Piling Materials: Treated Wood and Alternatives

Water Quality Factsheet for Permit Applicants

Jack Gregg, Water Quality Program
California Coastal Commission

This factsheet is a summary of information compiled by Water Quality Program staff. It is not a requirement by the Coastal Commission, and it may be superseded by site-specific information.

Background

This factsheet focuses on the potential water quality impacts of coastal development projects in which pilings are used to support overwater structures such as piers, wharfs, and docks, or to keep floating docks in place. A piling is a group of piles, which are columns made of wood, steel, concrete, or other materials driven into soil or sediment to support foundations, retaining walls, or other structures.

Traditionally, pilings were made from timber, which will degrade over time where exposed to air or oxygenated water. In addition, in marine or brackish waters, many organisms use wood pilings for food or shelter, causing degradation of the wood. Since at least the middle of the 18th century, various chemical treatments have been applied to timber pilings to maintain their effectiveness for a longer period. Unfortunately, some of those chemical treatments have adverse impacts on water and sediment quality, and can be toxic to non-target aquatic organisms.

Selection of proper piling materials can be an important aspect of protecting coastal resources from development, and this factsheet was developed to answer common questions about piling materials. New materials are continually under development to either protect treated wood pilings, or replace the treated wood with more resistant materials.

Piling Materials

Wood: Wood needs to be treated for long term use in the marine or aquatic environment. The chemicals used to protect the wood from fungus, insects, and marine boring organism ("marine borers") in or over water are discussed below. For additional information, on the use of treated wood in the aquatic environment see the report published by NOAA Fisheries in 2009.[1]

Creosote-treated wood: Creosote is a mixture of hydrocarbon compounds that has been used to protect wood products since at least 1838, and has been used in millions of pier pilings world-wide. Creosote is the portion of chemical products obtained by the distillation of a tar that remains heavier than water. It is a mixture of many compounds and different batches may have different compositions and properties in the environment.

Creosote is only partially soluble, and once impregnated into timber it can prevent the decay of the wood and its destruction by marine organisms. Unfortunately, slow solution of some creosote components and physical breakdown of the treated wood leads to toxicity in the surrounding

[1] NOAA Fisheries, Southwest Region. (2009). *The Use of Treated Wood Products in Aquatic Environments: Guidelines to West Coast NOAA Fisheries Staff for Endangered Species Act and Essential Fish Habitat Consultations in the Alaska, Northwest and Southwest Regions*. October 12, 2009; 58 pages. http://www.westcoast.fisheries.noaa.gov/publications/habitat/treated_wood_guidelines_final_2010.pdf

water and sediment. In addition, some of the creosote is released from the wood over time (picture sticky material on old telephone poles). The Coastal Commission and other state agencies (e.g., California Fish and Game) no longer allow the installation of creosote-treated pilings,[2] but many still exist in coastal waters of the state and the world.

Metal-arsenate wood treatments: Chromated copper arsenate (CCA) and ammoniacal copper zinc arsenate (ACZA) are wood preservatives derived from metal compounds and arsenic that through their toxic properties preserve the wood from decay fungi, wood-attacking insects (including termites), and marine borers. These metal-arsenate preservatives have been used as a substitute for creosote in many places, in part because they have known formulations so that their properties in the environment are more predictable than that of creosote. However, these metal-arsenate chemicals are still toxic, and can produce adverse impacts when used where they can leach from pilings into the aquatic environment.

NOAA Fisheries (2009) recommends the following Best Management Practices (BMPs) for applications that may use metal-arsenate treated wood:

- *Proper Material Selection – BMP Treated Wood*

  Perhaps the most important BMP is simply proper selection of treated wood materials for a project. At the basic level, this means that the treated wood product contains no more than the minimum level of pesticide necessary for the use, as summarized in WWPI (2006a). Higher retention levels do not lead to extra durability. They only lead to increased leaching and subsequent impacts (Lebow and Tippie 2001).

  The simplest way to ensure that the wood to be used has been properly treated is to require the project proponent to use products that have been BMP certified through a third party inspection process. The WWPI has set up such a procedure, so that products can be verified as being produced in compliance with production BMPs (WWPI 2006a). This means that they will be treated to proper retention standards and be processed to maximize fixation of the product. This would result in lower leaching rates (as used in the environmental exposure models). This is crucial to insuring that predicted levels of contamination are in fact those which are likely to occur. BMP treated wood is denoted with a written certification from a company accredited by the American Lumber Standard Committee (in compliance with regulations of the U.S. Department of Commerce), or through the presence of a BMP mark as seen in the WWPI documents (2006a, 2006b). However, in the event that an improperly labeled material arrives at a job site, a visual inspection and rejection of materials (with visible residues or bleeding) requirement is still recommended.

In the same document, NOAA Fisheries recommends:

- *Although the wood should be BMP certified in many proposed applications, it should still be inspected on site and any pieces found to have visible residues or bleeding of preservative should be rejected. If ammoniacal treated wood has a noticeable odor, then it has not been properly processed or aged and the preservative may not be properly fixed. The wood should be rejected and the failure of the BMP certification process reported.*
- *If prefabrication is done on-site, construction debris must be salvaged and disposed of properly. Cutting stations can be set up with large tarps to capture debris. The cutting station should be kept well away from the water to minimize transport of sawdust by wind.*

[2] The leaching of toxic chemicals into the water is considered a violation of Section 5650 of the Fish and Game Code and is inconsistent Coastal Act policies 30230 and 30231.

