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Treated timber in Australia: CCA and the alternatives

Where to use treated timber

There are a variety of treated timbers now readily available for a wide range of building purposes.

They offer superior performance in almost any situation where timber is exposed to weather, in contact with the ground or under water. Some examples include:

- Framing and roofing timbers.
- Timber decking, pool surrounds.
- Wall linings, cladding, fascia.
- Poles and posts, haysheds.
- Stumps, sub-floor timbers.
- Fencing, landscaping, playgrounds.
- Bridges, railings, marinas, piers.
- Oyster farms, vineyards.
- Railway sleepers and wagons, truck floors.
- Water cooling towers.
- Pergolas.
- Domestic fencing.
- Rural fencing.
- Boats.

A general guide to treated timbers

Introduction

Treated timber, in one form or another, has been in use around the world for about two thousand years. For example, animal, vegetable and mineral oils, as well as coal tar pitches and bitumen were all employed by the ancient Egyptians as wood preservatives. A more refined version of coal tar pitch - coal tar creosote - is our oldest industrial preservative, being used in large quantities all around the world for some 200 years. Today, there are a number of different treatments that have been developed to suit different grades of timber and different construction purposes. Not surprisingly, treated timber has become indispensable for both domestic and commercial building purposes across the world. Treated timber is also a valuable material for many non-building constructing purposes, from fence posts and landscaping products to the most sophisticated ocean-going yachts.
This technical report is a general guide about treated timber and the processes used to treat different timber grades for a wide variety of purposes. The titles of more detailed publications and the URL addresses of some useful websites have been included for those interested in finding out more about treated timber products.

Treated timber has become an indispensable core building material for both domestic and commercial construction.

What is treated timber?

Treated timber is timber that has been through a process, or number of processes, to apply specialised chemicals to its untreated form. The result of these treatments, or preservative processes, is to significantly extend the life of the timber by protecting it from a number of biological, climatic and chemical hazards.

Why use timber treated with preservatives?

Many commercial timbers are not naturally resistant to rot, insect attack or the effects of sunlight, heating, cooling, rain and frost. Pressure treatment with preserving chemicals, howver, protects wood products against decay and insect infestation. Untreated wood in contact with the ground or water will typically only last from one to four years. Pressure-treated wood, however, can last decades – usually around 30 to 40 years, and often more than 50 years.

Advantages of treated timber

Some advantages of treated timber include:

- supporting a long-life building material under potentially hazardous conditions;
- significant cost and energy savings in the manufacture of timber products;
- versatility – treated timber can be used outdoors, indoors, above ground, underground, and in direct contact with fresh or salt water;
- a variety of finishes that provide additional attractiveness; and
- greater flexibility for design to overcome difficult site situations.

How is timber treated with preservatives?

Pressure treatment is a process that forces chemical preservatives deep into the cellular structure of the wood (see figure 1 on page 3). The process takes place in a closed treatment cylinder where both vacuum and pressure is applied to the “charge” of timber as the preservation chemicals are introduced. This process ensures that the impregnated wood is well preserved to provide a protective barrier against wood borers, termites and decay for long periods of time. Many manufacturers guarantee their treated wood to resist decay and termite attack for 40 years or longer.

The main types of preservatives and application processes.

There are three main types of preservatives:

- water-borne, e.g. CCA, ammoniacal copper quaternary (ACQ), Copper (CU) azole, boron compounds;
- oil-borne, e.g. creosote and Pigment Emulsified Creosote (PEC); and
- organic solvent-borne, e.g. Light Organic Solvent Preservatives (LOSPs) such as TBTN and Copper (Cu) naphthenate.

These preservatives each have different benefits and characteristics and are often applied to the timber by different processes.

Vacuum / Pressure Impregnation using CCA, ACQ, Copper azole and creosote.

