WOOD PRESERVATION ON THE FARM

Province of British Columbia
Ministry of Agriculture, Fisheries and Food
Resource Management - Crop Protection

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INTRODUCTION

Man has long recognized that, under damp conditions, wood has a tendency to deteriorate. Early attempts at wood preservation involved application of water-repellent materials such as pitch, oils, and tars with varying degrees of success.

Only within the last 100 years has the role of fungi, as the principle cause of decay, been recognized. Other living organisms which attack wood include insects such as termites and beetles; bacteria, rodents, and woodpeckers. However, losses due to these organisms are minor in comparison to the damage done by fungi. Most chemical preservatives which protect against fungus invasion also prevent inroads by termites and other insects. Wood used in salt-water situations is also subject to attack by teredos, but discussion of this aspect of wood preservation is beyond the scope of this publication.

THE WOOD-ATTACKING FUNGI

Moulds – Moulds develop on wood under warm, moist conditions. They are superficial and can be removed by brushing or planning. Moulds, in themselves, do not weaken wood, but they may aid the activities of more serious decay fungi.

Sapstain fungi – These fungi penetrate the sapwood, resulting in gray to black discolouration which cannot be removed. They feed on the sugars and starches but do not attack the cell walls, thus having very little effect on wood strength.

Decay fungi – Decay-causing fungi are the most serious of the wood invaders as they attack the cell walls, robbing the wood of its strength. Most decay fungi are in a class called *Basidiomycetes*, which is characterized by the production of conspicuous galls, conks, brackets, or mushrooms which release millions of tiny spores capable of starting new infections if they land on a piece of damp, unprotected wood. In the absence of toxic materials, decay fungi develop most rapidly when temperatures are between 24 and 32 degrees C, moisture content of the wood is greater than 30 per cent, and oxygen supply is adequate.

Soft rot fungi – Under some conditions, such as extreme wetness, the decay fungi may be unable to develop, but soft rot fungi belonging to the groups *Fungi Imperfecti* and *Ascomycetes* may cause damage. They tend to be more tolerant of most chemical preservatives that the *Basidiomycetes* and can be a real problem in wooden water tanks, pipes, and pilings.

NATURAL METHODS OF DECAY PREVENTION

Once wood has been dried below 20 percent moisture content it will not decay. Even under exterior uses, very little decay occurs provided the wood is able to dry off reasonably quickly after becoming coming wet. However, decay is inevitable when wood is in contact with the ground or contains cracks, grooves, or trimmings that hold water for prolonged periods.

Under such conditions, it may still not be necessary to treat with chemical preservatives if decay-resistant heartwood is available and suitable for your purpose. Among our native trees in British Columbia, western red cedar and yellow cedar are the most durable under conditions favouring decay. However, even these trees vary in their natural durability and may benefit from treatment with chemical preseratives.

Among introduced trees, black locust, sassafras, redwood, red mulberry, red cedar (juniper), white oak, and catalpa are very resistant to decay.

CHEMICALS USED IN DECAY PREVENTION

Oil-type Preservatives

Oil-type preservatives increase the flammability of wood until all the solvent has evaporated. They should not be used in enclosed areas containing plants or animals as the solvent vapours are both toxic and flammable. Conversely, oil-type preservatives tend to decrease the electrical conductivity of wood.

Creosote – Coal-tar creosote is a distillation product collected during preparation of coke from bituminous coal. It is the oldest and most widely used wood preservative. Some of the advantages of creosote are (1) high toxicity to fungi and insects; (2) low cost; (3) long lasting in both fresh and salt water; (4) non-corrosive to metals and wood; (5) easy to determine depth of penetration.

Its disadvantages include (1) strong odour; (2) oily nature makes it objectionable to handle and difficult to paint over; (3) irritating to the skin of workers; (4) flammability for a time after treatment until the lighter oils have evaporated; (5) toxic to plants growing nearby.

Creosote is well-suited for preservation of railway ties, utility poles, pilings, and bridge timbers. It is not generally recommended around farms and gardens where it may come in contact with workers or food-producing plants or animals.

Anthracene oils (Carbolineums) – These are heavier coal-tar oils which are not as prone to losses from evaporation. They are usually more expensive than creosote and they are very similar in properties.

Creosote mixtures – Many industrial preservatives contain a mixture of creosote and lower-priced coal tars or petroleum oils as a means of reducing costs. As petroleum oils and coal tars are not very toxic to fungi and insects, the mixture must be fortified with a toxicant such as pentachlorophenol if the proportion of creosote in the mixture is low. These compounds are no longer recommended around farms, gardens or dwellings.

Pentachlorophenol (PCP) – The value of pentachlorophenol as a preservative against decay and termites was first discovered in the 1930s. Its popularity grew steadily after that and it became the next most widely used preservative after creosote in the 1960s and 70s. Since then, however, it has been recognized as an environmental contaminant and its use is being phased out. It may still be used for pressure treatment of fence posts but it should not be used where humans, livestock or garden plants are liable to come in contact with it. Treated wood continues to give off harmful vapours even after the solvent has evaporated, therefore it must not be used inside dwellings, greenhouses or other farm buildings.

