Volume II
Section IV
WWPI Documents

Documents in order

1. Best Management Practices. Descriptive brochure. Includes general information and information not specific to creosote.
2. Best Management Practices. More technical than 1.) above. In specification format.
3. Treated Wood in Aquatic Environments. Semi-technical document. Has section on selection of preservative with retention recommendations. Also has WWPI risk matrix.

Volume II
Section IV
WWPI Documents

1. Best Management Practices. Descriptive brochure. Includes general information and information not specific to creosote.

Best Management Practices

For the use of treated wood in aquatic and other sensitive environments

Wood Preservation Canada
Préservation du bois Canada

TIMBERPILINGCOUNCIL
FOUNDATION & MARINE PILING

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Developed for the United States and Canada by:

Western Wood Preservers Institute • Wood Preservation Canada • Southern Pressure Treaters' Association • Timber Piling Council

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Mussels (Mytilus trossulus) and bryozoans (Phylum bryozoa)

PLEASE NOTE:

The marine organisms shown in this document represent a small subset of the 67 different invertebrate species that were identified in six inch square samples collected from treated wood piling.

Chapter One: The Importance of BMPs

Introduction

Protection of the quality of water and the diversity of life forms found in lakes, streams, estuaries, bays, wetlands and other sensitive environments of North America is a goal and responsibility shared by every inhabitant of the continent. An endless list of human activities can impact these environments: storm waters that run off our streets, exhaust from our boats and cars, municipal and industry discharges, and construction of our homes, docks and piers, to name but a few. Maintaining the quality of our treasured resources requires that everyone do their part.

Pressure treated wood is a building material widely used to construct piers, docks, buildings, bridges, walks and decks used in or over aquatic and sensitive environments. The pressure treated wood products industry is committed to assuring its products are manufactured and installed in a responsible manner that minimizes any potential for adverse impacts to these important environments. To achieve this objective the Western Wood Preservers Institute (WWPI), Wood Preservation Canada (WPC), the Southern Pressure Treaters Association (SPTA) and the Timber Piling Council (TPC), hereafter referred to as the "Supporting Organizations," have developed and encourage the use of these BEST MANAGEMENT PRACTICES (BMPs).

What are the Best Management Practices?

The BMPs are recommended guidelines for the production and installation of treated wood products destined for use in aquatic and other sensitive environments. The guidelines were developed by the Supporting Organizations through a consensus process, based on the core philosophy of chemical minimization. Both environmental and economic concerns support the goal of placing enough preservative into a product to provide the needed level of protection while also minimizing use of the preservative above the required minimum to reduce the amount potentially available for movement into the environment.

Specification Considerations

There are a variety of preservative systems and treated wood products approved for use in or above aquatic and sensitive environments. **The first step** in specifying a particular treatment is to assure the preservative is approved for the intended application through the U.S. Environmental Protection Agency (U.S. EPA) and Canadian Pest Management Regulatory Agency (Canada PMRA) registration and/or review process. These government agencies establish the legal parameters for use of wood preservatives. To meet any BMP guideline a treatment must comply with these restrictions. The common goal of using the BMPs is to produce products having effective levels of protection with minimum environmental impact by minimizing the potential for migration or leaching of the preservative chemicals from the treated wood products.

The second step in specifying involves the application of the appropriate product standard from the Use Category System developed and maintained by the American Wood-Preservers' Association [AWPA] (U.S.) or Canadian Standards Association [CSA] (Canada); or the customer-specific treatment standards. These product specifications establish the minimum amount of chemical (retention) and depth of injection (penetration) that is needed to assure effective

performance against decay or other wood destroying organisms. The BMPs along with the additional processing requirements are separate from and in addition to the product standards. There is a shared responsibility between the specifier and treater to assure the level of chemical application selected will meet the goal of minimizing the migration or leaching of the treating chemicals into the environment.

BMP Product Production Systems

The material preparation, treatment and post treatment procedures and technologies for achieving the BMP objectives vary among preservatives and individual treating plants. A treating plant may choose to produce some or all products in compliance with production BMPs or a purchaser may specify compliance with BMPs in a particular purchase agreement. In either case compliance with production BMPs for products leaving the plant that are designated for use in aquatic or sensitive environments is the responsibility of the treating firm.

It is not recommended for a specifier or regulator to designate a specific BMP treatment process for a product where more than one method of meeting a performance goal is available. It is the quality of the final product that matters, not how that end result is achieved.

BMPs are in a state of evolution. While this document incorporates the best available production technologies and knowledge, efforts are continuing to better understand the performance of wood preservatives in the environment, develop better treatment procedures and improve the BMP quality assurance processes. Research continues in several areas including understanding the environmental impacts of the products, improved treating systems, opportunities to reduce the amount of chemical needed to achieve performance and development of new preservatives. As knowledge and technology advance, the BMPs will be updated through amendment or at the time of the regular five-year scheduled reviews. Amendments will be posted at www.WWPInstitute.org.

BMP Applicability

The BMPs have been developed by the "Supporting Organizations" and are applicable to product processes and species produced in the United States and Canada.

Added time, additional cost and sourcing constraints may result from meeting the production and quality assurance BMP guidelines; and a user or permit regulator should specifically require compliance with BMPs where it is determined there is a sufficient need or justification. The focus of these BMPs is on uses in aquatic and sensitive environments; their use is not germane for any treated wood application in a non-aquatic/non-sensitive area.

NOTE: *This document is designed to serve market needs in both the U.S. and Canada even though there are some slight differences in product standards established by the American Wood-Preservers' Association for the U.S. market and the Canadian Standards Association for Canada.*

BMPs Quality Assurance

Quality oversight and inspection to assure compliance with production standards is important in any manufacturing process. For BMPs this is accomplished at two levels: Internal Quality Control at the production level; and inspection with certification by an independent third party agency. Inspection standard and protocols have been established in **Quality Assurance Inspection Procedures for Best Management Practices (BMPs) for the Use of Treated Wood in Aquatic and Other Sensitive Environments**, included in Appendix A.

A specification for BMPs is not complete or accurate unless it includes a requirement for independent third party inspection by an accredited agency, and certification documented by either the BMP Mark or a letter issued by the agency certifying inspection and compliance.

Virtually all softwood lumber, including treated wood, traded in North America is inspected by agencies accredited by the American Lumber Standard Committee, Inc. (ALSC) in compliance with regulations of the U.S. Department of Commerce. While ALSC does not accredit BMP inspection since the requirements are outside AWPA and CSA standards, those agencies accredited to inspect treated wood are most qualified to apply the BMP inspection guidelines and determine compliance. ALSC accredited agencies are the only firms accepted for the BMP Mark Program. A list of ALSC accredited treated wood agencies may be found at www.alsc.org/contacts_treatedlist_mod.htm.

BMP User Responsibilities

Achieving the shared goal of the BMPs cannot be accomplished unless the user of the product follows the appropriate guidelines regarding transportation, handling, inspection, storage, installation, demolition, maintenance and disposal of the product. These recommended guidelines are contained in **Chapter 4** of this document.

Chapter Two: Guide to Selection, Specification and Quality Assurance

Preservative Selection

A key step in designing a project in an aquatic or sensitive environment is the specification of the treated wood to be used. There are a variety of available treated wood products approved for use in and/or above such environments depending upon the intended use, species, required performance and environmental conditions. The specifier should carefully consider the options in terms of required retention levels (AWPA or CSA Standard) as well as potential environmental impacts. The industry treats only with preservative chemicals registered for the specific uses by the federal, provincial or state agencies. The most common products, addressed by this document, are those treated with ACQ (Alkaline Copper Quaternary), ACZA (Ammoniacal Copper Zinc Arsenate), CA-B (Copper Azole), CCA (Chromated Copper Arsenate), Creosote, Copper Naphthenate, and Penta (Pentachlorophenol).

Performance

The purpose of treating wood products is to provide protection from wood destroying organisms or decay, thus extending the useful life and structural performance of the material. The appropriate applications of each product, the minimum penetration, and the minimum retention (amount of preservative in the **assay zone** – the zone in which wood is subject to testing) are established by the AWPA in its Use Category System and by the CSA 080 Standards, which delineate the various limitations and results of product treatment.

Environmental and Aesthetic Considerations

In designing a project, one needs to consider the characteristics of various treated wood products in relation to the purpose of the project and the environmental characteristics of the site. Products used in a heavy industrial application will likely be different from those used in a public boardwalk. Similarly, the use of a moderate amount of treated wood in a fast flowing river is likely to pose a minimal risk; whereas, the use of large amounts of treated wood in stagnant water may pose greater risks.

The best available science shows that pressure treated wood poses minimal risk to aquatic environments when: used in accordance with the AWPA and CSA specifications; used following the guidance provided by the appropriate required documents, such as the Consumer Information Sheets or Consumer Safety Information Sheets or the treated wood Material Safety Data Sheets (MSDS); and produced using the BMPs.

Help is Available

Risk assessment documents and models have been developed for the use of most preservative systems used in aquatic applications. Projects designed to use large volumes of treated wood immersed in and/or above poorly circulated bodies of water should be evaluated on an individual basis using risk assessment procedures. A complete set of guide materials to help evaluate environmental risks, select preservative systems and specify products are available on line at www.WWPInstitute.org.

Specifying the Best Management Practices

There are three steps to assuring that products to be used in aquatic and other sensitive environments are produced in compliance with the BMPs.

1. **Specify the appropriate material in terms of preservative and performance as defined in the American Wood-Preservers' Association (U.S.) or Canadian Standards Association (Canada).**

   Information on properly selecting and specifying treated wood may be obtained from AWPA, WWPI, WPC, SPTA or TPC. See the end of this chapter for website links.

