenol, although the concentrations detected were approaching the lower detection limit of the instrumentation. No biological effects would be expected at those levels arid none were detected in association with this bridge. Four sediment samples collected under or 0.9 m (3 ft.) downstream from the pentachlorophenol-treated bridge in Oregon also contained slightly elevated levels of pentachlorophenol (Fig. 18). A small decrease in several biological indices were also noted directly under the bridge, but this appeared be related to differences in stream bottom habitat in comparison to the upstream control. No adverse affects were noted when a bioassay was conducted on sediments removed from under the bridge (4).

There have also been recent research efforts to more accurately assess the rate of creosote leaching from treated wood submerged in water (15,16). Samples of Douglas-fir lumber creosote treated to 192 kg/m^3 (12 lb./ft.^{3}) were submerged in a tank of deionized water flowing at rates of 0, 40, or 80 mm/sec. (0, 1.6, or 3.2 in./sec.). The effects of water temperatures of 5°, 20°, or 35°C (41°, 68°, or 95°F) were also evaluated. Aliquots of leach water were removed after 0, 1, 2, 4, 8, and 24 hours, and then the tank was drained and re-filled with fresh deionized water. In some cases this process was repeated a third time. The aliquots of leach water were analyzed for five major components (acenapthene, dibenzofuran, fluorene, phenanthene, and fluouranathene) that comprised approximately 29 percent of the whole creosote and represented the medium and high boiling point fractions.

As shown for phenanthrene, the amount of each creosote component detected in the leach water typically rose quickly during the first 4 hours and then increased more gradually during the remaining 20 hours (Figs. 19 and 20). The amount of creosote released was positively correlated to both water temperature and flow rate. Water temperature appeared to have its greatest effect at the lowest flow rate. In some cases increasing the water temperature from 5° to 20°C appeared to have the greatest effect, while in other cases (i.e., phenanthrene) further increasing the temperature to 35°C caused the most noticeable increase in leaching. Increasing the flow rate increased the amount of each component leached at all temperatures evaluated. The authors speculate that turbulent flow at the highest flow rate (80 mm/sec.) may have further increased leaching in those trials. Further work is in progress at Oregon State to evaluate the rate of creosote release from treated wood exposed to leaching by rainfall.

Processing and Construction Considerations

The studies discussed in this paper evaluated leaching and environmental impact from typical treated wood that had been produced under conditions with at least adequate quality control or Best Management Practices (BMPs). Results may have been less favorable with wood that had been improperly treated and inadequately conditioned. With the water-based systems, chemical reactions

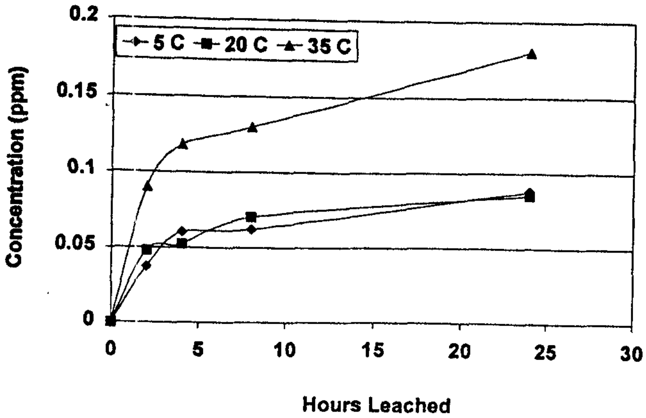

Figure 19.—*Effect of water temperature on leaching of phenanthrene from creosote-treated lumber submerged in water (without flow).*

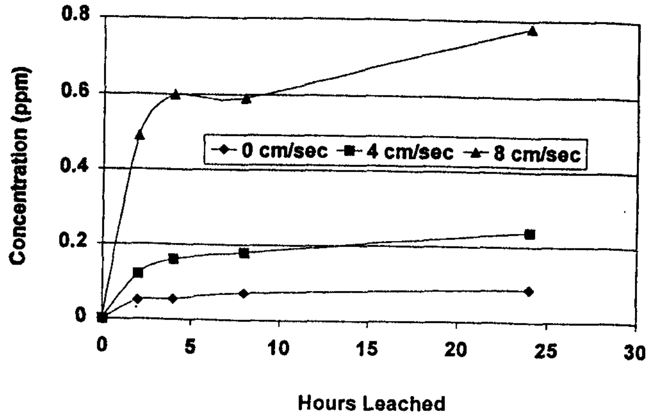

Figure 20.—*Effect of water flow rate on leaching of phenanthrene from creosote-treated lumber submerged in water at 20°C (68°F).*

take place to minimize the leaching of the active ingredients from the wood. The conditions needed to complete these reactions have been discussed by Cooper et al. (6), Lebow (10), and others. These "fixation" reactions should be complete or nearly complete before the wood is placed in service.

Leaching minimization is less clearly understood for the oil-type preservatives. Clearly, wood treated with oil-type preservatives should not be placed into service if it is oozing preservative or has an excessively oily surface. In some cases, treated woad that appeared to have a clean surface during installation has exhibited oozing or dripping on sunny days months or years later. The cause of this problem and methods to prevent it are not understood in all cases, but the probability of its occurrence can be lessened with processing steps such as expansion baths, final vacuums, and steaming. Recognizing the importance of fixation and other treatment practices, efforts are underway by both the Western Wood Preserver's Institute and American Wood Preserver's Association to develop guidelines or standards for the production of treated wood with minimum environmental releases (2, 14).

Construction and handling practices can also influence environmental releases. Because of their large surface area, construction debris such as sawdust and drill shavings release CCA components into the environment at a much greater rate than solid wood (12). As discussed, Brooks (4) noted that drill shavings appeared to make a substantial contribution to contaminant levels in sediments beneath a CCA-treated bridge. Reasonable care to collect construction debris, and similar careful construction practices, can help to minimize these unnecessary sources of environmental contamination (1 1).

Summary

The recent studies of the environmental impact of treated wood discussed in this paper have revealed several key points. All of the types of treated wood evaluated do release small amounts preservative components into the environment, and these components can be detected in soil and/or sediment samples. Only occasionally, within a short time after construction, can elevated levels of preservative components be detected in the water column. Detectable increases in soil and sediment concentrations of preservative components are generally limited to close proximity to the structure because the leached preservative components either have low water solubility or react with components of the soil or sediment. The poor environmental mobility of the preservative components has the positive aspect of limiting the range of any environmental contamination. However, over time it can also lead to gradual increases in soil levels of these components immediately adjacent to treated structures.

Although elevated preservative levels have been detected in sediments adjacent to wood used in aquatic environments, Brooks (3, 4) did not find any measurable impact on either abundance or diversity of aquatic invertebrates associated with those sediments.

In most cases preservative levels were below those that might be expected to impact aquatic life. Elevated preservative samples tended to be limited to the fine sediments beneath stagnant or slow-moving water where the invertebrate community is not particularly intolerant to pollutants.

Laboratory studies attempting to quantify the rate of preservative release from CCA- and creosote-treated wood have found that rates of preservative release are influenced by factors such as preservative retention, amount of water movement around submerged wood, water temperature, and rate ofrainfall. Research continues to develop models of these release rates that will allow more accurate prediction of environmental releases for a range of applications.

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