

Pesticide Toxicity Profile: Wood Treatment Pesticides¹

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This document provides a general overview of human toxicity and a cross reference of chemical, common and trade names of common wood treatment pesticides registered for use in Florida. This guide summarizes some of the more commonly-used wood preservatives.

General

Florida has a more hazardous environment for the life of wood than any other state in the U.S. Wood preservatives are applied to finished and unfinished wood products for protection against decay organisms and boring insects. Treating wood is not a new concept, as the Greeks poured oil into bored holes to preserve pillars supporting buildings. Impregnating wood with chemicals using vacuum and pressure processes began in 1831 with the French, and many chemicals have been tested for the wood-preserving activity. In spite of the long history, there are relatively few chemicals suitable for wood preservation. There are several miscellaneous chemicals used in wood treatment not listed in this guide, but there are 3 main groups of wood preservatives today: coal tar creosote, a group known

collectively as the inorganic arsenicals, and pentachlorophenol.

Inorganic Arsenicals

Chromated copper arsenate (CCA) was, by far, the most widely-used wood preservative in the U.S. Its uses as a commercial preservative began during the 1940s. There are three types of CCA, and at times, these may have been used interchangeably. These are CCA types A, B and C. The difference among them arises in the relative contents of chromium trioxide, copper oxide and arsenic that each contain. Some uses of wood preservatives containing CCA have been discontinued for wood products intended for residential building and consumer products. EPA determined that CCA posed unreasonable human health risks and discontinued certain residential uses at the end of 2003. Many of its industrial uses are still available. Examples of industrial uses that remain registered for CCA use include marine timbers and pilings, utility poles and plywood roof decking. Ammoniacal copper zinc arsenate (ACZA) is similar to CCA, but chromate is not its fixing agent. It is made water-soluble by

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The use of trade names in this publication is solely for the purpose of providing specific information. UF/IFAS does not guarantee or warranty the products named, and references to them in this publication does not signify our approval to the exclusion of other products of suitable composition. Use pesticides safely. Read and follow directions on the manufacturer's label.

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adding ammonia. After wood is treated, the ammonia and water portions evaporate, resulting in water-insoluble copper arsenate in the wood. Developed in the 1920s, it is more commonly used in the western U.S. for treating Douglas fir and other species that are difficult to treat. During the 1980s the product was improved with the addition of zinc oxide. The inorganic arsenicals, as a group, are advantageous in that they do not produce smell or vapors and surfaces that have been treated with them may be painted. Several disadvantages also exist, however, in that unless wood is re-dried after treatment, warping and cracking may occur. Additionally, these compounds don't protect wood from excessive weathering.

Coal Tar Creosote

Coal tar creosote is a brownish-black oily substance that has a "smoky" odor. It is produced as a byproduct in the production of coke, which is produced from coal and used in the manufacturing of steel. Creosote products were probably the first group of wood preservatives entering the commercial market. Because of its thick, oily consistency, it does not readily penetrate wood at ordinary temperatures. A process invented in 1838, known as "pressure-treating," allows creosote to penetrate wood. Creosote along with the pressure-treating process was instrumental in the development of the U.S. It is used mainly to treat railroad ties, but is also used in the treatment of large timbers, fence posts, poles and pilings. An advantage of creosote is that it is insoluble in water; disadvantages include its strong odor, tendency to exude from surfaces, and it can't be used in homes or other living areas because of its fumes.

Pentachlorophenol

Pentachlorophenol, also known as "penta" or PCP, had its wood preserving properties discovered in the 1930s. After the EPA cancelled its uses as a defoliant, disinfectant, herbicide and mossicide, the commercial wood-preserving uses were restricted in 1987. It is usually dissolved in petroleum or other organic solvents that allows it to adequately penetrate wood. At times, it is added to creosote to enhance preserving effectiveness. Most commercial uses of PCP are used to treat utility poles and crossarms for

utility poles. It has no residential uses. Advantages of PCP are that it can be dissolved in oils having a wide range of viscosity, vapor pressure and color, and it is easy to handle and use. Disadvantages are that it does not provide protection as well as creosote, it's not suitable for use in living areas, and it is toxic and irritating to plants, animals and people.