2. **Specify that the material must be produced and utilized in compliance with the BMPs.**

   Suggested language for inclusion in project specifications: Following the product and treatment specifications per #1 above insert:

   All treated wood products in this project shall be produced in compliance with the "Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments" (BMPs) published by the "Supporting Organizations," August 1, 2006 or the most current version including published amendments.

3. **Require third party independent inspection agency assurance that the products are produced in conformance with the BMPs.**

   Language suggested for inclusion to project specifications. Following the specification in #2 above, insert:

   All treated wood in this project shall be certified by an independent third party inspection agency to have been produced in compliance with the BMPs.

   Compliance will be documented by either Item A or B below:

   A. Producers Participating in BMP Mark Program
   The presence of the BMP Mark legibly stamped, branded, marked, end tagged or an equivalent designation on each piece of material or lot arriving on site.

   Or

   In lieu of placing the BMP Mark on each piece of material or lot, a certificate of compliance issued and signed by an accredited, independent, treated wood inspection agency (see discussion of BMP Mark Program – next page) certifying that the material and/or its production was inspected in compliance with the "Quality Assurance Inspection Procedures for Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments" published by the "Supporting Organizations," August 1, 2006 or the most current version including published amendments. The BMP Mark shall be shown on the certificate of compliance.

   B. Producers Not Participating in BMP Mark Program

   A certificate of compliance issued and signed by an inspection agency certifying that the material and/or its production was inspected in compliance with the "Quality Assurance Inspection Procedures for Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments" published by the "Supporting Organizations", August 1, 2006 or the most current version including published amendments. An independent wood inspection agency of the producers choice and acceptable to the purchaser can be used to provide the inspection service.

What is the BMP Mark Program?

WWPI owns and has sole rights to authorizing the use of the BMP Logo. The application or display of the logo on material is authorized to producers with which WWPI has a current contract allowing its use. As a condition of the agreement, treating companies must demonstrate in writing that they have a contractual relationship with an American Lumber Standards Committee (ALSC)[1] accredited treated wood inspection agency with which WWPI has a contractual agreement authorizing their oversight services of the use of the BMP Mark under the BMP Quality Assurance Inspection Program. The presence of the logo is thus a tool to show the user that the materials were produced in compliance with the BMPs; however WWPI is not an inspection agency and conducts no oversight of the treating or inspection processes per se. Any unauthorized use of the 'Mark' is subject to civil and criminal actions. A list of producers currently authorized to use the BMP Mark and the approved agencies can be found on WWPI's website at www.WWPInstitute.org. WWPI should be notified immediately if the 'Mark' is used by any firm not on the list.

A producer wanting to treat to the BMPs, but choosing not to participate in the BMP Mark Program, is not permitted to use the 'Mark' but is required to provide a certificate of compliance issued and signed by an independent treated wood inspection agency of its choice and acceptable to the purchaser.

In addition to production guidelines, these BMPs also include guidelines that purchasers should use for installation of treated wood products. To specify full compliance with the BMPs, the specifier should provide for on-site inspection prior to installation and conformance with applicable Installation and Maintenance Guidelines found in Chapter 4.

Suggested language for inclusion in project specifications:

Project managers, contractors and sub-contractors on this project shall be familiar with and apply as appropriate the Installation and Maintenance Guidelines of treated wood as outlined in the "Best Management Practices for the Use of Treated Wood in Aquatic and Other Sensitive Environments" published by the "Supporting Organizations," August 1, 2006 or the most current version including published amendments.

Further information on uses and specifications for each preservative treatment system can be found at the following web links.

Western Wood Preservers Institutes website:
http://www.wwpinstitute.org

Wood Preservation Canada website:
http://www.woodpreservation.ca

Southern Pressure Treaters Association website:
http://www.spta.org

Timber Piling Council website:
http:// www.timberpilingcouncil.org

American Wood-Preservers' Association website:
http://www.awpa.com

[1]The American Lumber Standard Committee (ALSC) which oversees the inspection of treated lumber and plywood products does not endorse, oversee or provide any quality control services in regard to BMPs and has no responsibilities regarding the program. In the BMP quality assurance procedures ALSC accreditation is used only as a tool to identify agencies which would most likely be qualified and able to perform the BMP inspection and certification services.

Chapter Three: BMPs for the Production of Treated Wood

PART A: General BMPs for the Production of Treated Wood

General

The following BMP procedures are applicable to the production of treated wood using all preservative systems. Additional preservative-specific BMPs are listed in Part B of this chapter. Treaters may obtain additional information in AWPA standard M20-01 (Guidelines for Minimizing Oil-Type Wood Preservative Migration) or may develop specific technologies based upon their unique plant facilities that meet or exceed the BMP criteria.

Preservatives

The preservative chemicals used to treat wood in accordance with these BMPs shall be those listed in AWPA Use Category System (UCS) Standard U1 Section 4: Standardized Preservatives and shall comply with the requirements referenced therein or as appropriately specified by the Canadian Standards Association (CSA 080).

Preservative Treating Solution

Specific solution requirements for each preservative listed in Standard U1 Section 4 can be found in the specific 'P' Standard referenced. Compliance with the AWPA treating solution requirements is a BMP treating criteria.

Plant and Product Cleaning Standards

- Follow good housekeeping practices in the plant to minimize sawdust, wood shavings, dirt and debris or residue collecting on the wood surface prior to treatment.
- The treatment cylinder (retort) should be kept clean and free of debris.
- Clean treating solutions are necessary and shall be used to produce clean products. Several process techniques have been utilized to maintain treating solutions in an acceptable condition (see individual BMPs in Chapter 3, Part B). These include, but are not limited to: filtering, turnover of tank inventory, controlling tank temperatures, using cone or dome shaped tank bottoms, minimizing storage and treating tank levels, using high quality solvents and preservatives, and periodic draining and cleaning of work tanks when residues are present.

Anemones (Metridium senile) and a featherduster annelid (Schizobranchia insignis)

Processing

- Wood products should be sorted and treated by charges containing wood of similar sizes, classes, species, species groupings, moisture content, conditioning methods, treating characteristics and retention levels.
- Use appropriate seasoning and conditioning methods for the specified preservative treatment (i.e. air seasoning, kiln drying, steam conditioning, heating in oil, Boultonizing).
- Follow AWPA Standard T1 procedures and process limitations as appropriate for preservative and materials being treated.

- Treating should be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

- Treat using a standard pressure process such as Bethel full cell, modified full cell, Lowry (modified empty cell) or Rueping empty cell as appropriate for preservative type and final application of treated product.

- Final vacuum time is recorded only after attaining a minimum 22 inches Hg (75 KPa) sea level equivalent and maintaining that minimum for the duration of the vacuum cycle.

- Apply appropriate post-treatment conditioning techniques to minimize preservative loss after treatment. These processes are generally preservative specific with specific systems based upon plant equipment characteristics and capabilities at the treating facility. The following techniques or methods are shown as examples and are usually more applicable when treating with oil-type preservatives:

  – Transition between various phases of the treating process (e.g. pressure to final vacuum or final vacuum to atmospheric pressure) should be at a rate which allows the wood and preservative to reasonably adjust to such changes. Slow transitions generally result in a product with less surface exudations. The rate of transition varies with the size of the material being treated.

  – At the conclusion of the pressure period, and prior to removing preservative from the cylinder, the sealed cylinder should be allowed to remain sealed while the pressure in the cylinder equalizes with the treated wood. When the pressure has stabilized, a very slow release of pressure should be facilitated.

- Document the BMP treating techniques used with a permanent treating record document and maintain all records and procedures in accordance with the Quality Assurance Inspection Procedures for BMPs.

Inspection

The following inspection guidelines are key factors in producing and providing a quality treatment and a clean BMP product.

- **Inspection** To the degree practical material should be inspected to assure it is reasonably clean and free of dirt and sawdust prior to treatment.

- **Monitoring of Treating Solutions** The plant operator shall inspect treating solutions and plant process filters to assure the treating solution is free of debris and meets the requirement for the specific preservative.

- **Post Treatment Visual Inspection** A visual inspection shall be performed to verify the treated product meets the criteria specified for BMP processed material and that no excessive residues or surface deposits are present. If the criteria are not met, the product shall be rejected or reprocessed using appropriate post treatment conditioning techniques to meet the BMP surface appearance criteria.

- **Re-inspection Option** Since the occurrence of natural variability of wood sampled in a charge or production lot is recognized, re-inspection is permitted when there is a dispute over BMP treatment conformance. This should be conducted prior to a decision for re-treatment.

- **Pre-shipment Inspection and BMP Certification** A final visual inspection shall be conducted prior to the material leaving the treating facility to ensure the surface and treated product have no excessive residue or preservative deposits present, have not developed any excessive bleeding and to verify the presence of the BMP trademark on the material or treating certification. Any problems detected shall be corrected prior to shipment.

PART B: 1
BMPs for Specific Preservatives Used in the Production of Treated Wood

ACQ – Alkaline Copper Quaternary

Best Management Practices

The BMPs for ACQ are intended to minimize preservative migration from ACQ treated wood. In order to achieve this, the following BMP, as well as the general guidelines referenced in **Chapter 3, Part A**, shall be followed:

Post-Treating Procedures

Select appropriate post-treatment procedures to minimize preservative loss by using one of the following technologies, which may be chosen as a function of time, temperature and humidity, and must be adjusted based on the characteristics of the material and the process.

- Air Seasoning
- Kiln Drying
- Steam Conditioning
- Other Artificial Heating

Technical Notes

ACQ is considered an excellent treatment for many western softwoods including Hem-Fir and Douglas-fir because of its ability to achieve standard penetration and retention of preservative in these difficult-to-treat species.

