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Feature

Photo courtesy Timber Specialties Co.

Pressure-treated Wood

A new look at a traditional product

By Henry Walthert, CAE

It may seem pressure-treated wood has been around forever. Some may view it as an old product with very little, if any, innovation. While the former statement may have some element of truth, the latter is far from accurate.

Treated wood products, in some form or fashion, have been around for millenia. In the 1925 publication, *The Preservation of Wood*, A.J. Wallis-Taylor reported wood preservation by chemical means could be traced back more than 4000 years, to the time when the Egyptians apparently used bitumen to treat wooden dowel-pins in the stonework of temples. The Roman Empire saw tar, linseed oil, cedar oil, and mixtures of garlic and vinegar used for the preservation of wooden structures.[1]

In the Middle Ages, charring of wood surfaces and soaking in brine, alum, arsenic, or copper salts were common methods of protecting wood from decay organisms.[2] Investigations to develop alternative wood preservation agents were reported in the late 1600s. With the coming of the 1800s, economic development and population growth drove the need for durable wood products, including materials for ships, railway ties, and trestles.[3]

Treated wood products have, and continue to be, part of the backbone of this country's development and expansion. In its early history, Canada's expansion rested on the steel rails held together by treated wood cross-ties. As its population grew and expanded, the need for power was met by generating stations that distributed electricity using power lines suspended on treated wood utility poles. Similarly, the telegraph lines used to communicate were hung on these same poles. Bridges for roads and railways were constructed using treated wood products. Many of these applications are still used in practice today.

Pressure-treating with preservatives

Wood exposed to the elements eventually falls prey to insects or fungal organisms that cause decay through a natural process. For this reason, it is important to protect wood and make it less desirable to decay organisms. This is done through the process of pressure-treating wood with preservatives. To facilitate the production of pressure-treated wood products, the preservatives are manufactured using either oil or water as solvents to assist with penetration into the wood. It is through this the preservative is able to form a protective barrier resistant to insect and fungal attack that would cause the structure's decay and deterioration.

Oilborne preservatives

Oilborne preservatives include creosote—a byproduct of the coking process in steel production first introduced in the early 1800s. Creosote-treated wood is primarily used for railway cross-ties, but can also be employed for marine/land piling, heavy timber, and bridge construction. Another oilborne preservative, pentachlorophenol (PCP), was introduced in Canada in the 1950s and is primarily used for utility poles and cross-arms but can be specified to treat timber for construction. The oily nature of these preservatives helps stabilize the wood and protects it from moisture and wood-destroying organisms.

Waterborne preservatives

Developed in 1945, the waterborne preservative, chromated copper arsenate (CCA), was first used for industrial/commercial/agricultural uses. It was introduced to the residential construction market in the 1970s to provide an alternative to more costly naturally durable wood species.

As a competitively priced alternative with similar service life, CCA pressure-treated wood products in Canada allow for the use of more plentiful Canadian species such as spruce, pine, and fir. CCA's ability to chemically bind to the wood fibres through a process called fixation ensures a long service life.

Canadians' desire to increase their living space by building decks, gazebos, and play structures around their homes has been the driving force behind the need for outdoor wood building materials. The do-it-yourself market requires products that are simple to work with and easy to install. It was CCA that initially assisted in the popularity of pressure-treated wood in outdoor residential applications and grew the market for future generations of treated wood products.

Permanent wood foundations using CCA pressure-treated wood were also introduced in the 1970s as an alternative to concrete and block foundations. Wood foundations provide for easy construction, especially in areas where other foundation materials are difficult to obtain or construct. They provide a warm, dry, and easy-to-finish basement or crawl space. Permanent wood foundations are built in accordance with Canadian Standard Association (CAN/CSA) S406-92 (R2008), *Construction of Preserved Wood Foundations*. The *National Building Code of Canada* (*NBC*) and various provincial codes include permanent wood foundations as a standard form of residential foundation.