Copper naphthenate – Copper naphthenate is a popular preservative for wood used in boat hulls, exterior planking, greenhouse benches, greenhouse flats, posts, and poles.

It is available as a ready-to-use at 1-2% copper or as a concentrated solution at 6-8% copper for mixing with light petroleum oils. When used in pressure treatments, the solution should contain the equivalent of 0.5% metallic copper. For dip or brush applications, a copper metal equivalent of 1-2% is recommended. It is recommended for painting the cut ends of wood which has previously been pressure treated with preservatives. Copper naphthenate is slightly corrosive to the zinc coating of galvanized nails. For best results where long nail life is important, use stainless steel or copper nails if they are available at reasonable cost.

Zinc naphthenate – Where the green colour of copper naphthenate cannot be tolerated, colourless zinc naphthenate may be substituted. It is less likely to cause corrosion of galvanized nails, but as a preservative it is less effective than copper naphthenate.

Copper 8-quinolinolate – This material is widely used for sapstain control on freshly cut lumber and for treating textiles and cordage for outdoor uses. Treatment is done by brushing or dipping with a solution containing 0.25-2.0% copper 8-quinolinolate in light petroleum oil. It may be used for fruit and vegetable boxes, bins, baskets, mushroom trays and the wooden interiors of refrigerated rooms and trucks. For such uses it should be diluted in water rather than oil. It is not intended for use in bins or containers where produce will be in direct contact with the treated wood during long-term storage.

Water-borne Preservatives

Most water-borne preservatives decrease the flammability of wood. On the other hand, they may cause the treated wood to absorb water during wet weather. This can lead to alternate swelling and shrinking which puts stress on lumber and nails. It can also increase the electrical conductivity of the wood. To avoid these problems in important areas such as sundecks, a suitable water-repellant finish should be applied every couple of years.

Chromated copper arsenate (CCA) – Chromated copper arsenate (CCA) is now the most widely used preservative for pressure treatment of fence posts as well as lumber for use around farms, dwellings and playgrounds. While the treatment solution is highly toxic, the preservative become fixed within the wood and, once the treated wood is dry, there is little or no residue on the surface. CCA, under a variety of trade names, is available only to pressure treating firms and is not intended for on-farm use. There are several types of CCA, depending on the components used to make up the treating solution. The type utilizing copper oxide is preferred as it produces no deposits on the surface of the wood and it is now the only type available in Canada. The treated posts and lumber are recommended for all farm uses except direct contact with food products or in bee hives. For extra protection against decay, cut ends of CCA treated products may be painted or dipped with copper naphthenate. CCA is not corrosive to galvanized nails or staples but may be slightly corrosive to aluminum. For best results, use stainless steel or double hot-dipped galvanized fasteners.

Ammoniacal copper arsenate (ACA) – Ammoniacal copper arsenate (ACA) and ammoniacal copper zinc arsenate (ACZA) are similar to CCA in that they are fixed in the wood. ACA is not as insoluble as CCA and therefore is more subject to leaching and consequently not as long lasting. ACZA is said to be more resistant to leaching than ACA.

Acid copper chromate – Acid copper chromate, although not as effective as CCA, has the advantage that it can be used to pressure treat lumber to be used in construction of bee hives without danger of contaminating the honey or wax or harming the bees. It is not readily available in Canada, however.

Borax and boric acid – Borax and boric acid are used in some countries for treatment of lumber to be used in high humidity situations. However, boron compounds are easily leached and are of little value for outdoor use in high rainfall areas. They are considered to be relatively non-toxic and fire-retardant treatments for indoor uses.

Copper sulfate – Solutions of copper sulfate, also known as bluestone, have been used for on-farm treatment of green posts and lumber. Copper sulfate is not recommended as it is easily leached out of the wood and is also very corrosive to galvanized nails, staples and wire.

Zinc chloride – Zinc chloride was formerly widely used as a wood preservative because of its low cost, cleanliness, lack of odour, handling ease and fire-retardant properties. However, it leaches readily and is therefore not useful for soil contact or outdoor exposure in high rainfall areas. Chromated zinc chloride is more resistant to leaching. Zinc chloride in water can be applied as a spray to cedar shake and shingle roofs to control moss. The effect is short-lived however, and the preservative value quite low.

MATERIALS OF LITTLE PRESERVATIVE VALUE

Coal tar, crude petroleum, fuel oil, diesel oil and used crank case oil, when used alone, have very little preservative value. To be effective they must be fortified with a toxicant such as copper or zinc naphthenate.

Similarly, paint, linseed oil, whitewash, concrete, or water repellents will not prevent decay in wood which is exposed to water for prolonged periods or is in contact with the ground.