Specifiers and installers should follow the guidance in the ACQ treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA. Consumer Information Sheets are not required for ACQ.

ACQ is not recommended for salt and brackish water immersion applications.

ACZA – Ammoniacal Copper Zinc Arsenate

Best Management Practices

The BMPs for ACZA are to allow an acceptable level of chemical stabilization to occur prior to the material leaving the treating facility. In order to enhance the process of stabilization and assure clean, residue-free surfaces, the following BMP procedures, as well as the general guidelines referenced in **Chapter 3, Part A** shall be followed:

Treating Techniques

- If the Lowry (modified empty cell) process can be used to obtain the specified product retention, it is the preferred process for BMP products.
- Following treatment using a full cell or modified empty cell process, a minimum final vacuum of 22 inches Hg (75 KPa) sea level equivalent shall be applied for a minimum of two hours. If possible, the retort should be heated between 180°F and 210°F (82°C – 99°C) during the vacuum process.

Post-Treating Procedures

All ACZA BMP material shall be processed using any one, or a combination of the following procedures. The selection will be at the discretion of the treater.

- **Minimum Plant-Holding Time** Products (with treating stickers in place for sawn and plywood products) shall be held in a storage area with free air circulation for a minimum of three weeks when average ambient temperatures equal or exceed 65°F (18°C). If the ambient temperature is less than 65°F (18°C), kiln drying or another source of artificial heat shall be used to achieve the minimum temperature requirement.*
- **Post-Treatment Kiln Drying** Products shall be kiln dried to a maximum moisture content of 30% (ASTM Method D 4442 oven dry basis) in the specified treated zone used for assay per AWPA product standard by employing a kiln cycle of 120°F – 160°F (50°C – 70°C) dry bulb temperature.
- **In-Retort Ammonia Removal Plus Plant-Holding Time** After the final vacuum period with heat, the retort door shall be opened and ambient air drawn through the treated wood charge from the door to the rear of the retort, vented to a scrubber at a rate of 250 cfm (7.08 m3/minute) minimum, for a period of three hours. The material is then handled in the same manner as under "minimum plant-holding time" described above except the minimum holding time is one week at the specified average temperatures.

NOTE: As an option, the material may also be placed into a separate closed conditioning vessel in order to draw the ambient air with appropriate vacuum and time to remove the ammonia vapors.

- **Aqua-Ammonia Steaming Cycle** Following the normal post-pressure period vacuum to draw excess preservative solution from the wood, the material is subjected to a post-treatment steam-conditioning process. The heating coils are covered with a minimum 2% solution of ammonia in water, which is heated for about 3 hours. A minimum temperature of 190°F – 200°F (88°C – 93°C) shall be maintained for at least 1.5 hours. The heating process is followed by a final vacuum of 2 hours, then an hour of drawing fresh ambient air through the retort to remove excess ammonia vapors and to cool the surface of the material. Material will then be processed with a minimum one-week plant-holding time at the average temperature requirements as stated above in that procedure.

- **ACZA Solution Bath/Rinse Procedure** Following an appropriate time to allow surface deposits to establish and equalize in ambient conditions, the treated material is loaded into the treating retort and covered with an ACZA treating solution (concentration of active chemical is not a significant factor) and circulated for a minimum one-hour bath. The rinse is followed by a one-hour vacuum after which the material can be removed to storage or prepared for shipment. This process contributes to the visual appearance and stability of the surface conditions in many ACZA treated products while providing more consistency of surface color and removal of residues. This process has not been verified as a means to achieve or improve chemical stabilization in treated wood.

*Average ambient temperature is determined over a 24-hour period using the high and low temperature recorded locally for that day.

Technical Notes

Specifiers and installers should follow the guidance in the ACZA treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the product in conformance with the Consumer Safety Information Sheet for Inorganic Arsenical Pressure Treated Wood and product labeling.

Because of its ability to treat the refractory Douglas-fir heartwood to meet the AWPA penetration and retention standards, ACZA is most prevalent on the West Coast for use in industrial product treatment of timbers, commercial decking for walkways and bridges or piling used in all sensitive or aquatic environment applications.

Chemical stabilization is the term applied to the chemical reaction in which the active ingredients of a waterborne treating solution become attached to the wood cells resulting in leach resistance and durability of the product. A key to the treating process for ACZA is the presence of ammonia, which facilitates carrying the active ingredients into the cell structure of the wood during treatment. Evaporation and removal of the ammonia following treatment is critical for the remaining ingredients to become stabilized, thereby minimizing the opportunity for leaching from the product in its end use. The BMP procedures are designed to accelerate the removal of ammonia and aid in the completion of the stabilization of the chemicals in the wood and provide lasting protection from the wood destroying organisms in service.

At the time of the revisions to this document there were no approved test methods or standards developed to accurately define the level of chemical stabilization in ACZA. This is being studied and when an acceptable test is established it will be incorporated into the ACZA BMP.

CA-B – Copper Azole

Best Management Practices

The BMPs for Copper Azole are designed to minimize preservative migration from Copper Azole treated wood. In order to achieve this, the following BMPs, as well as the general guidelines referenced in **Chapter 3, Part A** shall be followed:

Post-Treating Procedures

Apply appropriate post-treatment procedures to minimize preservative loss by using one of the following technologies, which may be chosen as a function of time, temperature and humidity, and must be adjusted based on the characteristics of the material and the process.

- Air Seasoning
- Kiln Drying
- Steam Conditioning
- Other Artificial Heating

Technical Notes

Specifiers and installers should follow the guidance in the copper azole treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA. This information is available from your lumber supplier.

Copper Azole is considered an excellent treatment for many western softwoods including Hem-Fir, Western Hemlock and Ponderosa Pine. Achieving the required penetrations in Douglas-fir may require the addition of ammonia to the copper azole treating solutions, elevated treating temperatures and extended pressure periods.

Copper Azole treated wood is not recommended for salt and brackish water immersion applications.

CCA – Chromated Copper Arsenate

Best Management Practices

The BMPs for CCA are designed to minimize preservative migration from CCA treated wood. The following BMP, as well as the general guidelines referenced in **Chapter 3, Part A**, shall be utilized.

Treating Procedures

Full Cell (Bethel) Pressure Treatment is recommended for most western species. Modified Full Cell procedures should be limited to sapwood species, e.g., Southern Yellow Pine. Preservative solution quality should be closely monitored.

Post Treating Procedures

Apply appropriate post treatment procedures to maximize preservative fixation by using one of the following technologies, which may be chosen as a function of time, temperature and humidity, and must be adjusted based on the characteristics of the material and the process.

- Air Seasoning
- Kiln Drying
- Steam Conditioning
- Hot Water Bath

The best available technology for confirming fixation in CCA treated material is the Chromotropic Acid Test (AWPA Standard A3-11, Method for Determination of the Presence of Hexavalent Chromium in Treated Wood, [1995]). If testing shows that fixation has not been achieved according to the Chromotropic Acid Test, the material should not be shipped until fixation according to the Chromotropic Acid Test is confirmed.

Technical Notes

Specifiers and installers should follow the guidance in the CCA treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the product in conformance with the Consumer Safety Information Sheet for Inorganic Arsenical Pressure Treated Wood and product labeling.

CCA is considered an excellent treatment for most softwood species. Achieving the required penetrations in Douglas-fir may be extremely difficult. CCA is not recommended for Douglas-fir marine piling (except as the first treatment in “dual treatment”) or for treatment of interior Douglas-fir.

Fixation In the CCA treating process, water is the carrier to move the metals or active ingredients into the wood where they become fixed to the wood. Once the chemical reaction called "fixation" occurs, the potential for migration of active ingredients is minimized.

While a complex reaction, fixation, which is a function of temperature and time, essentially involves the reduction of the hexavalent chromium to trivalent chromium with the formation of a complex mixture of insoluble chromates. In the process, insoluble arsenates of copper and chromium are also precipitated in the treated wood.

Chromic acid or Chromium VI is the component in the CCA process which is the basis for the Chromotropic Acid test. The procedure can detect Chromium VI at concentrations as low as 15 parts-per-million. Material passing the test (i.e., no detection of Chromium VI) for use in aquatic environments will be 99.5 to 99.95% fixed. The Chromotropic Acid test is a rigid qualitative procedure specifically for CCA treated wood.

Fixation Period The following post-treatment processing limits have been found to significantly enhance preservative fixation while also avoiding conditions which would cause losses in mechanical properties.

The time-temperature limitations specified below are appropriate for all species and can be found in the appropriate AWPA Specification.

a. Hot Water Bath (Liquid Fixation Processes), Maximum Temperature: 220°F (105°C) Duration: Until the outer 0-0.5 inches (0-12mm) portion in 4 out of 5 borings per charge pass the Chromotropic acid test. (AWPA Standard A3, Method 11) or not to exceed the maximum time-temperature combination listed below.

Temperature/Time:

- 220°F (105°C) 6 hr.
- 203°F (95°C) 9 hr.
- 185°F (85°C) 12 hr.
- 167°F (75°C) 18 hr.
- 149°F (65°C) 24 hr.

b. Air and/or Kiln Drying Processes, Maximum Dry-bulb Temperature: 160°F (70°C), Maximum wet-bulb Depression Temperature: 20°F (10°C) Until the outer 0-0.5 inches (0-12mm) portion in 4 out of 5 borings per charge pass the Chromotropic acid test. (AWPA Standard A3, Method 11).

c. Steaming Processes, Maximum Temperature: 220°F (105°C) Duration: Until the outer 0-0.5 inches (0-12mm) portion in 4 out of 5 borings per charge pass the Chromotropic acid test. (AWPA Standard A3, Method 11) or not to exceed the maximum time-temperature combination listed below.