Currently, CCA is primarily used in industrial, commercial, and agricultural applications. These include:

- plywood;
- marine applications;
- highway construction;
- fence posts and poles for agricultural use;
- round poles and posts used in building construction;
- poles for highway and utility uses;
- sawn cross-arms;
- laminations before gluing;
- cooling towers;
- shakes and shingles; and
- land, freshwater, foundation, and marine piles.

Ammoniacal copper zinc arsenate (ACZA) was introduced in Canada in the 1970s for the treatment of wood used in marine structures and construction timbers. For a short time it was also used to treat utility poles.

Borate preservatives

Borates are a more recent addition to the preservatives available for pressure treatment of wood. Wood treated with borates is used in protected or interior construction applications—lumber for fascia and trim, and plywood for wall and roof sheathing and subfloors. While very effective, borates' water solubility requires the treated wood be used in applications not exposed to wetting.

Photos courtesy Wood Preservation Canada

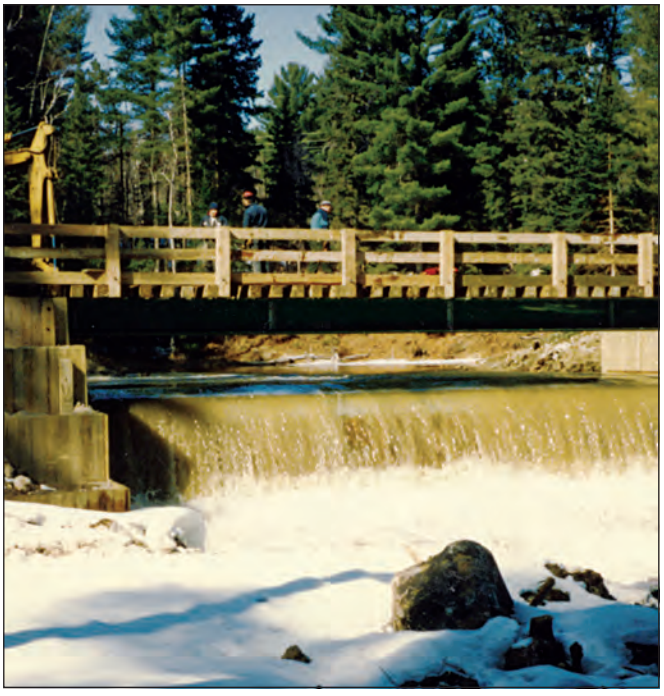
Creosote-treated marine pilings support a waterside pedestrian walkway.

Chromated copper arsenate (CCA) continues to be used in industrial and non-residential applications, such as highway guardrails.

It is important to note wood preservatives are classified as pesticides and, as such, are regulated under the *Pest Control Products Act* administered by Health Canada's Pest Management Regulatory Agency (PMRA). All pesticide products, including wood preservatives, must obtain a registration from PMRA to be sold and used in Canada. To obtain a registration, each pesticide must go through an extensive data review covering all aspects of human health/safety, environmental fate, and efficacy. If PMRA deems the pesticide acceptable, the product receives a registration label.

Organo-metallic preservatives

In 2003, the industry voluntarily withdrew CCA from the market for most residential treated wood products to facilitate the introduction of the new organo-metallic preservatives—alkaline copper quaternary (ACQ) compounds and copper azole (CA). These produce a green-coloured wood product with an appearance and benefits similar to those of CCA-treated wood, but without the arsenic and chrome components.



Pentachlorophenol (PCP)-treated timbers have commonly been specified for wood bridge construction.

ACQ and CA have gained wide acceptance in the residential marketplace since their introduction in 2004. Retailers across Canada carry a range of products, including:

- dimension lumber;
- plywood;
- posts;
- landscape ties;
- lattice;
- spindles; and
- stair stringers.

In fact, CAN/CSA-O80 Series-08, *Wood Preservation*, used by specifiers, now includes numerous other applications for ACQ- and CA-treated wood, including highway guardrail posts.