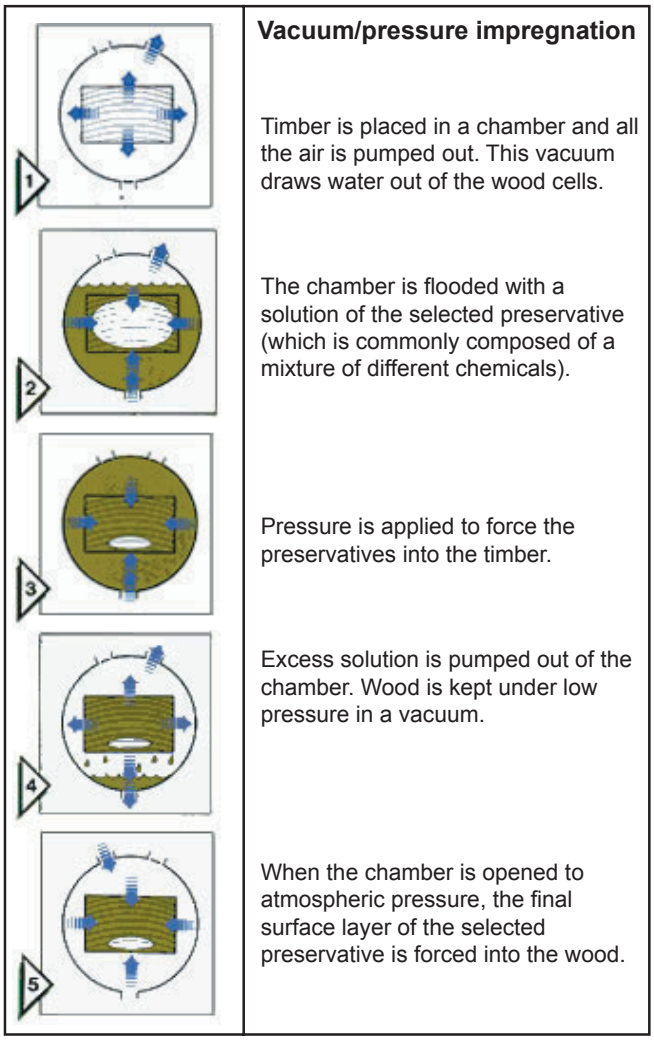
This process, often referred to as the Bethel or Rüping treatment cycle, is used to achieve deep preservative penetration for the protection of piles, poles, fencing, building timbers and many types of wood used in domestic and industrial construction. The chemicals, especially CCA, are generally fixed or locked into the wood structure following this process.

Rotting seat posts made from untreated timber

Sound treated timber retaining walls

(Photographs courtesy Harry Greaves)

Figure 1 *- The vacuum/impregnation process is used for applying preservative treatment to timber to achieve deep preservative penetration for many types of wood used in domestic and commercial construction.*



Double Vacuum / Immersion: using LOSPs such as TBTN and Cu naphthenate.
This process is less rigorous than the ones described on the previous page. Lower pressure is used and often shorter vacuum times. It achieves relatively shallow penetration of the preservative and leaves a smaller amount of the chemicals in the wood. It is used for the protection of building timbers not in ground contact, such as cladding, decking and fabricated joinery components.

Dip / Diffusion using boron compounds like Polybor.
These preservatives are delivered to the wood, generally in its undried state, by dipping the charge of timber into the chemical and allowing the chemical to diffuse into the wood cells. The process is designed to protect timber against insect attack and should be used for indoor or sheltered situations above ground, since the chemicals are not fixed or locked into the wood structure.

Why are some types of treated timber green?

The most commonly used preservatives contain copper. As wood treated with these preservatives dries and reacts to the sun's ultraviolet rays, the wood turns a greenish colour. This is caused by a chemical reaction – part of the fixation process that binds the preservative in to the wood.

Modern, covered treatment plants showing cylinders and charge of timber ready for treatment . (Photographs courtesy Harry Greaves)

A typical timber treatment process for posts, power poles, landscaping logs and the like.

Posts are placed inside the treatment cylinder. The process is then initiated.

After the process is completed, the posts are removed and stored ready for use.

How do I know that I am purchasing properly treated wood?