Temperature/Time:

- 220°F (105°C) 6 hr.
- 203°F (95°C) 9 hr.
- 185°F (85°C) 12 hr.
- 167°F (75°C) 18 hr.
- 149°F (65°C) 24 hr.

Copper Naphthenate

Best Management Practices

The BMPs for Copper Naphthenate are designed to assure a clean product and minimize the potential for chemicals to enter the environment. In order to minimize the amount of Copper Naphthenate material available to migrate into the environment, the following guidelines, as well as the general guidelines referenced in **Chapter 3, Part A**, shall be used when treating material for use in aquatic, above water, or other sensitive applications:

Treating Techniques

- The empty-cell process should always be used for full-length pressure treatment with oil-borne preservatives if it will provide the desired retention. Either the Rueping process (empty-cell with initial air) or the Lowry process (empty-cell without initial air) can be used.
- Full length and butt thermal treatment of naturally durable species such as Western Red Cedar for poles can also be used to minimize the potential for chemicals to enter the environment.
- Following treatment using an empty-cell process a minimum final vacuum of 22 inches Hg (-75 KPa) sea level equivalent shall be applied for a minimum of two hours. If possible, the retort should be heated between 180°F and 210°F (82°C – 99°C) during the vacuum process.

Treating Procedures

- **Solution Filtration** The Copper Naphthenate solution in use shall be filtered regularly or otherwise kept clean to remove solids, which may otherwise be deposited on the wood during treating.
- Any accumulation of moisture in the preservative work tank should be drained off prior to treatment.

Post-Treating Procedures – Oil Carrier

For Copper Naphthenate treated products with an oil carrier to be used in sensitive environments or where bleeding of preservative is objectionable, use one of the following BMPs:

- **Expansion Bath** This process increases the temperature of the preservative solution surrounding the wood for the purpose of recovering excess preservative and improves surface cleanliness of the product. Follow the general procedures described in AWPA UCS Standard T1-05, section 2.7. Use a minimum expansion bath of one hour. The maximum temperature

of the expansion bath shall be 220°F or 230°F (104°C to 110°C) depending on the specific commodity standard limitations. The expansion bath shall be followed by a vacuum period using a minimum of 22″ of Hg (-75 kPa) for a minimum of two hours.

- **Final Steaming** Following the pressure period and once the Copper Naphthenate has been pumped back to the storage tank, a vacuum shall be applied for a one-hour minimum at not less than 22″ of Hg (-75 kPa) of vacuum to recover excess preservative. Following the vacuum period, the wood shall be subjected to steaming for a two-hour time period for lumber and timbers and three hours for piling per the limitations of the AWPA Commodity Standards. The minimum temperature during steaming shall be 200°F (93°C) and the maximum shall be 240°F to 245°F (116°C to 118°C) depending on the species being treated. After steaming, apply a final vacuum for a minimum of four hours at 22" of Hg (-75 kPa) of vacuum.
- **Extended vacuum cycle** This technique involves the use of extended vacuum cycle time or double vacuum cycles where a second vacuum is pulled after allowing the retort to equalize to atmospheric pressure following the "break" from the first vacuum cycle. Preservative collected in the cylinder during the first vacuum cycle should be pumped to the work tank before initiating the second vacuum cycle.

Additional treating information to minimize environmental exposure of oil-type wood preservatives in pressure treated wood can be found in AWPA Standard M20-01, or latest revision.

Post Treating Procedures – "Light" Solvent Carrier

For Copper Naphthenate treated products with a light solvent carrier, such as AWPA Standard P9, Type "C" solvent for sensitive environment applications, use the following BMP:

- A final vacuum shall be used for a minimum of 1 hour at a minimum of 22″ of Hg (-75 kPa) of vacuum.

Additional treating information to minimize environmental exposure of oil-type wood preservatives in pressure treated wood can be found in AWPA Standard M20-01, or latest revision.

Creosote

Best Management Practices

The BMPs for Creosote are intended to minimize the amount of preservative material available for migration into the environment. The following guidelines, as well as the general guidelines referenced in **Chapter 3, Part A**, shall be used when treating material for use in sensitive environment, aquatic or marine applications:

Treating Procedures

- Follow recommendations in AWPA M20-01 (or most recent publication) Standard providing Guidelines for Minimizing Oil-Type Wood Preservation Migration as appropriate for Creosote P1/P13 and product treated for Sensitive Environment exposure.
- Treat using preservative specified in AWPA Standard P1/P13, "Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water) Use."
- The "in use" Creosote inventory maintained by the treating firm at the plant for BMP-treated applications shall be purchased, managed and/or processed such as to maintain a xylene insoluble (XI) of 0.5% maximum and to maintain moisture content within specifications. (Exception – A xylene insoluble (XI) level of 1.5% will be allowed for facilities treating Ponderosa or Southern Pine due to the higher level of extractable sap and resins associated with these species).
- Techniques shall be incorporated into the treating process to minimize the amount of residual Creosote, which may occur on the surface of the treated product. (Techniques may vary depending upon the product type and wood species).
- On Southern Pine, if plant equipment allows, steam conditioning is an alternative to conditioning by kiln drying. Steam conditioning may result in energy savings by shortening post-treatment cycles while producing desired cleanliness and dryness.

Post-Treating Procedures

Prior to shipment, material for aquatic applications shall be processed under one of the following procedures as determined by the producer:

- **Expansion Bath** Following the pressure period the Creosote should be heated 10°F to 20°F (6°C to 11°C) above press temperatures (following the preservative and species temperature limitations set by AWPA) for a minimum of one hour. Pump Creosote back to storage and apply a minimum vacuum of 24 inches of Hg (610 KPa) for a minimum of 2 hours.

- **Steaming** Following the pressure period and once the Creosote has been pumped back to the storage tank, a vacuum shall be applied for a minimum of two hours at not less than 22 inches of Hg (560 KPa) of vacuum to recover excess preservative. Release vacuum back to atmospheric pressure and steam for a two-hour time period for lumber and timbers and three hours for piling. Maximum temperature during this process shall not exceed 240°F (115.5°C). Apply a second vacuum for a minimum of four hours at 22 inches of Hg (560 KPa) of vacuum.

- **Vacuuming** Following the pressure period and once the Creosote has been pumped back to the work tank, a vacuum shall be applied for a minimum of one and half hours at not less than 22 inches of Hg (560 KPa) of vacuum to recover excess preservative. Then, depending on plant equipment: 1.) vacuum for a minimum of one and half hours at not less than 22 inches of Hg (560 KPa) or 2.) steam material for one-hour minimum and then pull not less than 22 inches of Hg (560 KPa) vacuum for a minimum of one and half hours. Maximum temperature during steaming shall not exceed 240°F (115.5°C).

Mussels (Mytilus trossulus)

Technical Notes

The purpose of the BMP for Creosote is to minimize the amount of surface residues which are available to migrate to the environment. The purchase of low xylene new Creosote and management processes to maintain low XI levels will assure that there are a minimum of contaminants on the surface of the finished product. The post-conditioning requirements (e.g. steaming or expansion bath and vacuuming) help to assure that excess Creosote is removed from the product while maintaining the required amount in the assay zone to meet the product specification after treatment. Surface Sheen – when driving Creosote piling, visible oil sheen will often develop on the water surface. This sheen represents only a trace quantity of Creosote preservative and in most all instances it will dissipate within 24 – 48 hours through biodegradation, evaporation or oxidation of the Creosote. Available data indicates this sheen, which decreases rapidly following installation, will not harm aquatic life nor will it enter the food chain.

Specifiers and installers should follow the guidance in the Creosote treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the material in conformance with the Consumer Information Sheet for Creosote pressure treated wood. Creosote should not be used in those portions of projects subject to frequent public contact, i.e., handrails, sunbathing decks, etc.

Dual Treated Marine Piling

Best Management Practices

The BMPs for Dual Treating requires that individual BMPs for each preservative be specified for the treatment unless the same objectives can be obtained through a combined practice. In addition to the individual BMPs for each preservative specified, the general guidelines referenced in **Chapter 3, Part A** shall also be utilized.

Dual treatment is generally only specified on the Pacific Coast in coastal areas south of San Francisco, California, the Atlantic Coast between New Jersey and Florida, and along the Gulf Coast.

Treating Procedures

- Refer to the BMP for the waterborne preservative being specified and for Creosote.
- Techniques shall be incorporated into the Creosote treating process to minimize the amount of residual Creosote, which may occur on the surface of the dual treated product. Techniques will vary depending on experience, equipment, product type and wood species.

Post-Treating Procedures

After initial treatment but prior to the second treatment, follow the post-treating procedures for the waterborne preservative specified.

Prior to shipment but after the second treatment with Creosote, the material shall be processed under the following procedure by the producer:

- **Vacuuming** Following the pressure period and once the Creosote has been pumped back to the work tank, a vacuum shall be applied for a minimum of three hours at not less than 22 inches of Hg (560 KPa) of vacuum to recover excess preservative and dry the material surface.

Colonies of plumose anemones (Metridium senile), tubeworms (Spirobids) and coralline algae (Lithothamnium)

Pentachlorophenol (Penta)

Best Management Practices

The BMPs for Penta are to ensure responsible treatment and product use. Its use in marine projects should be limited to above the splash zone because Penta does not protect against marine organisms. In order to minimize the amount of Penta material available to migrate into any sensitive environment during its use, the following guidelines, as well as the general guidelines referenced in **Chapter 3 Part A**, are recommended when treating material for these applications. Following these procedures should result in a clean and dry treated wood product:

Treating Procedures

Manage the treating plant's "in-use" Penta by continuous filtration or other available methods to maintain the solution with minimum particulate matter. Such processes will result in less surface deposits, minimizing the amount of material which may be released from in-service wood.