Applications of field preservative treatments to cuts and bore holes, water repellants or other coatings, if not applied by the manufacturer at their facility, should take place at the cutting station before the wood is taken to the overwater area. These applications must be allowed to dry and/or cure.

- *If minimal cutting, boring or touch-up preservative applications must be performed over water, then tarps, plastic tubs or similar devices should be used to capture debris, spills or drips. Vacuums may also be used during construction to capture debris. Any excess field preservative should be wiped off and not applied in the rain. Any debris which falls into the water should be promptly removed. Debris should be stored in a dry place until it is removed from the project site.*

Metal Pilings: Metal piles include steel pipes that can be driven into consolidated sediments, large-diameter casings that can be used as forms for concrete, and structural steel (such as I-beams). While metals used for pilings are relatively inert in the ocean, some projects propose coating the metal with various materials to reduce corrosion or to improve the appearance of the pilings. If metal pilings are coated, the coating material must be shown to not cause adverse impacts to coastal resources; see information on coating materials, below.

Concrete Pilings: Concrete piles can support large loads, are resistant to decay and boring organisms, and have little or no impact to water quality once hardened. Concrete has relatively high compressive strength, but much lower tensile strength. For this reason concrete is usually reinforced with materials that are strong in tension (often steel). Reinforced concrete is often used for pier and dock construction in the marine environment.

Concrete takes time to cure, and as the curing processes occur the concrete hardens and alkaline chemicals are released. Since the first three days of curing is critical to the ultimate strength of the piling, the concrete must be kept moist and temperatures controlled during that time. The waters in contact with the curing concrete develop a very high pH that can have toxic impacts in enclosed waters (e.g., streams or shallow bays). While curing continues over time (it is reported that 90% strength is achieved in about 30 days), it is the first few days that pose the most risk as far as pH impacts to aquatic organisms. Therefore, concrete piles must be cured for at least 30 days prior to placement in coastal waters.

Piling Wrapping Materials: In recent years, the Coastal Commission has required that wood pilings with metal-arsenate preservative treatment be "wrapped" with plastic sheets that are durable in the marine environment and sealed to prevent release of the toxic chemicals. This has allowed ongoing use of treated wood in the marine environment, since wood may still be preferred by applicants for small projects or where the project entails repairs an existing wood structure. Use of concrete or steel pilings as replacements for wood pilings in a predominantly wooden structure could potentially compromise the structural integrity of the existing facility, due to the differences in material properties (e.g., strength, flexibility, and weight).

The use of treated wood sealed with wrapping material may have the advantage of maintaining the structural features of wood and protecting the wood from decay and boring organisms, while minimizing release of toxins to the environment. Wraps can be installed on the treated wood pile by the manufacturer, or applied on-site. Wraps can be pre-formed plastic, such as polyvinyl chloride (PVC), or fiberglass-reinforced plastic wrap products with an epoxy fill in the void between the wrapping and pile.

Typically, pilings are wrapped such that the plastic cover extends above and below the portion of the piling in contact with water. The wrapping may extend down into the substrate up to 5 feet below the mudline; the Coastal Commission has recently been requiring that the wrapping extend at least 18 inches below the mudline to contain the treatment chemicals. The wrapping may also extend either up to the top of the piling, or to a minimum height above the high-water line to protect the treated wood from wave splash and above-normal high-water events.

Coating Materials: Coatings of various materials, such as paints, epoxy, and fiberglass are periodically proposed by project applicants to protect the pilings or improve their appearance. Epoxy-based paint or other hard coatings applied onshore in a manner that meets legal requirements (e.g., air quality standards for volatile coating materials) are not expected to continue leaching in the marine environment. There are many proprietary formulations of coating materials. The coating material should be specified by the manufacturer for use in the marine environment, since degradation of the coating can lead to debris in the water, and repairs of coatings overwater risk spills to the environment.

If the coating material does have components known to be contaminants of concern for coastal waters (e.g., creosote or copper), then more information should be provided with the permit application on whether these materials are released from the coating over time. If adequate information is not available, another coating should be used.

Coatings used in the marine environment need to be durable, especially if used where subject to abrasion or damage by boats. Hard coatings like fiberglass are not flexible, and may crack from expansion, shrinkage, or movement of the wood piles. If coatings are damaged under the waterline, a repair to apply additional coating material may be difficult or impossible without removing the piling. Coatings should be applied and cured at an appropriate site well away from coastal waters (e.g., at an industrial facility), if possible. If coatings must be applied over coastal waters, additional Best Management Practices will be required.

Other Piling Materials: Other materials have been suggested for use as pilings, such as recycled plastic, and glass-infused wood pilings. Before consideration of the use of these other materials in coastal waters, information on their physical, chemical, and toxicity characteristics will be required.