METHODS OF APPLYING PRESERVATIVES

Pressure treatment – Pressure treatment is by far the best method for treating wood which is to be used under conditions of severe decay potential. It can only be done at large commercial pressure-treatment plants. Wood to be treated must first be kiln-dried or well-seasoned to remove water. Various methods of pressure treatment are used, depending on the preservatives, the kind and dimensions of the wood, and the intended use of the end product (see CSA-080).

Minimum retention of creosote required to provide long-lasting preservation is the area of 80 kg per cubic metre for fence-posts. For CCA and ACA, the recommended retentions are approximately 9 kg per cubic metre for structural poles, 6.4 kg for fence posts or lumber in contact with the ground and 4 kg for sundecks or lumber not in contact with the ground.

Hot and cold bath treatment – The most effective non-pressure method is the hot and cold bath. The preservatives which can be used in this manner are creosote, creosote mixtures, and petroleum oils containing copper or zinc naphthenate.

If large volumes of wood are to be treated in this way, two tanks are required. The well-seasoned wood is first heated in the preservative for one to three hours at 80 to 105 degrees C and then transferred to the second tank where it is soaked for a further hour or more at about 38 degrees C. Where small quantities of wood are to be treated, a single tank can be used by simply removing the heat after the initial treatment and allowing the preservative and wood to cool down overnight. The theory behind this method is that as the wood cools down, a vacuum is formed in the cells and the preservative is sucked into the wood. Retentions of 40 – 140 kg of preservative per cubic metre of wood are commonly achieved by this method.

An advantage of this method over pressure treatment is that the treatment of poles and posts can be confined to the butt area if desired. While it is much more effective and faster than any other non-pressure method, it has the disadvantages or requiring heating equipment, being more expensive to set up, and being more prone to fires than other methods.

Cold soaking – The same preservatives as are used in the hot and cold bath can be used in the cold-soak method. In this case, treatment time must be for a minimum of 24 – 49 hours or longer, but not for more than one week. The wood must be dry and the treatment is best done during the summer when temperatures are warm. This method is very suitable for the treatment of round pine or oak posts. It is not suitable for the treatment of round posts of most other species used in British Columbia. Pine fence-posts treated by this method can be expected to last 20 years or more.

End diffusion – In this method, fresh cut, unpeeled posts are allowed to stand butt-end down in a tank containing a measured volume of 15-20 per cent zinc chloride in water. After three quarters of the solution has been taken up (1 to 10 days) the posts are turned end for end until the remainder of the solution is absorbed. They are then stored for 30 days with the tops down before using.

Double diffusion –This method is basically the same as end diffusion. In this case, one solution such as copper sulfate is first allowed to diffuse into the wood and it is then followed by a second solution such as sodium chromate. This results in the formation of insoluble copper chromate in the wood.

This method has resulted in longevity of pine fence-posts exceeding 15 years.

Steeping – In this method, green or seasoned peeled posts or lumber are soaked for one or two weeks in unheated 5 percent zinc chloride solution in water. Ash and pine benefit markedly from this treatment, but other species show variable results.

Dipping – Dipping for a few seconds up to 15 minutes in one of the preservative oils may be adequate for treatment of window sashes and other types of wood where the decay potential is low. The wood must be well-seasoned before dipping.

This is very fast, low-cost operation, but it is of very little value for preservation of wood to be used in severe decay situations.

Brushing – Application of two coats of a preservative oil by brushing or flooding may be useful for certain exterior woodwork including the cut end of pressure treated lumber. It has little value for preservation of fence posts or other wood in severe decay situations.

Treatment of standing poles – Treatment of standing utility poles can result in several years extra life comparatively low cost.

If the pole is severely weathered, particularly where cross-arms are attached, it may be given an over-all spray with copper or zinc naphthenate in oil. Treatment must be done in the summer when the wood is completely dry. Up to 20 litres or more of solution will be required for each pole.

If the area of concern is at the ground-line where decay is most rapid, use a procedure such as the following:

1. Excavate soil to a depth of 40 to 60 cm.
2. Scrape off all decayed wood.
3. Apply a 0.6 to 1.2 cm-thick coating of approximately 8 percent copper napthenate in grease to a band from 40 cm below to 30 cm above the soil-line.
4. Wrap the treated area in a waterproof bandage.
5. Refill excavation.

PRESSURE TREATMENT STANDARDS

As indicated, the best protection of wood occurs with pressure treatment and it is also the most cost-effective method. There are largely three different levels of treatment that are of interest to the farm user depending on the end use: (1) structural wood, (2) wood in contact with fresh water or ground and (3) wood not in contact with fresh water or ground. Coastal or salt water is another separate end use.

Net Retention of Preservative

The amount of preservative retained in the wood after completion of the entire treating cycle is referred to as the net retention, and it is usually expressed as kilograms of preservative per cubic metre of wood.