Post-Treating Procedures

Surface treatment Following the pressure period, incorporate one of the following procedures into the treating process to minimize the amount of residual treating solution which may occur on the treated product surface. Techniques may vary depending upon the product type and wood species.

- **Steaming** Material may be cleaned by final steaming within the limits specified for that commodity in AWPA, T-1 – Section 8.
- **Expansion Bath** When final steaming is not utilized the treater may use an expansion bath. Perform this expansion bath in accordance with AWPA T1, Section 2. This generally involves heating the preservative 10°F to 20°F (-12.22°C to – 6.67°C) above pressure temperatures for a minimum of one hour, followed by pumping the preservative back to storage and applying a minimum vacuum of 22 inches (55.88 centimeters) for a minimum of two hours.
- **Extended vacuum cycle time** This technique involves the use of extended vacuum cycle time or double vacuum cycles where a second vacuum is pulled after allowing the retort to equalize to atmospheric pressure following the "break" from the first vacuum cycle.
- Preservative collected in the cylinder during the first vacuum should be pumped to the work tank before initiating the second vacuum.

Before removal of material from the treating area, the treater should verify the material is free of surface deposits and/or drippage of excess preservative. Drippage is generally the result of product continuing to adjust to ambient conditions of temperature and pressure.

Technical Notes

Surface Sheen Occasionally when installing Penta-treated wood in or over water, a visible oil carrier sheen may develop on the water surface. This sheen contains a negligible quantity of Penta as there is generally less than 1% Penta in Penta-treated wood. In nearly all instances this sheen will cease in less than 24 hours through bio and photodegradation. Available data indicates that this sheen does not represent any harm to aquatic life nor will it enter the food chain. It is basically an aesthetic concern which decreases rapidly following installation

Steaming Steaming may produce contaminated process water requiring waste water treatment before discharge to meet local, state or federal regulations. Consult AWPA Treatment Standards to determine if this procedure is allowable, and for the duration and temperature limitations.

Pentachlorophenol-treated wood is not recommended for salt and brackish water immersion applications.

Chapter Four: Installation and Maintenance Guidelines

Achieving the goals of the Best Management Practices can only be fully achieved if the users of the products are also engaged. The following guidelines are suggested practices, but other applicable practices may be determined by the specifier or project managers.

Design and Purchasing

It is recommended that any order for the purchase of treated wood materials should involve communication between the purchaser/specifier and the seller or treating company whichever is most practicable or customary, and that the order, including the environmental concerns with the project, should be reviewed in detail with the producer.

- Projects should be designed and specified to provide for the maximum amount of cutting, prefabrication and framing prior to treatment. This allows for better treatment of product and minimizes the need for field cutting and treatment.
- Where treated wood may be subject to continual abrasion, such as floating docks against piling, the project should incorporate design features to prevent the ongoing contact. This will increase the life of the project and minimize treated material entering the environment.

Transportation

- When additional protection from precipitation is desired or warranted it is recommended preservative-treated sawn wood material be top wrapped or covered while being transported to its designated location.
- Care should be taken during the loading and unloading of the preservative-treated wood to prevent or minimize damage to the product that causes untreated areas to be exposed. If untreated areas become exposed by damage they should be field treated with an approved preservative (Copper Naphthenate) as per AWPA Standard M4.

Inspection, Acceptance, Rejection

- As soon as practical after receipt, the material and the accompanying paper work should be inspected to assure it has been treated to specified AWPA standards and certified to have been treated under the BMP program by either the presence of a BMP Mark with a legible stamp, brand, mark, end tag or equivalent designation on the material or by a letter of certification from an independent third party inspection agency. If any problems exist, the supplier should be contacted immediately.
- BMP materials should be inspected to assure they are reasonably free of surface debris and excess surface chemical. Material treated with oil-type preservatives should be examined for signs of preservative migration, and excessive residues or bleeding.
- Where the products are of concern they should be rejected from installation and the treating company should be contacted immediately for corrective action.

Storage

- **On-site** The material should be stored away from the water until it is needed for installation. When preservative-treated wood is stored on the jobsite for an extended period and/or there is a threat of the material being exposed to precipitation, it is recommended the material be stacked above the ground. The area where the material is to be stacked should be free of debris, weeds and dry vegetation and should have adequate drainage to prevent the material from being subjected to standing water. Also, if warranted, all stacked material designated to be removed from service should be covered for disposal and material designated for use should remain covered until used.

- **Off-site** In situations where preservative-treated wood material is being inventoried prior to distribution to the jobsite or when material removed from service is taken to a storage site prior to its disposal or reuse, it should be stacked in a well-drained area free from debris, weeds and dry vegetation above the ground on bunks or pallets. The stacked material may be stored under a covered area or top wrapped with a tarp to minimize exposure to precipitation.

Field Treating Guidelines

Copper Naphthenate-based solutions are commonly used in field treating of holes, cuts or injuries, which occur to the treated product. The objective of field treatment is to assure complete product treatment.

The following guidelines should be followed in field-treating projects in sensitive environments:

- Follow the procedures outlined in AWPA Standard M4, Standard for the Care of Preservative-Treated Wood Products.

- When field treating by brushing, spraying, dipping or soaking do so in such a manner that the preservative does not drip or spill into the sensitive environment.

- Whenever possible, apply field treatments prior to assembling the structure over the body of water or sensitive environment.

- Conduct the application of the preservative so that any overspray or drippage of preservative can be recovered or retained.

- Specifiers and installers should follow the directions for use on the Copper Naphthenate-based end cut solution label and Material Safety Data Sheets (MSDS) for the product.

Jellyfish (Aglantha digitale)

Installation

- When field cutting, drilling or fabrication is necessary, it should be done away from the water or sensitive area to the degree practical and all waste, including sawdust, should be collected and disposed of appropriately. (See Disposal next page). There are many approaches to ensuring that the debris from field fabrication and maintenance activity is properly collected and removed, but the choice will depend on the situation and the construction or maintenance crew. It is recommended in most cases that fabrication be done at specific cutting stations in order to consolidate the collection of debris. The use of a tarp is suggested for collecting sawdust from circular saws and chainsaws, and plastic tubs or similar containers are suggested for collecting debris created from drilling holes on-site. The importance of collecting debris from construction and maintenance activities should be stressed in planning and budgeting for projects so that the crews clearly understand that debris collection is an integral part of the construction and maintenance process in order to minimize the release of preservative into the environment.

- Installation of oil-borne type preserved products may initially result briefly in a thin oily sheen on the water surface. Such sheens are generally of an aesthetic rather than biological concern and will dissipate in a relatively short period of time. Absorbent booms or barriers can be used to control and collect the sheens.

Demolition

The removal of existing treated wood structures from aquatic and sensitive environments should be done with care to minimize the potential for treated debris to enter the environment. The guidelines used in construction of new projects should be applied to demolition wherever applicable and the added effort should be considered in costing the project.

- Wherever practical the treated wood structure or as large a portion as practical should be removed well away from the sensitive environment for final demolition.

- All scraps and sawdust from the demolition should be collected and removed for appropriate disposal. In aquatic applications absorbent booms should be considered if needed to control drift of scrap materials from the work area or to control sheens which may develop with the disturbance.

- **Piling** If not otherwise specified by the regulatory permit or project plan, treated wood piling may be: 1) left in place; 2) pulled and moved off site; 3) cut off at the mud line; 4) cut off below the mud line and capped with clean material.

- **Salvage and Reuse** Depending upon the condition of the treated wood materials removed, the product may retain enough of the structural and preservative characteristics to make it suitable for reuse in a manner compatible with its original purpose. Common secondary applications include use as posts, landscape timbers and retaining walls. Distribution of such materials to the market, through sale or donation, should be done with great care to assure the structural and treatment integrity of the product and to assure that the new user is provided information on the use of the material including applicable EPA-approved Consumer Safety Information Sheets. Note: It is extremely difficult to detect internal degradation in any materials intended for reuse and it may be prudent to avoid the use of salvaged marine piling in foundation piling or structural applications.

Disposal

Treated wood scraps and sawdust as well as material for disposal that is not reused must be disposed of appropriately in a timely manner. The disposer should check with local authorities that have jurisdiction over this process to assure disposal is accomplished in compliance with all applicable requirements, which may supersede the following guidelines.

For a detailed discussion of Federal and State requirements see "Disposal of Treated Wood" at www.WWPInstitute.org.

- NEVER BURN TREATED WOOD IN OPEN FIRES OR FIREPLACES!
- Do not use treated wood as mulch.
- Do not leave the waste material on site or in stockpiles for extended time periods.
- Under federal regulations treated wood waste is classed or managed as a non-hazardous material and may be disposed of at municipal landfills approved to receive such material by state, provincial and local authorities.
- A few state or provincial governments have more stringent requirements for classification of wastes. However, in such cases the issue of treated wood has been addressed in law and/or regulations allowing for disposal in approved municipal landfills. For specifics, local state and provincial authorities should be contacted.
- There are various incinerators, waste-to-energy burners and industrial furnaces across the country, which are approved and permitted for utilization of Creosote and Pentachlorophenol-treated wood waste.

Graceful crabs (Cancer gracilis) in a mating grasp

Appendix A: Quality Assurance Inspection Procedures For Best Management Practices (BMPs) For the Use of Treated Wood in Aquatic and Other Sensitive Environments

Unless otherwise defined, all terms and definitions in these procedures shall be as found in the American Wood-Preserver's Association (AWPA) Book of Standards.