The introduction of ACQ and CA initially created some confusion in the retail sector because the change in preservative formulations required closer adherence to recommended standards for fasteners and connectors. The new formulations are more alkaline than CCA and, as a result, are more corrosive to metal. Within a short time, Canadian retailers were able to correctly source the proper materials, and no issue exists today when the proper fasteners/connectors are used.

Re-evaluating wood preservatives

In 2011, PMRA completed a re-evaluation of the traditional heavy-duty wood preservatives including CCA, ACZA, creosote, and PCP. The re-evaluation was an extensive process conducted in conjunction with the U.S. Environmental Protection Agency (EPA)—the registration authority in the United States. All aspects of the preservatives (including health/safety, environmental effects, and efficacy) were examined. The re-evaluation's outcome supported the continued use of these preservatives primarily in the industrial/commercial or agricultural applications listed earlier. Some residential applications for CCA remained, including permanent wood foundations and shingles/shakes.

This year has seen changes in the residential pressure-treated wood market as the next generation of new wood preservatives are being launched. Making its way into the market this year is a carbon-based wood preservative that is colourless and gives the treated wood a natural appearance without the customary green colour of most other residential treated wood preservatives. Wood treated with this preservative is limited to use in above-ground applications.

Also poised to enter the Canadian market is micronized copper azole (MCA). Sub-micron particles are physically deposited in the wood cells in solid form without the use of solvents, fixing to the wood

Alkaline copper quaternary (ACQ) compounds and copper azole (CA) have gained acceptance for outdoor projects like decking and gazebos.

Borate pressure treatment protects lumber and plywood products used in protected or interior construction.

Carbon-based wood preservatives are colourless. This allows the natural appearance of 'ordinary' wood to be maintained.

Micronized iron oxide pigments added to the wood preservative gives colour to pressure-treated wood.

like a coating. Wood treated with MCA can be used both above ground and in ground contact. It can range in colour from a pale green to natural brown and cedar shades.

Wood preservation certification

In 2005, Wood Preservation Canada launched the Canadian Wood Preservation Certification Authority (CWPCA) to monitor compliance to Environment Canada's *Technical Recommendations Document* (*TRD*) *for the Design and Operation of Wood Preservation Facilities 2004*. This document outlines in great detail the means by which treated wood producers must design and operate their facilities to protect plant employees and the environment. The requirements are state-of-the-art and were developed through the collaborative efforts of industry, labour, Environment Canada, and Health Canada. More than 220 criteria are examined on an annual basis through an internal audit subjected to third-party external review. Additionally, an external third-party audit is conducted every three years to ensure compliance.

The CWPCA program is a major success story; it now includes 53 of the 54 treating plants currently operating in Canada. Certification requires a minimum 90 per cent compliance to the *TRD* depending on the preservative type used. In most plants, compliance is 95 per cent or more, with several scoring 100 per cent. Most retailers require CWPCA certification as part of their sourcing requirements. Many specifiers also request CWPCA certification in their purchasing process.

The industry is continuing to work with the regulators to update the *TRD* to include new preservatives and technologies as they are introduced. A new edition is expected to be completed by the end of this year.

For treating plants using the traditional wood preservatives—CCA, ACZA, creosote, and PCP—compliance to the *TRD* will become mandatory next year as a result of the PMRA re-evaluation. With the industry's support, PMRA will include a requirement for *TRD* compliance on product registrations so only certified plants can use these preservatives in Canada.

Conclusion

It is virtually impossible to go anywhere in Canada and not encounter some sort of pressure-treated wood product in service.

Through wood preservation, people can continue to benefit from the use of Canada's most renewable building material. Extending wood's service life lessens the demand on the forests. Indeed, the beauty of wood as a construction material is enhanced by the science of wood preservation.

Notes

[1] For more, see the 1991 "United States Wood Preservation Patents in the 19th Century" by J.P. Hosli.

[2] See note 1.

[3] For more, see B. Fuller's "The Analysis of Existing Wood-preserving Techniques and Possible Alternatives" from 1977 in a technical report by Mitre. Also see A.J. Wallis-Taylor's *The Preservation of Wood* from 1925.

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