The net retentions in the CSA 080 commodity standards are generally adequate for most Canadian conditions; these retentions are minimum levels to ensure adequate performance. Considerations such as desired service life, replacement cost, climate, ground contact, exposure to weather, exposure to insect attack, size of material depth of sapwood may suggest that a higher net retention would be desirable. The user is at liberty to specify more the retention required by CSA 080, should a higher factor of safety be desired. However, suppliers should be contacted to verify that the contemplated levels can be successfully met in practice.

Net retention may be determined in two ways: net gauge retention is the total weight of preservative absorbed, divided by the volume of wood that was in the charge; assay retentions are determined from analysis of the preservative contained in specified zones (the treated shell) of the wood. Determining retentions by assay methods is gaining wider acceptance among standards- writing organizations. Tables 1 and 2 (Appendix) lists some minimum recommended preservative retentions.

Penetration of Preservative

Preservatives penetrate more readily along the grain than across it, and the full cross-section of the timber will be treated substantial lengths wherever end grain is exposed. Side grain is penetrated much less readily; sapwood is easier to penetrate than heartwood, and edge grain is more uniformly penetrated that flat grain.

To improve overall penetration most sawn lumber is incised. Knife-like incisions of a uniform depth and pattern are made on the four sides. These incisions are made with an incisor machine, with four rollers containing embedded chisel-profile teeth. Incisions are parallel to the grain in a staggered arrangement so that the preservative can penetrate both lengthways and sideways to adjacent incisions.

As with net retentions, the CSA 080 commodity standards outline the minimum penetration requirements. These may, of course, be increased if conditions warrant, but the specifier is again cautioned to ensure that deeper penetration can be achieved in commercial practice

Finishes

Wood pressure treated with water-borne preservatives may be painted or stained provided the moisture content, after treating is reduced to about 20%. Occasionally there may be surface deposits of preservative which should be removed. In addition, the color imparted to the wood by the preservative may affect the final shade of any stains used. Products treated with water-borne preservatives are maintenance free and do not require surface finishing unless the natural color is not acceptable.

Generally speaking, wood that has been treated with creosote, creosote solutions or oil-borne preservatives cannot be successfully stained or painted.

Inspection and Quality Control

To ensure that the pressure treated wood product meets the requirements of the governing standards, certain inspection and quality control procedures should be observed. These are outlined in the CSA 080 standards M1, M2, M3 and M4. Each pressure treating plant should have on site, or have access to, adequate laboratory facilities for performing the necessary tests required by the appropriate standards. Complete documentation should be compiled and copies made available to the buyer.

Alternatively, the easiest option for the end user is to look for wood that is stamped with the Canadian Wood Preservers' Bureau (CWPB) quality mark (Figure 1). Just like a lumber grade stamp, the CWPB quality mark is your assurance that you are purchasing and/or selling a product that meets acceptable high standards. Testing for the quality of treatment in lumber is a complex procedure that is difficult to perform once the material leaves the treating plant. Careful determination of penetration and retention of preservatives must be made by trained professionals in order to ascertain whether or not the product meets required standards. The CWPB quality mark assures that you are receiving the quality of product you have specified, independently tested to ensure conformance.

The Canadian Wood Preservers' Bureau is an independent organization consisting of consumer and industry representatives who have established regulations for the inspection of pressure treated wood in order to meet rigorous standards. Consumer representatives form the majority of the governing body. Participation in the CWPB Quality Assurance Program assures that all CWPB licensed producers meet the minimum criteria. Membership is open to the pressure treated wood industry and is completely voluntary.

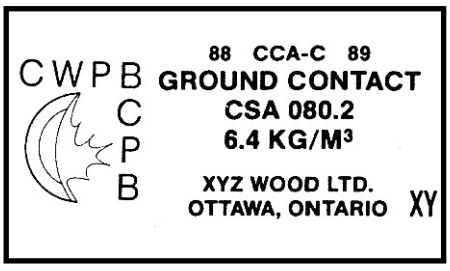

***Figure 1**: A product bearing this stamp indicates it was produced in 1988-89; using Chromated Copper Arsenate, Type C, ground contact use; meets CSA 080.2 at 6.4 kg/m3 retention; by XYZ Wood Ltd., Ottawa, Ontario; and inspected by XY Inspection services.*

Inspection and Quality Control continued...

In preparing a project specification, it is advisable to have all the wood pieces sized, drilled, notched and trimmed to finish dimensions, prior to pressure treating. Should field fabrications be unavoidable, adequate field treatment of all exposed surfaces must be performed, using an acceptable brush-on preservative, to restore the integrity of the preservative treatment.

End Use Guide

The introduction of new preservatives for pressure treatment in Canada over the past 20 years has provided the specifier with a variety of special properties from which to choose for his particular requirements. Added advantages offered by these preservatives have extended the use of wood to new applications.

The End Use Guide Tables 1 and 2 (Appendix) lists all preservatives presently available from pressure treating plants across Canada. All of these preservatives have been approved by and are periodically reviewed and assessed by the CSA Committee on Wood Preservation to arrive at recommendations included in the CSA 080 Wood Preservation standards. The table is a general summary of the Committee's studies and recommendations. In addition, preservatives are classed as pesticides and, as such, are registered for use by Agriculture Canada.