Wood that has been treated to the preservation Standard requirements will be fit-for-purpose and should be clearly identified by a brand or mark, as defined and required by the Standard.

Timber users should check that there is a label indicating that the product is in conformance with Standards Australia specifications AS1604-2000. Look for treated wood information appearing on an end tag or in an ink stamp along the timber surfaces, as shown in the photographs below.

Wood products treated in accordance with this Standard should carry a stamp or brand, indicating the hazard level to which it has been treated, (as indicated by the arrows in the photographs below).This information will be the third component of the brand.

The other components in the brand are the number codes, indicating the type of preservative and the treatment plant.

Two types of branding or marking to demonstrate that the timber has been treated in accordance with AS 1604-2000(Photographs courtesy Harry Greaves)

Standards for Treated Timber

The specifications for timber treatment processing in Australia are addressed by Standards Australia in the standard AS1604-2000 series. These documents set down the preservation requirements for round and sawn solid timber, and wood-based composite products like particleboard, plywood, LVL and glue-laminated timber.

The Standards detail the preservative penetration and retention requirements, including preservative types and processes (in the case of non-solid wood products), for a range of biological hazards and end uses.

AS1604 – 2000 preservative specifications reflect the six defined Hazard Classes – H1 refers to protection of timber products used internally and above ground with potential exposure to Lyctus borers. H6 refers to timber products used externally and in marine environments. All of the exposure conditions which are likely to occur throughout Australia are covered in the Standard.

For more information, including the complete AS1604.1-2000 standard, visit the Standards Australia website at http://www.standards.com.au/.

CCA and other popular preservatives

CCA (copper chromium arsenic) is Australia's (and the world's) most widely used wood preservative. It has been used safely in Australia for more than 40 years, and some 130 treatment plants using this material currently operate around the country. CCA treatment is effective - for example, extending the life of a radiata pine post from a few years to 30 years or more - and it is relatively inexpensive.

Alternatives to CCA are available: However, they are not as widely used. The main reasons for this are (1) wood treated with them is generally more expensive than CCA-treated timber; and (2) the best alternatives, ACQ (ammoniacal copper quaternary), and Tanalith E (copper azole), do not yet have the proven long service track record of CCA.

Copper Chromium Arsenic (CCA)

A long and impressive record

CCA was invented by an engineer in India in 1933 and patented in 1934. It has a long and impressive record for extending the life of building and construction timbers in all regions of the world.

This long and effective service record, together with its extensive testing and usage history, indicate that CCA-treated timber products are both environmentally harmless and, when used properly, safe for humans and animals exposed to them.

The CCA treatment

CCA treatment involves the impregnation of timber with a preservative solution made from copper, chromium and arsenic compounds. The timber impregnation process is completed in enclosed industrial treatment cylinders, (such as those in the photographs on page 3).

The roles of the ingredients are:

- copper to control fungi
- chromium to fix the copper and arsenic in the wood, and
- arsenic to control termites.

The correct combination (or ratio) of these elements, as described under Australian Standards, is critical to the in-service performance of the products.

The treatment process is closely controlled, usually by computer micro-processors. Post-treatment handling in the plant and in the treatment yard should ensure that the fixation process has been completed so that virtually all the CCA becomes chemically bonded within the wood structure.

Timber clad homes made with CCA-treated products.

It is essential to ensure that CCA-treated timber has been produced properly, i.e. that the CCA is well fixed and the wood is surface dry and free of any visible deposits.

Regulation of CCA

In Australia, CCA (and all other) preservatives are approved and regulated by the Australian Pesticides and Veterinary Medicines Authority (APVMA), formerly known as the National Registration Authority. There is also some additional regualtion controls from other government departments, including environmental agencies. The APVMA registration process consists of efficacy (testing the preservative's ability to produce the intended result) and environmental impact assessments, as well as safe use and handling criteria. The actual preservative treatment levels are set down by Australian Standards, and by State legislation in Queensland and NSW. Only dedicated commercial treatment plants have access to CCA. Unlike preservatives such as creosote, liquid CCA is not available to the public.