1. SCOPE

These Quality Control and Inspection Procedures are applicable to all pressure treated wood products produced under the BMPs for use in, above or in the vicinity of aquatic and other sensitive environments and are supplemental to the requirements of AWPA and/or other product specifications. Inspection in regard to product specification or treating standards is separate and in addition to the BMP inspection requirements.

Producers that choose to treat to the BMPs, but choose not to participate in the WWPI BMP Mark Program are not permitted to use the 'Mark,' as described in Paragraph 2.2 of this document, but will be required to provide a certificate of compliance issued and signed by an independent treated wood inspection agency of its choice and acceptable to the purchaser for each lot.

2. DEFINITIONS

2.1 BMPs

Best Management Practices are published guidelines developed for use in specifying and producing material for use in aquatic and other sensitive environment projects in the United States and Canada. The BMPs were developed and published by the Western Wood Preservers Institute (WWPI), Wood Preservation Canada (WPC), Southern Pressure Treaters Association (SPTA) and Timber Piling Council (TPC).

2.2 BMP Quality Mark

2.2.1 A mark registered under the Federal Trade Marks Act, as indicating certification of conformance to pressure treated processing and pressure treated product rules. A mark which when stamped or affixed to wood products, certifies that all the actions and quality certification requirements under these Quality Assurance Inspection Procedures have been met by both the treater and the Quality Control Agency which licenses the use of the mark by pressure treating plants.

2.2.2 A register protected logo which, when included with the 'MARK,' denotes compliance to the BMPs:

This mark remains the property of WWPI and shall only be used by authorized agencies and producers.

2.3 Quality Control Agency

An organization that either (1) is acknowledged by WWPI as authorized under the BMP Mark Program; or (2) designated acceptable by agreement between the purchaser and producer to issue a certificate of compliance for lots, to audit, by testing and sampling, the quality marked or certified BMP products treated in accordance with these Quality Assurance Inspection Procedures to assure conformance.

The Quality Control Agency shall have no financial interest in any company producing any portion of the products inspected and tested. The Quality Control Agency shall not be owned, operated or controlled by any such company.

2.4 Residence Quality Supervisor (RQS)

An individual designated by the treater and approved by the Quality Control Agency who performs the functions and meets the requirements of Paragraph 3.1.2. The Quality Control Agency shall initially and continuously thereafter determine that the Resident Quality Supervisor can demonstrate satisfactory knowledge of all manufacturing, sampling and testing requirements.

2.5 Seller

As used in these Quality Assurance Inspection Procedures, a seller is each owner of the products described by the Quality Assurance Inspection Procedures beginning with the treater and including intermediate sellers between manufacture and use.

2.6 Purchaser/User

Entities, individuals or representatives who are responsible for the acquisition and installation of BMP treated wood products.

2.7 Treater

A company or firm engaged in the treatment of the products covered by these Quality Assurance Inspection Procedures.

Core samples are removed by a hollow drill bit called an increment borer.

2.8 Lot and Lot Inspection

A lot for inspection at plants will be a single charge or a shipment, whichever is less. A lot for inspection at plant storage yards, at sales yards, in transit, or at jobsites will be that material available at the time and place of inspection which contains products from only one treating plant and will contain only one species or species group and one preservative treatment.

2.9 Suspended for Cause

The suspension of production required by an agency when it determines that a continuous non-conformance in treating to BMPs has been identified.

Lumber under five inches thick requires a minimum of 0.40 inch penetration; lumber over five inches thick requires a minimum of 0.50 inch penetration.

3 REQUIREMENTS

3.1 Quality Control

Products conforming to this procedure shall be produced under a system of quality control with the following requirements:

3.1.1 Treating Equipment and Records

The following are both initial and continuing minimum treating plant equipment and record requirements. The Quality Control Agency shall initially and continuously thereafter determine that the manufacturing equipment meets the minimum requirements described in these Quality Assurance Inspection Procedures.

Procedures:

(a) An effective operating system or procedure to remove residuals and debris from preservative solutions.

(b) Facilities at either the plant or at a central laboratory for making all BMP test requirements.

(c) 1. An operating system of BMP record keeping which shall include records of consecutively numbered treating charges showing the basic data required in AWPA Standards M2, including the volume of wood, solution concentration, gallons absorbed, and the results of the inspection of each completed charge. Records shall be retained for one year after shipment.

2. Track and code all post treatment processes and testing to assure compliance with BMPs.

3. A statement of compliance will be attached to each program treating charge report stating conformance to BMPs.

4. A copy of the treating record and RQS report shall also be kept in a separate file and available to the quality control agency's representative during normal working hours.

(d) An internal quality control program maintained by systematically checking treated wood for conformance to these Quality Assurance Inspection Procedures, and applicable AWPA Commodity Standards.

3.1.2 Resident Quality Supervisor (RQS)

An individual shall be appointed by the treater and approved by the Quality Control Agency to oversee and/or perform plant quality control and:

(a) Shall be responsible for conformance of all quality marked or certified products to the requirements of these Quality Assurance Inspection Procedures.

(b) Must understand all requirements of these Quality Assurance Inspection Procedures and be able to recognize these requirements in each class of material produced.

(c) Must understand the capabilities of the treating equipment and procedures in use and be able to judge its proper function in achieving the BMPs.

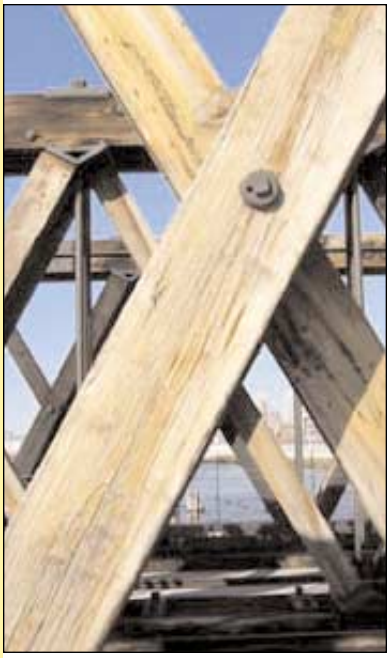
(d) Shall have authority to stop any operation found to be causing non-conformance attributes.

(e) Shall have authority to correct any operation found to be causing non-conforming attributes.

(f) Must determine that all requirements contained in these Quality Assurance Inspection Procedures are continuously met by reviewing treatment records and performing any and all necessary tests prescribed.

(g) Record findings certifying compliance and attach a copy to the treating records.

(h) Notify the Quality Control Agency of the availability of BMP material for review.



3.1.3 Quality Control Agency Duties

Quality Control Agency described in Paragraph 2.3 shall check and approve the plant equipment, Resident Quality Supervisor and the first five charges and shall thereafter perform continued checking and testing as specified by these quality Assurance Inspection Procedures:

(a) Initially and continually thereafter, determine that procedures and requirements of these Quality Assurance Inspection Procedures are being adhered to by the Treater.

(b) Review plant quality control records noting any deficiencies.

(c) Check plant equipment for compliance with Paragraph 3.1.1 at least once each six months.

(d) Perform the sampling and testing required by WWPI's BMPs at a ratio of 1:10 BMP charges produced or portion thereof.

(e) Generate a report of findings to be reviewed with RQS.

3.1.4 Compliance Documentation for Producers Participating in BMP Mark Program

(a) The presence of the BMP Mark legibly stamped, branded, marked, end tagged or otherwise on each piece of material or lot or;

(b) A certificate of compliance for each lot as defined in Paragraph 2.8.

3.1.5 Compliance Documentation for Producers Not Participating in BMP Mark Program

(a) A certificate of compliance for each lot as defined in Paragraph 2.8.

3.1.6 Non-conformance

If a product non-conformance is found by the Quality Control Agency or the Treater, at either a point under the Treater's jurisdiction or at a location not under his jurisdiction, the Treater will correct the non-conformance or remove the Quality Mark under the supervision of the Quality Control Agency. The Treater should be afforded every opportunity to correct non-conformance. Where applicable, material may be re-treated, and all re-treatment shall be in accordance with the appropriate AWPA Standards and these Procedures. If the lot fails to conform after re-treatment, the Quality Mark shall be removed from all pieces in the non-conforming lot and any certificate of compliance shall be withdrawn for the materials.

A minimum of twenty core samples are randomly taken from each charge of treated wood to measure depth of penetration.

3.1.7 Suspension and Warning

A treating plant participating in the WWPI Mark Program suspended for cause from applying the Quality Mark to its products while under license of one Quality Control Agency shall not apply the Quality Mark under license of another Quality Control Agency until it has successfully re-qualified with the original Quality Control Agency. A treating plant placed on warning for cause by its licensing Quality Control Agency shall not apply the Quality Mark under the license of another Quality Control Agency. Upon suspension and warning WWPI will be notified.

Plumose anemones (Metridium senile) and compound ascidians (Dispaplia occidentalis)

4 MARKING

4.1 Proper Identification

To insure that treated material produced by producers participating in the WWPI Mark Program is properly identified as being produced in compliance with these Quality Assurance Inspection Procedures, it shall be legibly stamped, branded, marked, end tagged, or otherwise have permanently affixed a quality mark containing the following information:

4.1.1 Identity

Identity of the treating plant.

4.1.2 Preservative

Preservative code and retention as specified.

4.1.3 Mark

BMP registered logo where authorized, i.e.:

4.1.4 Arrangement

The information required by this procedure shall be arranged in the Quality Mark format in compliance with the AWPA Standard M-6 and generally accepted industry formats. The BMP Mark may be included with other quality information or placed separately.

4.1.5 Material Packaging

A Treater may not mix in one package material which bears the Quality Mark with material that does not bear the Quality Mark.

4.1.6 Location

The location of the quality marks shall be according to industry standards and/or user requirements.