While the table is not in itself a specification reference, it will serve as an aid to specifiers and purchasers; consultation of appropriate standards for detailed recommendations is urged.

How to Specify

The specifier is urged to adopt the following wording when specifying pressure-treated products:

"The wood (insert quantity, dimensions, species) shall be vacuum pressure impregnated in accordance with CSA standard (insert CSA standard reference) to an average net retention of (insert retention in kg/m3) by (insert gauge or assay) of (insert type of preservative)."

The wording of an example specification for a landscaping project using timbers or dimension lumber or both would read as follows:

"The 120,000 fbm of red pine landscaping timbers, 4" x 4" nominal size, shall be incised and vacuum pressure impregnated in accordance with CSA standard 080.2 to an average net retention of 6.4kg/m3 (0.40 pcf) by assay of chromated copper arsenate (CCA)."

USES OF WOOD PRESERVATIVES ON THE FARM

Table 3 (Appendix) lists a series of selected uses for preservative treated wood with the common pressure treatment chemicals of CCA, ACA, PCP and creosote. The following discussion provides more in-depth information on some specific uses.

Beehives

Creosote, pentachlorophenol, CCA, ACA and ACZA must **not** be used in the construction of beehives as they can contaminate honey and wax and cause mortality of the bees.

Acid copper chromate, copper naphthenate, zinc naphthenate and copper quinolinolate can be used safely in all parts of beehives. Ensure that the treated wood is thoroughly dried before use. When it is dry, treated wood can be painted with latex paint. Some visible bleeding of preservative may occur through white and light pastel colors when painting over oil-borne treatments.

Fence-posts

In the major agricultural and urban areas of BC, pressure-treated posts which will last for at least 20 years are readily available. The only circumstance which normally warrants treatment on the farm is the availability of untreated posts at little or no cost. Even then, it would be better to have them pressure-treated at the nearest treating plant rather than use an inferior method at home. An exception to this would be the availability of hand-split old-growth cedar posts or other decay resistant species, in which case a dip or brush-on treatment would be adequate.

In purchasing pressure-treated wood, it is important to have some assurance that the depth and retention of preservative is sufficient for the intended use. Certified pressure-treating plants provide a guarantee that the CSA 080 standard has been met. Look for the CWPB quality assurance stamp (see example on p. 8). Laboratory analysis will also confirm that adequate treatment has been carried out but there is no use doing that if you have already bought and paid for the posts. A good rule of thumb is to buy only from well-established firms with a proven record of providing good products. Don't buy 'pressure-treated' posts from an entrepreneur selling off the back of a truck.

Fence Railings, Corrals, Structural Lumber

For maximum life, all wooden fencing and structural lumber subject to weathering or other conditions which favour decay should be treated with preservatives. The choice of treatment should be influenced not only by cost but also by importance of appearance, ability to paint over the treated wood, and need to discourage chewing by livestock. Horses can chew through cedar boards and destroy a fence or corral in a short time. For outdoor corrals, a harder species of wood, lightly treated with creosote, will last longer in the presence of a 'cribber'. Do not paint or spray wood with used crankcase oil as it contains lead and can cause poisoning in livestock.

Greenhouse, Mushroom Houses, Nurseries

Copper and zinc naphthenate, copper quinolinolate and CCA can be safely used for greenhouse structures, benches and flats. The wood must be thoroughly dried before introducing the plants. Never use creosote or pentachlorophenol in a greenhouse.

In mushroom houses, copper and zinc naphthenate of CCA can be used in structural lumber but only CCA or copper quinolinolate should be used in the growing trays. Pentachlorophenol must not be used at all in mushroom houses.

Besides their use in greenhouses, preservatives are also used in the nursery industry to treat burlap and twine for wrapping 'B&B' nursery stock and in retail nursery for display benches. Copper naphthenate is the preferred material for these uses.

Shake Roofs

In new construction, where a cedar shake or shingle roof is desired, use pressure-treated shakes or shingles for maximum life. If untreated shakes or shingles were used recently and they have not yet become colonized by moss, their life can be extended by a spray application of zinc naphthenate. However, the application does create a fire hazard during hot, dry weather. Apply as a low-pressure spray to avoid drift in the late evening or early morning when relative humidity is high and there is sufficient dew to dampen the roof. Ensure that there is no smoking or open flames in the vicinity until all the solvent has evaporated.

Silos

In the construction of bunker silos, both posts and lumber should be treated, preferably by pressure methods, unless decay-resistant wood such as western red cedar is used. As in the case of fence posts, pine is the most easily treated wood. Copper naphthenate, and copper quinolinolate can be used for all parts of bunker silos. The wood must be thoroughly dried after treatment before filling the silo. Do not use CCA treated wood in direct contact with silage.

