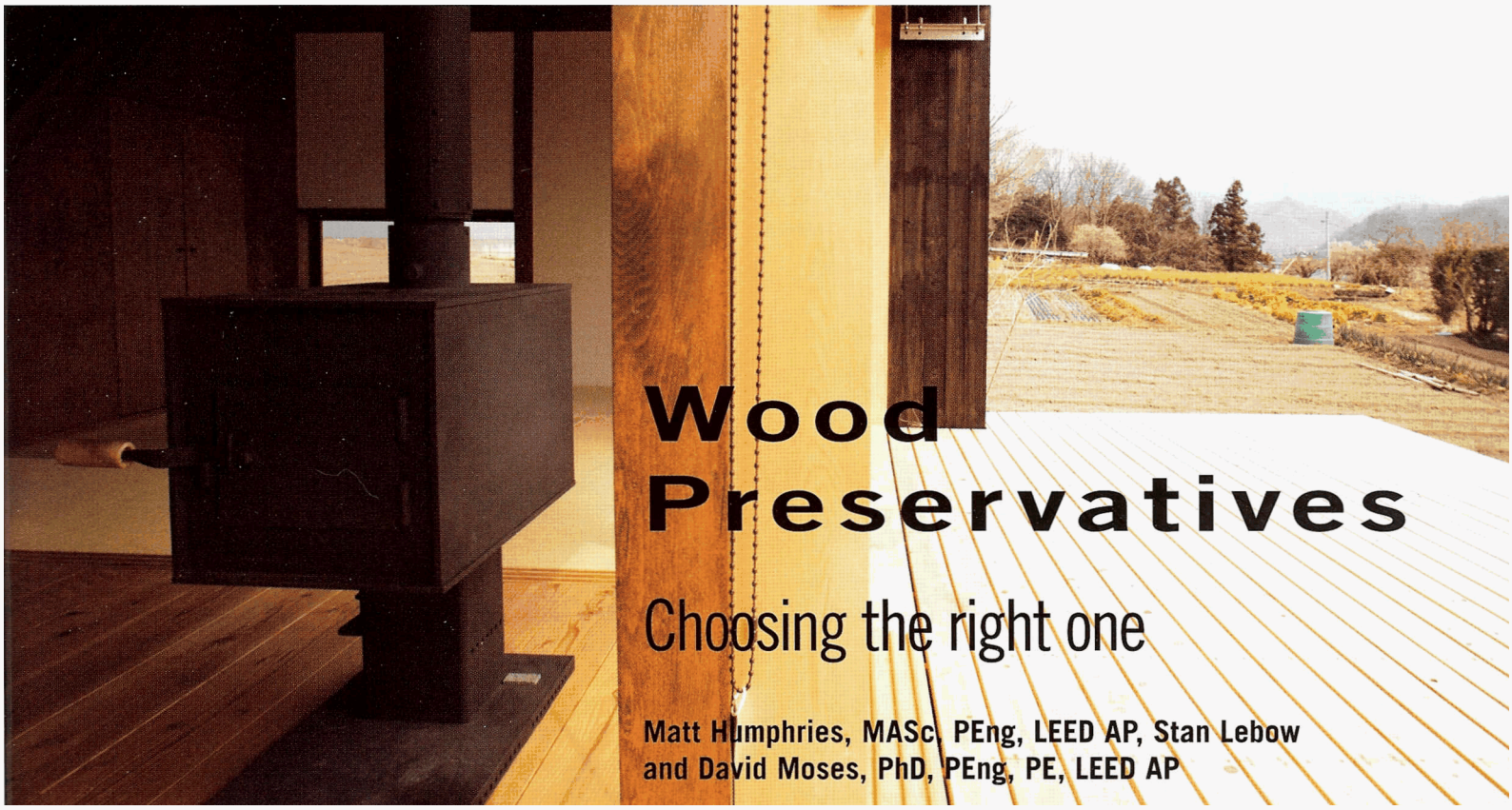

Wood Preservatives

Choosing the right one

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This photo of the Saskihouse shows pressure treated deck, but non-treated Alaskan cedar components outdoors.
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If you are having trouble choosing the right wood preservative system for your application, you are not alone. Dozens of products are available, some older types have gone out of use, others may be completely inappropriate for your application. As designers, specifiers and builders, you need to understand key information to be able to navigate through all of these chemical treatments to find the one suitable for your wood products.