Arsenic in CCA – very safe, but take some simple precautions

Arsenic is the twentieth most abundant element in the earth's crust, with soil containing this element at concentrations of between about 0.2 and 20 parts per million.

The arsenic used in CCA is in a form - arsenate or pentavalent arsenic - that is five to ten times less toxic than the most toxic form, arsenite. The user of CCA-treated timber is not exposed to any chemical hazards and numerous scientific studies on the safety of CCA -treated timber have all concluded that the arsenic in treated timber poses no health threat to humans or animals.

For example, in an exhaustive 15 month study completed in 2002, the Florida Physicians Arsenic Workgroup, a panel of six eminent physicians appointed by the Florida Department of Health, concluded that for children using CCA-treated timber playgrounds "the amount of arsenic that could be absorbed from playground soil and CCA-treated wood is not significant compared to natural sources and will not result in detectable arsenic intake."

A recent review of CCA conducted by the APVMA came to a similar conclusion. That is, "based on a consideration of the exposure to CCA-treated timber products, in particular children's play equipment, there was no compelling evidence from the available data to conclude that there was likely to be an unacceptable risk to public health from exposure to arsenic from CCA-treated timber." The APVMA also showed that normal dietary intake of arsenic was about 4-5 times higher than could possibly result from exposure to CCA-treated timber.
A number of studies have shown that CCA is not absorbed into above-ground food crops such as grapes, tomatoes and cucumber. Similarly, none of the elements of CCA will move from CCA-treated logs into the dry indoor environment of a CCA-treated log house.
However, use of sawdust or wood chips from treated timber as mulch is not recommended because of uncertainty surrounding the release of CCA components in mulched environments or where the components of the CCA may end up in the long term. Nothwithstanding the above cautionary recommendation, there is a school of thought that suggests CCA-treated timber residues, when used as mulch, (in contrast to untreated woodchip mulch) will provide better weed control and enhance some soil microbiota.
Similarly, using treated wood shavings is not recommended, despite suggestions from some studies that it can reduce the exposure of animals to disease-causing micro-organisms that inhabit untreated bedding.
Although the risks are small, using treated wood in applications involving repeated contact with food - such as cutting boards and food boxes - is not recommended.
Collecting rainwater from a roof with CCA-treated shingles for drinking is also not recommended. But, again the risk appears small; a two-year Canadian study found a slight rise in arsenic levels in tank water in the first year, peaking at 5 months, and no detectable contamination in the second year.

Disposing of CCA treated timber waste

CCA-treated timber residues should not be burned. Small volumes of CCA-treated timber wastes or off-cuts from domestic or residential uses should be disposed of through normal waste collection services.

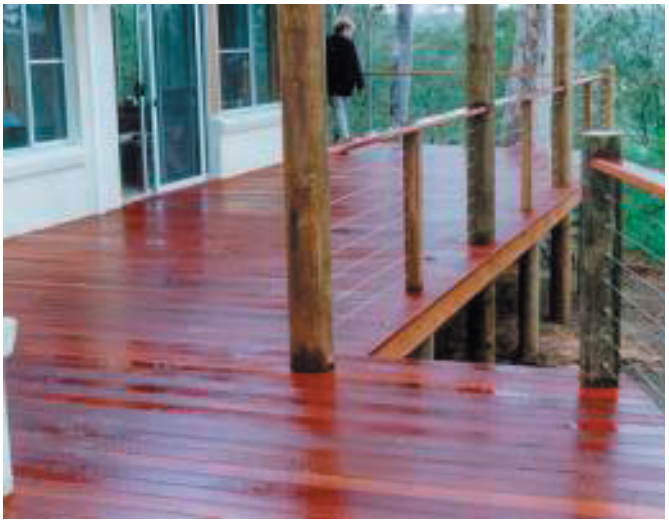
Larger quantities of treated wastes from industrial building projects may need to be disposed of at approved (impermeable) landfill sites.