Poles treated with creosote or pentachlorophenol may be used for construction of silos provided they do not come in contact with the silage or are in an area where livestock can rub against them. Silos previously constructed with creosote or penta-treated lumber should be re-lined with untreated lumber or lumber treated with one of the acceptable products.

Tree and Vine Supports

The support system must be built to last because the support is a critical part of the planting. If the posts, wire or anchors fail in a support system, the deteriorated or broken trellis can be difficult or impossible to repair. The support failure can lead to growth problems, reducing production and depreciating the entire investment.

Tree and Vine Supports continued…

Pentachlorophenol's deleterious effects on plants of all types are well documented. In addition, plants may be susceptible to any oil treatment as it volatizes in hot weather causing a phytoxic or burning response to the plant from freshly treated posts. If creosote or oil-impregnated penachlorophenol posts are used, plant rootstocks should be kept at least 45 cm away from the posts at the soil line. While adequate spacing between plants and penta treated wood may drastically reduce the possibility of plant damage, CCA treated posts are a safer alternative for plants in the orchard or vineyard.

Wood posts with brush applied or dipped treatments are not recommended for support systems. Neither are posts with hot-and-cold-bath or cold-soak treatments. Since it is impossible for a buyer to visually determine the amount of chemical penetration and retention in the wood, posts should only be purchased from a dealer who can certify the types of pressure-treated wood posts he offers. Posts should be treated to CSA Standard 080 for wood in ground contact.

Food Storages

Wood inside fruit and vegetable storages is exposed to the same high humidity as the food (95% RH, or more). This is necessary to preserve the fresh quality of the potatoes, apples or other produce living in the storage rooms. But, unfortunately, the humidity also supports growth of wood-destroying fungi and moulds, even where the wood is not in ground or floor contact. Since growers have started using improved humidifying equipment to maintain higher humidity in fresh food storages, many cases of serious wood deterioration have been reported. Several new wood-framed storages have failed in as little as 4-6 years!

At present, there are **no wood-preserving chemicals approved in Canada for direct contact with food in long-term storage**. Canada Plan Service designs for wood stud-framed food storage walls (M-6110, M-6111, M-6112) specify a CCA-pressure-treated wood sill where moisture may collect at the bottom of the concealed stud-spaces. As well, the studs should be either CCA or ACA pressure treated, or butt-soaked in a compatible wood preservative such as copper naphthenate. In this case the treated wood is doubly separated from the stored food by a continuous polyethylene vapor barrier, as well as the steel, plywood or lumber interior lining. The studs and other wood frame barrier, as well as the steel, plywood or lumber interior lining. The studs and other wood frame parts of interior walls and air plenums are a special problem because they are surrounded by the high humidity. Therefore, these **should be pressure-treated** (not just butt-soaked). **Linings should be preservative-treated** unless in contact with food; then use either galvanized sheet steel or a wood that is naturally rot-resistant (cedar, for example). For linings, avoid non-durable woods such as aspen, poplar, hemlock and spruce. The Pesticides Directorate of Agriculture Canada advises that traces of copper and/or arsenic, if found by food inspectors, can result in condemnation of the entire contents of a food storage. It is the grower's responsibility to prevent food contamination from any source, including improper use of wood preservatives.

Where ACA or CCA treated wood studs and other wall framing is used (1) thoroughly hose down the treated wood to remove surface residues, then (2) cover all treated wood framing with **untreated** wood slats, plywood or galvanized steel to separate the food from the framing.

Food Storages continued…

Ceilings over the stored food are a special problem. Moisture condensing on the underside of a ceiling (or exposed ceiling joists) can drip back down onto the stored food. If a wood ceiling is preservative treated, there is a risk of food contamination from the dripping moisture. If any treated wood is used the ceiling structure (wood strapping, etc.) it should be located **above** the vapour barrier and an **untreated** lining material. Adding extra insulation above the ceiling or improving air circulation with fans will reduce condensation.

HAZARDS OF USING PRESERVATIVES

Damage to Vegetation

All wood preservatives are toxic to plants to some degree. Creosote, petroleum oils, and pentachlorophenol will kill most foliage upon contact. Particular care must be used when applying these materials to standing utility poles as valuable trees and shrubs nearby may be seriously disfigured by the vapours given off on a hot day.

Easily leached preservatives such as copper sulfate may also damage the roots of plants up to a foot or more from the treated wood.

As previously mentioned, creosote and pentachlorophenol should never be used in greenhouses as they will give off toxic vapours when the temperature rises on a sunny day.

Wood by-products are often used as soil and growing medium amendments in the greenhouse and nursery industry. Care must be taken to ensure that any bark, sawdust or shavings has not been produced from logs or lumber that was treated with wood preservatives. Until recently, contamination of sawdust and shavings with pentachlorophenol was common as a result of its use as an antisapstain treatment in sawmills. The materials currently being used for sapstain control are not as toxic to plants, nevertheless the possibility of problems in plants grown with sawdust or shavings should not be ignored. Bark is less likely to contain any preservative residue, although it sometimes contains toxic levels of salt if the logs were stored too long in salt water.