Toxicity

Wood preservatives are pesticides that protect wood from decay and insects; therefore they must be toxic to be effective. Applicators that do the treating of wood are most subject to exposure and those who use the products are much less likely to suffer exposure. Because of this, it's especially important for applicators to take precautionary measures to minimize their risk of exposure. Exposure to these chemicals can occur during the mixing process, handling operations, entering treatment cylinders, working around spraying or dipping operations, handling freshly-treated wood products, cleaning or repairing equipment, or disposing of chemical wastes. These are like other pesticides in regards to routes of exposure: oral ingestion, dermal or eye absorption, and inhalation of vapors into the respiratory tract. Because most wood preservatives have a strong odor and taste, ingestion is very unlikely. The more likely exposure routes are through skin contact or inhalation of vapors; consequently, many of these products labels will contain precautionary measures regarding suitable personal protective equipment, including respirators. Products within all three of these major groupings of wood preservatives carry the signal word, DANGER, on their labels and are classified as restricted use pesticides. The product labels provide basic first aid instructions, as do the Material Safety Data Sheets supplied by distributors.

Inorganic Arsenicals

Acute effects of exposure to high concentrations of inorganic arsenicals can cause nausea, headache, diarrhea, and abdominal pain, if ingested. Prolonged exposure can produce persistent headaches, abdominal distress, salivation, low-grade fever and upper respiratory irritation. Long-term exposure can cause liver damage, loss of hair and fingernails,

anemia, and skin disorders. Chronic effect studies with laboratory animals indicate that it causes genetic effects. It has been shown to be associated with cancer in people who either drink water or breathe air contaminated with arsenic. There are no literature citations regarding adverse environmental effects. Arsenate is strongly adsorbed on soil and is largely unavailable for plant uptake or leaching into groundwater.

Coal Tar Creosote

Creosote can acutely cause skin irritation, burns, or dermatitis. Its vapors are irritating to the eyes and respiratory tract, and ingestion can cause nausea and abdominal distress. Chronic animal studies indicate that it is a carcinogen and it has been associated with skin cancer in some occupationally exposed workers. The presence of creosote or other phenolic compounds in the human body will impart a dark, smoky color to the urine. Other laboratory animal studies indicate that it is a mutagen. There are statements on individual product labels which convey these potential effects. There are no known injuries to wild animals involving creosote. Although small amounts of creosote may enter the environment, most of it is quickly biodegraded.

Pentachlorophenol

Pentachlorophenol is irritating to the eyes and respiratory tract. Ingestion or excessive dermal or inhalation exposure can lead to fever, headache, weakness, dizziness, nausea, and profuse sweating. The exact amount required to produce human illness is unknown. Skin penetration is the most common route of exposure. Prolonged high exposure levels can lead to an acne-like skin condition or other skin disorders; it may also cause damage to the liver, kidneys, and nervous system. Product labels note that it is restricted in use due to fetotoxicity and oncogenicity in laboratory animals. This chemical is extremely toxic to fish and exposure to concentrations in the parts-per-billion range can cause death of fish. Because the major uses of PCP don't involve soil applications, any concentrations detected in soil would most likely be due to bleeding of the preservative from treated wood. Accumulation in plants and animals is unlikely because it's not

translocated in plants and it's rapidly eliminated by mammals following exposure.

Additional Information

Milton, F.T. 1994. The preservation of wood. University of Minnesota Extension Service Publication MI-6413-S.

Nesheim, O.N, F.M. Fishel and M.A. Mossler. 2005. Toxicity of pesticides. UF/IFAS EDIS Document PI-13. <http://edis.ifas.ufl.edu/PI008>.

Reigart, J.R. and J.R. Roberts. 1999. Recognition and management of pesticide poisonings, 5th edition. United States Environmental Protection Agency Publication EPA-735-R-98-003.

Seyler, L.A., et.al. 1994. Extension toxicology network (EXTOXNET). Cornell University and Michigan State University. <http://extoxnet.orst.edu/index.html>. Visited November 2005.

Table 1. Cross reference list of common, trade and chemical names of wood treatment pesticides.

Common name*	Trade names	Chemical name
CCA	CCA®, Osmose®, Wolmanac®	Chromated copper arsenic containing: Arsenic pentoxide Chromium trioxide Copper oxide
Coal tar creosote	Osmoplastic®, Timberlife®	Coal tar creosote
Pentachlorophenol	Forpen®, Penta®, Pentacon®, Penwar®	Pentachlorophenol
*Basic molecule; isomers not listed.		