There are a number of recycling/reuse options for spent CCA-treated timber currently in use around the world. In Australia the amount of recycling or reuse is limited and the difficulties of recycling the treated timber and disposing of waste still present some challenges. The CSIRO has identified this problem as a subject for current scientific research.

Light Organic Solvent Preservatives (LOSPs)

LOSPs are preservatives made up in a solvent system containing insecticides for internal use, or combinations of fungicides and insecticides for external use. They may also sometimes contain water repellents.
LOSPs are used to protect timber against insects, including termites, and decay, though they are not intended for use in ground-contact situations. LOSPs can provide some measure of weather protection when water repellents have been incorporated into the preservatives.
Although they have traditionally been colourless, it is now possible to obtain green and brown-coloured LOSPs. Do not confuse green tinted LOSP-treated timber with the green CCA used in ground contact applications, where LOSPs are definitely unsuitable.
The coloured appearance of LOSP-treated timber is short-term. Also bear in mind that some of the dyes used in coloured LOSPs might migrate through paint films that are later applied to the surface of the LOSP-treated timber. Note also that the timber supplier may have coloured the LOSP-treated timber just to identify it, and in this case the colour must comply with the Standard, i.e. red or blue for house framing, depending on where it is to be used.
Most types of preservative-treated timber are subject to the effects of weathering when used in exposed outdoor situations. LOSP-treated timber is no different, and when it is used in such a situation it will benefit from the application of surface coatings of preservative that provide additional protection against moulds, discolouration, checking and dimensional movement.
LOSP-treated timber is generally more prone to the effects of external exposure than CCA-treated timber, and it should always be given a protective coating after treatment.

LOSP-treated external joinery, benefiting from a well-maintained paint coating



Whether it is outside decking for verandas or quality interior flooring, there is a wide variety of treated timbers from which to choose that provide efficient, environmentally sound, aesthetically pleasing and practical solutions to most of your interior and exterior building needs.

Since the LOSP treatment leaves the timber dry and stable, these type of preservatives are used for high value building components such as external joinery, e.g. windows, and for protecting house framing against termites (H2 level).
LOSP-treated timber suppliers may provide guidelines for painting, but you should always follow the surface-coating manufacturer's instructions.

Creosote and Pigment Emulsified Creosote (PEC)

Creosote and PEC are both heavy-duty preservatives used to protect such commodities as poles, sleepers, marine piles and engineering timbers against decay, insects, including termites and marine borer attack. These oil-borne preservatives also provide excellent weather protection.Creosote is easily recognized from its dark oily appearance with a characteristic pungent smell. It is a complex preservative made up of more than 300 chemical components. It must comply in its composition and properties with the specifications set down in AS 1640.1-2000. PEC is a variation of normal creosote in which water and pigment have been added to make it more user-friendly and less mobile in the wood treated with it.
Both normal creosote and PEC are usually applied by vacuum-pressure impregnation, with the application of some heat in the treatment cylinder.
Being oil-borne, these preservatives will migrate slowly in the treated timber and may leave an oily surface finish. PEC, with its special pigment content, is less likely to do this than normal creosote.

Key Benefits

Creosote is one of man's oldest preservatives, dating back hundreds of years. Therefore it has a long service history. Some benefits of using creosote or PEC include:

- effective against decay, insects, and marine borers
- strongly water repellent giving good weather resistance and stable treated products
- very long lasting with no need for maintenance treatments.

If you are working with creosote / PEC-treated timber or the liquid preservatives avoid getting treated sawdust or splashes of liquid creosote or PEC on your skin. Take special care when working in bright sunshine as it is known that creosote can cause a (reversible) skin irritation akin to sunburn. This is likely to be more prevalent in fair-skinned people. You should cover up and/or apply barrier creams to exposed areas.

The beauty and practical benefits of preservative-treated timber

Further reading

AS1604-2000 series, SPECIFICATION FOR PRESERVATIVE TREATMENT. Standards Australia

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www.tpaa.com.au

www.preservedwood.com.au

www.woodpreservativescience.org

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www.apvma.gov.au/chemrev/arsenic_draft_review.pdf

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