Poisoning of Humans and Animals

All wood preservatives are poisonous to animals, so appropriate precautions must be taken during their application. Some are hazardous, both from the point of view of accidental swallowing and skin contact. This group includes creosote, pentachlorophenol, petroleum oils, and the heavy metal salts. Others, such as copper sulfate, zinc sulfate, borax, and copper naphthenate are dangerous only when relatively large quantities are taken internally

Poisoning of Humans and Animals continued…

The three most commonly used hazardous preservatives are creosote, pentachlorophenol, and chromated copper arsenate (CCA). Of these, creosote seldom causes problems because it is objectionable in appearance that workers take great pains to avoid contact.

CCA, while extremely poisonous, is not available for use by other than trained personnel and thus also has a good safety record as far as end-user hazard is concerned. It is hazardous to workers in pressure-treatment plants and the treatment plants themselves must be well-managed to prevent environmental contamination.

There is a problem in disposing of cut lumber and old posts that have been treated with CCA. If they are burned, the arsenic will be released. If livestock are allowed to forage in the ashes, they may be poisoned. To avoid escape of arsenic, treated lumber and posts should be buried rather than burned. Escape of arsenic from the wood itself will be very slow and will not constitute a hazard.

The greatest danger of poisoning in the past was with the careless use of pentachlorophenol. Because of its easy availability and innocuous appearance, many people assumed that it was quite safe and either did not read or chose to ignore the label warnings. As a result, there have been numerous cases of poisoning due to excessive skin exposure to this chemical, especially in developing countries where proper protection was not used. There is very little warning of illness prior to death from over-exposure to this chemical. Chances of survival once symptoms are noticed are not particularly good.

Pentachlorophenol around farm yards and in shavings are sawdust used for bedding, also resulted in contamination of meat and milk. To avoid further problems with pentachlorophenol, it is best to discontinue its use. Any treated posts on hand should be used away from farm buildings where livestock do not rub up against them. There is no acute hazard to the animals from such exposure but there may be a residue problem.

Wood treated with any of the preservatives and then dried before use is unlikely to cause more than minor skin irritation in humans or animals coming in contact with it. Treated posts and lumber should be dried or rinsed then dried, if necessary, at the treatment plant. It is advisable to use protective gloves when handling treated wood, particularly if it was treated with oil-borne preservatives. Leather or cloth gloves should not be used with oil-borne preservatives as they will absorb residues and transmit them to the hands.

A dust mask should be used when sawing treated lumber and, if possible, all the sawing should be done outdoors. Scraps of treated lumber should be buried rather than burned. Select an area where there is no danger of contaminating water.

APPENDIX

Table 1: Recommended minimum preservative retentions for treated products used on farms (by assay, kg/m^3). The CSA 080 reference standard is CAN/CSA 080.16.

COMMODITY / SPECIES	CREOSOTE	CREOSOTE/ OIL	PCP	ACA CCA	APPLICABLE STANDARD
ROUND POSTS* (incl. half-round and quarter-round posts)	80	96	6.4	6.4	CSA 080.5
SQUARE POSTS/POLES					CSA 080.2
Western larch, Jack, red, lodgepole, ponderosa, Southern yellow, Eastern and Western white pines, Western spruces, Birch, Maple	128	128	6.4	6.4	
Coast Douglas-fir, true firs, Eastern and Western hemlock	160	160	8.0	6.4	
Oak	112	112	5.6	6.4	
Beech	128	128	4.8	6.4	
POLES Assays are variable by species and exposed severity:					CSA 080-4
Coast and interior Douglas-fir, Western larch, Jack, white, red, lodgepole, ponderosa, Southern yellow pines, Western red cedar, Alaska yellow cedar, white and red spruce, Western hemlock.	96 to 260	no	4.8 to 12.8	9.6	
LUMBER/TIMBER					CSA 080.2
In soil contact		see “square posts/poles” above			
Not in contact with soil (incl. millwork) Western larch, Jack, red, lodgepole, ponderosa, Southern yellow, Eastern and Western white pines, Western spruces, Birch, Maple, Oak	96	96	4.8	4.0	
Coast Douglas-fir, true firs, Eastern and Western hemlock	128	128	6.4	4.0	
Beech	128	128	4.8	4.0	

* The allowable species for round posts are: Douglas fir, Western hemlock, Western larch, Jack pine, lodgepole pine, red pine, ponderosa pine, spruce, poplar, red alder and Southern yellow pine.

Note: Copper naphthenate/oil has been approved by the CSA 080 Technical Committee for some products and species. These applications will become officially part of the standard with the next edition of CAN/CSA 080.

APPENDIX

Table 2: Recommended minimum preservative retentions for residential and commercial uses (by assay, kg/m^3).