5. REINSPECTION

5.1 Reinspection in General

5.1.1 The settlement of a dispute between the producer and the customer or user of the product, as to any BMP attribute, shall be made by the Quality Control Agency.

5.1.2 Reinspection privileges shall be available to both buyer and seller upon request for the purpose of determining compliance with purchaser BMP specifications and effecting the settlement of compliance and invoices.

5.1.3 Product compliance with the requirements of the applicable BMPs is the responsibility of the Treater for 90 days after receipt of the shipment provided the shipment is not in use. Partial use of the shipment shall not prejudice the right to re-inspection of the remaining portion as long as the unused portion is in the form in which it was shipped.

5.2 Procedure

5.2.1 In performing Reinspection for treatment attributes, the Agency shall employ those tests approved in the applicable AWPA M or A standards (latest edition).

5.2.2 All attributes of treatment appearing on the Quality Mark or certificate shall be checked.

5.2.3 Complaints may be filed for illegible marks, incorrect marks and no marks where the Quality Mark has been specified. The Agency Quality Marks may be applied by qualified personnel of the Agency after compliance to applicable BMPs has been confirmed. Where material has been marked incorrectly, the mark shall be removed by any suitable means and any certificate of compliance shall be amended.

5.2.4 Lots failing to conform to BMP requirements shall be clearly marked as non-conforming and when possible separated from conforming material.

5.3 Compliance Variance

5.3.1 When 95% or less of a shipment or individual lots in a shipment conforms to the BMP requirements, the shipment or each lot of the shipment which fails shall be considered non-conforming and the Treater shall pay the cost of re-inspection. When a shipment or the lots within a shipment is more than 95% in conformance with the BMP requirements, the shipment or the lots within the shipment shall be considered conforming and the user shall pay the cost of Reinspection.

5.3.2 A customer is not required to accept non-conforming material. Non-conforming material found at reinspection shall be corrected or have the quality mark removed or the certificate of compliance withdrawn.

5.4 Records

Reports shall be issued to all parties to the compliant and copies shall be kept by the Agency for a minimum period of two years.

Sunflower starfish (Pycnopodia helianthoides) and a leather star (Dermasterias imbricata)

Dedicated to
William Joseph Baldwin
1949 – 2006

Whose leadership, foresight, dedication to sound science and technology, attention to detail, commitment to environmental responsibility and persistence provided the foundation for the BMPs.

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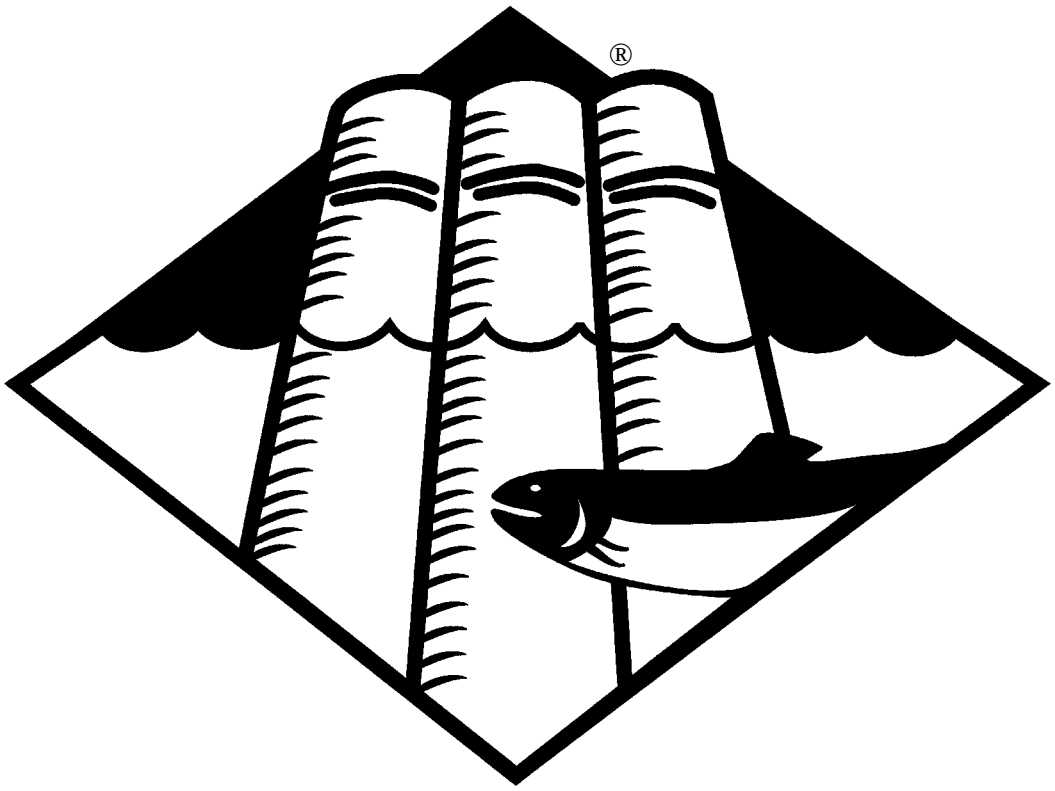
2.Best Management Practices. More technical than 1.) above. In specification format.

BEST MANAGEMENT PRACTICES

FOR THE USE OF TREATED WOOD IN AQUATIC ENVIRONMENTS



USA VERSION • REVISED JULY, 1996

Developed For Use In Specifying Materials For Use In Aquatic Projects
in the Western United States and Canada by:
Western Wood Preservers Institute • Canadian Institute of Treated Wood

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BEST MANAGEMENT PRACTICES FOR THE USE OF TREATED WOOD IN WESTERN AQUATIC ENVIRONMENTS

INTRODUCTION

PURPOSE

Protection of the quality of the water and diversity of the various life forms found in the lakes, streams, estuaries, bays and wetlands of North America is a goal and responsibility shared by every citizen. An endless list of human activities can impact the aquatic environment: storm waters that run off our streets, exhaust from our boats and cars, municipal and industry discharges, and construction of docks and piers, to name but a few. Maintaining the quality of our treasured aquatic resources requires that everyone do their part.

Pressure treated wood is a major material used to construct the piers, docks, buildings, walks and decks used in and above aquatic environments. The pressure treated wood products industry is committed to assuring its products are manufactured and installed in a manner which minimizes any potential for adverse impacts to these important environments. To achieve this objective the industry has developed and encourages the use of **BEST MANAGEMENT PRACTICES or BMPs.**

There are a variety of treatments and treated wood products approved for use in or above aquatic environments. Because of inherent differences in the treatment chemicals and the processes there are also a number of BMPs. While the goal of the BMPs are common, i.e., to minimize the migration or leaching of treating chemicals into the environment, the methods for achieving the goal vary and are discussed in detail. **It is the responsibility of the treating firm to assure that materials leaving the plant destined, and so designated, for use in aquatic environments have been produced in compliance with the BMPs.**

BMPs are in a state of evolution. While this document represents the best available technologies and knowledge, efforts are continuing to develop better methods for risk assessment, to improve the BMPs themselves and to develop a quality assurance process for use by specifiers and regulatory agencies. Research continues in several areas including understanding the environmental impacts of the products, improved treating systems, opportunities to reduce the amount of chemical needed to achieve performance and development of new preservatives. As the knowledge increases the BMPs will be updated and improved.

BEST MANAGEMENT PRACTICES

UTILIZING the BMPs

There are four steps to assure products utilized in aquatic environments incorporate BMP produced materials.

1. Specify the appropriate material in terms of performancas defined in the American Wood-Preservers' Association Standards.

2. Specify that the material be produced in compliance with these BMPs.

3. Require assurance that the products were produced in conformance with the BMPs.

4. Provide for on site inspection prior to installation and conformance with any recommended installation practices.

BEST MANAGEMENT PRACTICES
SPECIFYING MATERIALS

A key step in designing a project in an aquatic environment is the specification of the treated wood to be used. There are a variety of available treated wood products approved for use in and/or above aquatic environments depending upon the intended use, species, required performance and environmental conditions. The specifier should recognize that, in terms of required retention levels (AWPA Standard) as well as potential environmental impacts, materials specified for applications above or over the water are distinctly different than splash zone or in water applications. The industry treats only with preservative chemicals registered for the specific uses by the Environmental Protection Agency. The most common products are those treated with Creosote, ACZA (Ammoniacal Copper Zinc Arsenate), ACA (Ammoniacal Copper Arsenate) and CCA (Chromated Copper Arsenate). Other preservatives approved for some uses in or above water are Penta (Pentachlorophenol), Copper Naphthenate and ACQ (Alkaline Copper Quaternary).

PERFORMANCE

The purpose of treating wood products is to provide protection from organisms that can attack or decay the wood, thus extending the useful life and structural performance of the material. The appropriate applications of each product, the required penetration, and the required retention (amount of preservative in the assay zone) are established by the American Wood-Preservers' Association in their Commodity (C) Standards which delineate the methods and results of product treatment. A brief description of appropriate applications for each preservative in aquatic environments is included in each specific BMP.

ENVIRONMENTAL AND AESTHETIC CONSIDERATIONS

In designing a project, one needs to consider the characteristics of various treated wood products in relation to the purpose of the project and the environmental characteristics of the site. For example, the environmental risks associated with treated wood placed directly in the water are different from those associated with wood placed over the water. Products used in a heavy industrial application will likely be different from those used in a public boardwalk. Similarly, the use of a moderate amount of treated wood in a fast flowing river poses minimal risks; whereas, the use of large amounts of treated wood in stagnant water may pose significantly greater risks.

