Treated Wood

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WHAT IS PRESERVATIVE TREATMENT AND HOW DOES IT WORK?

Preservative treatment is the application of chemicals to wood to make the wood unattractive to organisms that like to eat it. These chemicals essentially make the wood inedible for fungi and insects that can destroy wood.

HOW WELL DOES TREATED WOOD WORK?

Treated wood can last virtually as long as you want it to, given the correct specification, quality control and installation. For example, service lives of over 80 years have been documented for treated fence posts in ground contact. However, as with any product, incorrect specification, inadequate quality control, poor design and/or major errors in installation (such as not applying a topical preservative to open cuts and holes that expose untreated wood) can greatly reduce the expected service life of treated products.

HOW ARE PRESERVATIVE CHEMICALS APPLIED TO WOOD?

Wood products for construction are typically treated in a factory, using a pressure process. The product is loaded into a vessel, then the vessel is filled with a treating solution containing the preservative chemicals. Often a vacuum is drawn first to pull the air out of the wood allowing the preservative to move in more easily. The vessel is then pressurized to force the solution into the wood. At the end a vacuum is drawn to remove free liquid from the cells, avoiding waste and bleeding after treatment. Most dimension lumber, and some engineered wood products such as glulam, plywood and LVL can be treated this way. Other composite products such as OSB can be preservative-treated during production. Preservative chemicals are added to the mix of wood flakes and resin prior to pressing into boards.

Preservatives can also be applied in the field, when a piece of treated lumber is cut or drilled. A cut end of treated lumber must be brushed with or dipped into a chemical, as this cut exposes untreated wood. The chemicals in treated wood, even though they have been applied under pressure, don't penetrate the wood all the way through to the core.

WHAT CHEMICALS ARE USED FOR FACTORY TREATMENT OF WOOD?
For residential lumber in exposed applications wood is usually treated with copper-based preservatives. These include **alkaline copper quaternary** (ACQ), **copper azole** (CA), and **micronized copper azole** (MCA). **Chromated copper arsenate** (CCA) is also used for some residential applications such as permanent wood foundations and shingles. An alternate category of chemicals are borate-based. **Sodium borate** and **zinc borate** are two commonly used compounds.

WHAT ARE THE KEY DIFFERENCES BETWEEN COPPER-BASED PRESERVATIVES AND BORATE?
Copper-based preservatives and borates are both effective at protecting wood from decay and insects under the right circumstances, however they are very different chemicals. A copper-based preservative chemically bonds to the wood; in other words, it is "fixed" in the wood and cannot diffuse throughout the piece nor can it wash out. This means copper-based treated wood can be used outdoors or even submerged in water.
Borate, on the other hand, is diffusible; in other words, it doesn't lock on to the wood like copper-based preservatives. The advantage of diffusion is borate's ability to keep moving deeper into the wood after pressure treatment. The disadvantage is that borate can leach out of treated wood that is continuously exposed to liquid water.
Sodium borate is quite diffusible and zinc borate less so, however neither is recommended for outdoor exposed use.

HAS CCA BEEN BANNED?
No. But the availability of CCA-treated wood has changed due to recent action in both the United States and Canada by manufacturers of the preservative. It may still be used to protect wood products exposed to soil in hidden permanent wood foundations, or roof shingles. Its use as decking and pergolas etc is now restricted.

HOW DO NATURALLY DURABLE WOOD SPECIES COMPARE TO TREATED WOOD?
The heartwood of naturally durable species such as western red cedar, yellow cypress and white cedar will all resist decay to some degree, but it is variable. The amount and type of natural fungi-toxic chemicals deposited in the heartwood determine how durable the wood is. The sapwood of all species is considered nondurable. Heartwood of second growth trees may be less durable than the best of the old growth but probably less variable. Wood that has been treated to CSA or AWPA standards will deliver more reliable durability performance on average than a naturally durable species.

WHEN SHOULD TREATED WOOD BE SPECIFIED?
Treated wood is necessary if the wood is expected to **stay wet for extended periods** of time or is **in contact with the ground**. Treated wood is also recommended if wood is used in an area of **termite or wood-boring beetle** activity.