COMMODITY / SPECIES	CREOSOTE	CREOSOTE/ OIL	PCP	ACA CCA	APPLICABLE STANDARD
EXTERIOR ABOVE-GROUND LUMBER/TIMBER (incl. exterior decking, fencing slats, siding, millwork)					CSA 080.2
Coast Douglas-fir, True firs, Eastern and Western hemlock	128	128	6.4	4.0	
Western larch, Jack, red, ponderosa, lodgepole, Southern yellow, Eastern and Western white pines, Birch, Maple	96	96	4.8	4.0	
Spruce, Beech	128	128	4.8	4.0	
INTERIOR ABOVE GROUND LUMBER/TIMBER (incl. flooring, joists, studs, millwork)					CSA 080.2
All species	NA[+]	NA	NA	4.0	
LUMBER/TIMBER IN SOIL OR FRESH-WATER CONTACT (incl. decking, sawn posts and columns, square fence posts, pickets, landscaping ties)					CSA 080.2
Western larch, Jack, red, lodgepole, ponderosa, Southern yellow, Eastern and Western white pines, Western spruces, Birch, Maple	128	128	6.4	6.4	
Coast Douglas-fir, true firs, Eastern and Western hemlock	160	160	8.0	6.4	
Oak	112	112	5.6	6.4	
Beech	128	128	4.8	6.4	
PLYWOOD					CSA 080-9
Above ground	96	no	4.8	4.0	
Ground or fresh-water contact	160	no	6.4	6.4	
PERMANENT WOOD FOUNDATIONS (Use certified material only)					CSA 080.15
Lumber	NA	NA	NA	8.0	
Plywood	NA	NA	NA	9.6	

NA[+]: Not approved by regulatory authority.

APPENDIX

Table 3: Selected uses for preservative treated wood

	CCA, ACA	PCP1	CREOSOTE1
AGRICULTURAL			
Poles and timber (structural framing)	yes	no	no
Exterior fencing posts, gates, dividers (animals unlikely to crib, bite or lick)	yes	yes	yes
Interior pen or stall dividers and liners (animals likely to crib, bite or lick)	yes	no	no
Components in ground contact (subject to decay or insect damage)	yes	yes	yes
Splash boards, skirt boards	yes	no[2]	no
Farrowing/brooding facilities	no direct contact with treated wood		
Slatted floors other than farrowing or brooding	yes	yes	yes
Manure storage	yes	NR	yes
Silage/feed storage and containers in contact with feed	no	no	no
Support structure	yes	yes	yes
Animal feed bunk			
Contact with feed	no	no	no
Support structure	yes	yes	yes
Animal water tanks	no	no	no
Grain storage	no	no	no
Truck boxes for feed or foodstuffs	no	no	no
Trailer floors for livestock	yes	no	no
Vegetable and produce storage	yes[4]	no	no
Greenhouse (framing and shelves)	yes	no	no
Wood in contact with plants	yes	no	no
Beehives	no	no	no
RESIDENTIAL			
Plywood foundation	yes	no	no
Patios, decks, walkways (clean and free of surface residues)	yes	NR	NR
Outdoor furniture and chairs (prolonged or frequent contact with skin)	yes	no	no
Public drinking water tanks	no	no	no
Landscape timbers	yes	NR	NR
Retaining walls	yes	NR	NR
Plant stakes	yes	no	no
Flower boxes	yes	no	no
Playground equipment	yes	no	no
Yard fences	yes	yes[1]	NR
Picnic tables	yes[3]	no	no
Cutting boards, counter tops	no	no	no
Food storage containers	no	no	no
Boat landings, docks, piers	yes	yes	yes
Residences – interior use	yes	no	no
Laminated beams – interior use	yes	no	no
Laminated beams – exterior use	yes	yes[1]	no
Log cabins/homes	yes	no	no
Trim and siding	yes	NR	NR
Sills, plates, headers, studs, joists	yes	no	no

APPENDIX

Table 3: Selected uses for preservative treated wood continued

	CCA, ACA	PCP1	CREOSOTE1
COMMERCIAL			
Interior use	yes	no	no[5]
Components in ground contact	yes	yes	yes
Exterior laminated beams	yes	yes	yes
Sign posts	yes	yes	yes
Pallets	yes	NR	NR
Bridge timbers	yes	yes	yes
Foundation pilings	yes	yes	yes
Marine pilings/timber	yes	no	yes

NOTES

1 Whenever there is potential frequent or prolonged human skin contact, apply 2 coats of an appropriate sealer to creosote and PCP-treated wood. Urethane, epoxy and shellac are acceptable sealers for creosote-treated wood. Urethane, shellac, latex, epoxy, enamel and varnish are acceptable for PCP-treated wood.

2 PCP treated wood is acceptable up to 153mm from bottom.

3 Wood must be free of surface residues.

4 Not in direct contact with produce and protected from condensation from treated wood contacting produce.

5 Except for wood block flooring.

NR Permitted use but not recommended.

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