For some people, the words wood and 'preservatives' conjure up memories of the familiar smell of creosoted railway ties. For others, media references to the toxicity of pressure treated lumber in backyard decks is top-of-mind. However, the average professional knows little about the history and current options for preservative treatment of wood products. This is a challenge, particularly for applications where a preservative must be chosen, and where, as designers, we want to make the right choice.

Preservatives have played a critical role in extending the life of our forest stock. At the turn of the 19th century, if not for the use of preservative treatment to extend the life of our forest stock, "wood consumption was rising at a rate that would have completely depleted our forests resources" (Morrell, 2004). We know also that using untreated wood building products is one of the most sustainable choices for construction with respect to embodied energy and storing carbon from greenhouse gas emissions.

Wood is an excellent choice when considering the full lifecycle cost analysis of the material – preservatives can help to extend the longevity of wood. However, as with most materials, information for the full lifecycle analysis appropriate for building designers is not currently available for all preservative-treated wood products. Some concerns for designers include potential off-gassing and/or leaching of chemical treatments,

the disposal of chemically-laden materials from off-cuts and during renovations, and the proximity of materials to sensitive habitat. Current research is addressing some of these concerns for existing preservatives, but economical options for recycling treated wood remain elusive. This missing piece of the puzzle will need to be addressed by the industry to help designers. And, while preservatives have been in use for decades, formulations are still evolving and many of the new products under development will have fewer concerns.

So given the best available practices within the industry, what products are most appropriate for specific applications? The major considerations for choosing the correct preservative are:

1. Type of wood product
2. Type of exposure
3. Expected type of deterioration (fungus versus insect)
4. Intended service life and structural importance
5. Sustainability / habitat concerns

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How does pressure-treatment work? (Lebow, 2007)

The purpose of pressure treatment is to force the preservative deep into the wood, almost to its center, to provide a layer of protection. Preservative specifications require a certain retention rate of the preservative in the wood which varies depending on the preservative and the wood species. Some species "treat better" than others. For this reason much of the pressure-treated lumber market is based on pine. However, many other species can also be adequately protected with the right combination of preservatives and treatment methods.

Copper is the primary protection against a broad range of organisms in many wood preservative formulations used in ground contact because of its excellent fungicidal properties and low mammalian toxicity. As some types of fungi are copper-tolerant, preservative formulations often include additional agents to provide further protection. There is continued interest in development of wood preservatives that contain no copper or other heavy metals. Development of such systems presents challenges because these organic compounds may be degraded by bacteria or other non-wood attacking organisms. These challenges are particularly acute for wood used in ground-contact applications.

Preservatives are typically soluble in either water or oil type solvents. Some preservatives are available in water or oil formulations. Water and oil type solvents each have advantages and disadvantages depending on the application.

Oil type preservatives, such as creosote and pentachlorophenol in heavy oil usually leave the wood surface dark brown in color, but have the advantage of imparting some water repellency to the treated wood. They are commonly used for heavy duty applications such as utility poles, bridge timbers, railroad ties and piles. Concerns with odor and surface cleanliness may limit their use in applications that involve frequent human contact.

Wood treated with water-based preservatives typically has a dry, paintable surface, and may also have lower odor than wood treated with some types of oil preservatives. However, water-based treatments do not improve the dimensional stability of the treated wood unless they are formulated with a water repellent additive. Hardwoods treated with water-based preservatives that utilize copper as the primary fungicide may not be adequately protected from soft-rot attack. In addition, some water-based treatments may increase the susceptibility of metal fasters to corrosion.

During construction, it is sometimes necessary to cut or drill pressure-treated wood products. In these cases, it becomes necessary to apply a protective coating to the cut surfaces using a preservative that has regulatory approval for field treatment. Copper naphthenate is commonly used for this purpose.