SHOULD PRESSURE-TREATED LUMBER AND PLYWOOD BE DRIED PRIOR TO INSTALLATION?
Yes. As with all construction wood, both treated wood and plywood should be dried to a moisture content of **19% or less** prior to installation in a building to ensure

dimensional stability. Drying is less important when copper-treated wood is to be used outdoors where it can season naturally.

WHAT IS INCISING AND WHEN IS IT REQUIRED?

Incising is the process of cutting many small slits into the surface of a piece of wood in order to increase the amount of preservative taken up by the wood during treatment. Many Canadian wood species are particularly difficult to treat or 'refractory', and incising is necessary to meet the penetration requirements stipulated by the CSA standards. Non-incised CCA-treated wood will have a shorter service life than incised CCA-treated wood, but the difference may not be noticeable in the short term (under 20 years) in relatively low decay hazard applications such as decking. For wood in critical structural applications under conditions conducive to decay, such as bridge decks, incising could make the difference between 4 and >40 years service.

Incising is not necessary with borate-treatment, because borate diffuses to achieve the required penetration. With borate-treated wood, there is no difference in performance between non-incised and incised, provided the target chemical content is achieved. Note there is a strength-loss penalty for incising, which is accounted for during structural design.

WHAT'S THE DIFFERENCE BETWEEN GREEN AND BROWN TREATED WOOD?

If you are shopping for treated lumber at a do-it-yourself retail centre, you may be confused by the choices and store staffers may not know much more than you do. Whether the treated wood on display is green, brown, yellowish, or bears a brand name, it's all been treated with a copper-based preservative. The brown products have merely been coloured to mask the greenish tone of the preservative. Note that the green tone of treated wood will fade as the wood ages, without any effect on the wood protection.

WHAT ARE FIELD-APPLIED PRESERVATIVES AND WHAT TYPES ARE AVAILABLE?

Field preservatives are chemicals that are applied to cut or drilling sites on treated wood at the construction site, and they should be purchased along with treated wood as they will inevitably be required. Field preservatives must be applied when treated lumber is cut in the field, as the cut will expose untreated wood at the core of the piece. Most field preservatives come in a liquid form and can be separated into two groups: organic solvent and water-soluble. The organic solvent preservatives are typically used for field-treating cut ends of pressure treated wood. There are two available chemicals in this category: **copper naphthenate** and **zinc naphthenate**. Of the two, copper naphthenate is more effective and can be used in all applications. Copper naphthenate is green. Zinc naphthenate is somewhat less effective, so its use is restricted to above-ground applications only; it should not be used on wood that will be in ground contact. Zinc naphthenate is available either colourless or colour-matched to the greenish tone of treated wood.

The water-soluble field-cut preservatives are **borate-based** and thus are typically used for field-treating cut ends of borate-treated wood. If the wood is not at a moisture content of **at least 35%**, a solution containing propylene glycol must be selected to assist the borate's diffusion through the piece. In addition to treating field cuts, the borate-glycol preservatives are also useful for protecting sound wood left in place when adjacent rotted wood has been removed. The remediated timber may have once been quite wet due to building envelope leaks but dried again during the opening and repair process. Some non-liquid field preservatives are also available, in paste or solid form (rods). These generally contain borate or fluoride and are inserted into drilled holes in the wood. These products are also very useful in large dimension or painted wood members that are expected to stay above 35% moisture content for an extended period, such as over-hangs or protruding heavy timber or log features exposed to frequent rain or snow exposure.

HOW ARE PRESERVATIVES APPLIED IN THE FIELD?

Liquid preservatives can be brushed on the cut end, or the end can be dipped into them. Spraying is not recommended. If dipping is used, a minimum of three minutes immersion is recommended. If brushing, use two coats. Only the cut or drilled area need be dipped or brushed. Wear proper protective gear (rubber gloves and eye protection) when using these preservatives, primarily because of the organic solvent. Borate rods and pastes are inserted into pre-drilled holes and plugged tightly with a piece of dowel, a plastic plug or some other suitable material to keep water out of the hole.

CAN I JUST FIELD-TREAT LUMBER IN PLACE OF USING PRESSURE-TREATED LUMBER?

Generally no, as you will obtain nowhere near the same level of durability or service life. Lumber must be pressure-treated to obtain the proper penetration depth and chemical level for adequate long-term protection of the lumber. Field treatment with organic solvent based preservatives works acceptably well on lumber ends but not on the flat surfaces. This is because end-grain of lumber absorbs preservative up to 100 times more than the flat surface. Penetration of organic solvent-based field cut preservatives into the flat surface of the lumber is minimal, typically 1 mm. With proper pre-conditioning and incising of the lumber, preservatives applied by pressure treatment can penetrate from 5 mm to the full cross section, depending on species, sapwood content and preservative chemical, among other factors. It would also probably not be cost-effective to attempt substitution of pressure-treated lumber with field treating. It would take a lot of chemical and a lot of labour, for an end product that will not perform adequately and may need replacing far sooner than expected.

HOW WET MUST WOOD BE FOR BORATE TO DIFFUSE THROUGHOUT THE PIECE?

Wood needs to be at a moisture content of at least 27% for effective diffusion of borate, and even then this high moisture content will only allow a slow migration. The borate can move at a rate of up to 1 mm/week, depending on temperature). Faster diffusion occurs when the moisture content and the wood temperature is higher. For example, at moisture contents of 40% or so, the chemical can migrate at a rate of up to 3 mm/week, if the temperature is right.

HOW WET DOES BORATE-TREATED WOOD NEED TO BE BEFORE BORATE WILL LEACH OUT?

Borate will leach out only while wood is exposed to flowing liquid water and the moisture content is above fibre saturation (averages around 27% moisture content, depending on wood species). This can occur when the wood has extended contact with rainwater or very heavy condensation. Moist air, even at 100% relative humidity, does not cause loss of borate.

WHEN BORATE-TREATED WOOD IS EXPOSED TO WATER, HOW LONG WILL IT TAKE BEFORE TOO MUCH CHEMICAL LEACHES OUT?

Short exposures to rain during transportation, storage and construction pose no problem. Even if fully exposed to rain in a wet place such as Vancouver, it takes a year or more before levels of borate in normal treated wood drop below the amount that controls decay.

WHAT TYPE OF NAILS SHOULD BE USED WITH TREATED WOOD?
Only hot-dipped galvanised or stainless steel nails should be used with CCA, CA or ACQ-treated wood. If CCA, CA or ACQ is specified, extended periods of wetting are presumably anticipated, and common wood nails corrode in wood under moist conditions. Electroplated galvanising is not thick enough to resist corrosion under moist conditions. MCA treated wood is less corrosive, and is labeled as suitable for contact with aluminum.

Only stainless steel fasteners and connectors should be used in areas near salt water. With borates, electroplated galvanised nails may prove adequate, because borates are corrosion inhibitors and borate-treated wood is presumably not going to be exposed to extensive liquid water. Further research is needed on the compatibility of fasteners with borate-treated wood. It's possible that even ordinary wood nails can be used with borate-treated wood, however the research to prove this has not yet been performed.

CAN SCREWS BE USED IN TREATED WOOD?
Screws cannot be hot-dipped galvanised but are generally available in stainless steel. There are other types of coated deck screws on the market for decking.

ARE THERE ANY CONCERNS WITH PAINTING TREATED WOOD?
No. The finishing properties of wood treated with waterborne preservatives depend primarily on the wood properties, not the preservative treatment. For any wood product, sanded or rough-sawn surfaces are recommended for best paint adhesion and stain absorption. In addition, all wood should be dry before painting. Because pressure-treated wood absorbs water during the treating process and may be at a high moisture content when shipped to lumber yards, and at time of installation the lumber must be (artificially or naturally) dried to 19% moisture content or less prior to painting/finishing.