Durability

In an attempt to categorize the degree of deterioration hazard for various applications, many countries have developed 'hazard class' or 'use category' systems that specify the preservative formulations which are suitable in particular situations. These categories may also specify the preservative retention (concentration in the wood) that is necessary for protection. For example, direct contact with soil or water is considered a severe deterioration hazard and preservatives used in these applications must have a high degree of leach resistance and efficacy against a broad spectrum of organisms. These same preservatives may also be used at lower retentions to protect wood exposed in lower deterioration hazards, such as above the ground. The exposure is less severe for wood that is partially protected from the weather, and there are preservatives that lack the permanence or toxicity to withstand continued exposure to precipitation, but may be effective in those applications. Other formulations may be so readily leachable that they can only be used indoors. The determination of the suitability of a preservative formulation or retention for these deterioration hazard categories is not an exact science. Preservatives are often tested under severe conditions in order to shorten the time needed for evaluation, and it can be difficult to use these tests to predict performance in less severe exposures. This is normally a frustration for designers who want to target design-life of building components and are searching for reliable, measurable, life-

Table 1 Preservatives classified by durability

Type of exposure	Preservative
Seawater	Creosote, chromated copper arsenate (CCA), Ammoniacal copper zinc arsenate (ACZA)
Fresh water or terrestrial piles	All above plus pentachlorophenol, oilborne copper naphthenate alkaline copper quat (ACQ) and copper azole (CA-B)
Critical ground contact	All above plus ESR-1721, ESR-1980 and ESR-2325
Ground contact	All above plus acid copper chromate (ACC), waterborne copper naphthenate, ESR-2325, ESR-2500 and ESR-2500-B
Above-ground, fresh water	All above plus copper xyligen (CX-A), 4,5-dichloro-2-N-octyl-4-isothiazolin-3-one and imidacloprid (EL2), propiconazole-tebuconazole-imicloprid (PTI) and ESR-2067
Dry or occasionally damp	All above plus SBX (borates)

Note: Availability of preservatives varies with location. Also check with local authorities for allowable uses in some jurisdictions. For preservatives for use in Canada, the applicable building code and CSA standards should be consulted.

expectancy data for specific treatments.

Table 1 provides a list of six exposure categories and applicable treatments. The designer, specifier or builder must also consider the end use application of the product, as indicated in Table 2. For example, while creosote will work as a preservative in all categories, its use is not recommended (and may not be allowed) for interior applications.

Coatings versus pressure-treatment

Coatings such as paints and stains may be formulated to act as water-repellents. However, they may or may not contain a preservative component. Surface-applied coatings with preservatives may be sufficient for short periods of exposure to dampness, however, they generally do not provide as much long-term protection as pressure-treatments because they do not penetrate deep enough into the wood products. As a result, re-application and regular maintenance are typically required. Check with the coating supplier for expected performance, suitability for specific wood products and expected use of the wood products (such as millwork, structural components, etc.).

Naturally durable species

Designers might also consider species that have natural durability and weigh this material property with the five major considerations to provide an alternative to using preservatives. Some naturally durable species are described in the references and may be appropriate. For example, with proper detailing for protection from moisture, some wood components may not be susceptible to decay and may last for the required design life with little or no treatment.

Table 2 End-use considerations

Odor or oily surface a concern?	Exclude creosote, pentachlorophenol in heavy solvent, oilborne copper napthenate. Check with coatings suppliers regarding painting or staining.
Frequent human hand contact?	Exclude CCA, ACZA and those listed above
Free of color?	PTI, EL2 and ESR-2067
Use in building interiors	All except creosote, pentachlorophenol and copper naphthenate. However, regulatory agencies strictly limit allowed interior uses of ACZA, CCA and ACC.
Little or no additional corrosion of fasteners?	Creosote, pentachlorophenol in heavy or light solvent, copper naphthenate, oxine copper, borates

Note: These preservatives are all water-based formulations that have Evaluation Reports from the International Code Council-Evaluation Service (ICC-ES). For more information refer to their report numbers on the ICC-ESWeb site: http://www.icc-es.org/reports/index.cfm?csi_num=06070&view_details=yes. For use in Canada, the applicable building code and CSA standards should be consulted.

Summary

Wood preservatives play a role in improving the life expectancy of wood products and help to extend the life of our forest resource. Durability of building components is a key aspect of sustainability and is directly connected to the efficient use of construction materials to extend the useful life of our buildings. With the right information, designers, specifiers and builders can weigh all the factors related to durability, lifecycle cost analysis and environmental effects when making the decision to use preservative treatments.

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Wood Reference Handbook, a publication of the Canadian Wood Council (https://shop.cwc.ca) www.durable-wood.com (now hosted through www.cwc.ca)

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