Based on the best available science, pressure treated wood poses minimal risk to aquatic environments when used in accordance with the AWPA specifications; installed following the guidance provided in the treated wood Material Safety Data Sheets (MSDS); used in conformance with the Consumer Information Sheets; and produced using WWPI's Best Management Practices (BMPs). Where a large treated wood project is proposed in a poorly flushed body of water, WWPI recommends a site specific environmental risk assessment. The Western Wood Preserver's Institute will help you determine if an individual risk assessment is necessary.

For Further discussion of the environmental aspects of BMPs and specification, see “ENVIRONMENTAL CONSIDERATIONS AND FOR USING BMP TREATED WOOD IN AQUATIC PROJECTS” on Page 29.

BEST MANAGEMENT PRACTICES
for
CREOSOTE

USES AND SPECIFICATIONS

Creosote is accepted for a full range of salt and fresh water applications in the American Wood-Preservers' Association (AWPA) Book of Standards. The specific commodity standards that should be used to specify the preparation and use of various Creosote treated products used in and above aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 -- Piles
C14 -- Wood for Highway Construction
C18 -- Material in Marine Construction
C28 -- Laminated Beams

Specifiers and installers should follow the guidance in the Creosote treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the material in conformance with the Consumer Information Sheet for Creosote pressure treated wood. Creosote should not be used in those portions of projects subject to frequent public contact, i.e., handrails, sunbathing decks, etc.

BEST MANAGEMENT PRACTICES

In order to minimize the amount of Creosote material available to migrate into the environment, the following guidelines shall be used when treating material for use in marine applications:

TREATMENT PROCEDURES

• Treat using preservative specified in AWPA Standard P1/P13, "Standard for Coal Tar Creosote for Land and Fresh Water and Marine (Coastal Water) Use."

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

• The "in use" Creosote inventory maintained by the treating firm at the plant for aquatic applications shall be purchased, managed and/or processed such as to maintain a xylene insoluble (XI) of 0.5% maximum. (Exception -- A xylene insoluble (XI) level of 1.5% will be allowed for facilities treating Ponderosa or Southern Pine due to the problems associated with the sap and resins in these species).

• Techniques shall be incorporated into the treating process to minimize the amount of residual Creosote which may occur on the surface of the treated product. (Techniques may vary depending upon the product type and wood species).

• Conditioning — The wood must be conditioned using one of the techniques recommended in Standard C2 or C3 of the AWPA Book of Standards.

POST TREATMENT PROCEDURES

Prior to shipment, material for aquatic applications shall be processed under one of the following procedures as determined by the producer:

• Expansion Bath -- Following the pressure period the Creosote should be heated 10 to 20˚F above press temperatures for a minimum of one hour. Pump Creosote back to storage and apply a minimum vacuum of 24" for a minimum of 2 hours.

• Steaming — Following the pressure period and once the Creosote has been pumped back to the storage tank, a vacuum shall be applied for a minimum of two hours at not less than 22" of vacuum to recover excess preservative.

Release vacuum back to atmospheric pressure and steam for a two-hour time period for lumber and timbers and three hours for piling. Maximum temperature during this process shall not exceed 240˚F. Apply a second vacuum for a minimum of four hours at 22" of vacuum.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

The Creosote product shall be inspected visually to insure that there are no excessive residual materials or preservative deposits. If the material does not appear clean and dry it shall be rejected. Once on site and prior to installation the materials should be visually inspected in accordance with the above directions. Materials which have developed areas of “bleeding” or do not meet the criteria of a clean and dry appearance should be rejected. Good housekeeping is essential to avoid surface deposits and keep the product clean until shipment and installation.

TECHNICAL NOTES

The purpose of the BMPs for Creosote is to minimize the amount of surface residues which are available to migrate to the environment. The purchase of low xylene new Creosote and management processes to maintain low levels will assure that there are a minimum of contaminants on the surface of the finished product. The post conditioning requirements (e.g. steaming or expansion bath) help to assure that excess Creosote is removed from the product. This must be accomplished in a manner which does not reduce the amount of Creosote in the assay zone (retention) below that specified for the particular product and application.

Surface Sheen — When driving Creosote piling, a visible sheen will often develop on the water surface. This sheen represents a trace quantity of Creosote. In almost all instances the sheen will dissipate within 24-48 hours through biodegradation, evaporation or oxidation of the Creosote. Available data indicates that this sheen, which decreases rapidly following installation, will not harm aquatic life nor will it enter the food chain.

Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES
for
CCA

USES AND SPECIFICATIONS

CCA (Chromated Copper Arsenate) is accepted for a full range of salt and fresh water applications in the American Wood-Preservers' Association (AWPA) Book of Standards. The specific commodity standards that should be used to specify the preparation and use of various CCA treated products used in and above aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 -- Piles
C14 -- Wood for Highway Construction
C18 -- Material in Marine Construction

Specifiers and installers should follow the guidance in the CCA treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the product in conformance with the Consumer Information Sheet for Inorganic Arsenical Pressure Treated Wood.

BEST MANAGEMENT PRACTICES

The BMPs for CCA are to assure that fixation occurs prior to the material leaving the treating facility. In order to assure fixation, the following BMPs shall be followed:

TREATMENT PROCEDURES

• CCA-C treating solutions should be used in accordance with AWPA Standard P5, C2, and C3 for Waterborne Preservatives.

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

• Treat according to AWPA Standard C-1.

POST TREATMENT PROCEDURES

Apply appropriate post treatment procedures to achieve fixation. Achieving fixation using one of the following technologies is a function of time, temperature and humidity and must be adjusted based on the characteristics of the material and the process.

• Air Seasoning
• Kiln Drying
• Steaming
• Hot Water Bath

The best available technology for confirming fixation in CCA treated material is use of the **Chromotropic Acid Test** (AWPA Standard A3-11 [1995]). If testing shows that fixation has not been completed, the material should be withheld from shipment and/or installation until fixation is confirmed.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

The CCA treated product shall be visually inspected prior to leaving the treatment plant to insure that no excessive residual materials or preservative deposits exist.

TECHNICAL NOTES

CCA is considered an excellent treatment for many western softwoods including Hem-Fir, Western Hemlock and Ponderosa Pine. Achieving the required penetrations in Douglas Fir may be extremely difficult. CCA is not recommended for Douglas Fir marine piling (except as the first treatment in "dual treatment") or for treatment of interior Douglas Fir.

FIXATION — In the CCA treating process, water is the carrier to move the metals or active ingredients into the wood where they become fixed to the wood. Once the chemical reaction called "fixation" occurs, the active ingredients become highly insoluble.

While a complex reaction, fixation essentially involves the reduction of the hexavalent chromium to trivalent chromium with the formation of a complex mixture of insoluble chromates. In the process, insoluble arsenates of copper and chromium are also precipitated in the treated wood. Fixation is a function of temperature and time. It can be achieved in several hours in a high temperature environment (176˚F) but can take several weeks at a low temperature (40˚F). Studies show that at 77˚F, 98% fixation can be achieved in 120 hours.

Chromic acid or Chromium VI is the fixative in the CCA process. An absence of Chromium VI indicates that the reaction is complete. This relationship is the basis for the Chromotropic Acid test for evaluating fixation. The procedure can detect Chromium VI at concentrations of 15 parts per million or less. Material passing the test (i.e., no detection of Chromium VI) for use in aquatic environments will be 99.5 to 99.95% fixed. The Chromotropic Acid test is a rigid qualitative procedure specifically for CCA treated wood.

MAXIMUM CHEMICAL LOADING -- Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES
for ACZA

THIS SECTION SUPERCEDED BY AMENDMENT # 1 April 18, 2002

USES AND SPECIFICATIONS

ACZA (Ammoniacal Copper Zinc Arsenate) and ACA (Ammoniacal Copper Arsenate) are accepted for a full range of salt and fresh water applications in the American Wood-Preservers' Association (AWPA) Book of Standards. Because of its ability to treat Douglas Fir (as well as other species) ACZA/ACA is most prevalent on the west coast. The specific commodity standards that should be used to specify the preparation and use of various ACZA and ACA treated products used in and above aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 -- Piles
C14 -- Wood for Highway Construction
C18 -- Material in Marine Construction

BEST MANAGEMENT PRACTICES

The BMPs for ACZA/ACA are to ensure that fixation occurs prior to the material leaving the treating facility. In order to assure fixation, the following BMPs shall be followed:

TREATMENT PROCEDURES

• Treat using chemicals specified by AWPA Standard P5 for Waterborne Preservatives.

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

• After treatment by either the Bethel (full cell) process or the Lowry (modified empty cell) process, a final vacuum of 22" shall be applied for a minimum of two hours. The retort should be heated to between 180˚F and 210˚F during the vacuum process. Note: If the Lowry (modified empty cell) process can be used to obtain the specified product retention, it is the preferred process for products to be used in aquatic environments.

• After removal from the retort, the materials shall remain on the drip pad until all drippage has ceased.

POST TREATING PROCEDURES

Prior to shipment material for aquatic applications shall be processed under one or a combination of the following procedures:

• Minimum Plant Holding Time — Products (with treating stickers in place for sawn and plywood products) shall be held in a storage area with free air circulation for a minimum of three weeks at ambient temperatures equal to or exceeding 60˚F. If the ambient temperature is less than 60˚F, kiln drying or another source of artificial heat shall be used to achieve the 60˚F requirement.

• Post Treatment Kiln Drying — Products shall be kiln dried to a maximum oven dry basis moisture content of 30% in the specified treated zone employing a kiln cycle of 120˚F to 160˚F dry bulb temperature. ASTM Method D442-84, using increment boring, shall be used to determine that the moisture content requirement has been met.

• In-Retort Ammonia Removal Plus Plant Holding Time -- Plants equipped to follow this procedure will find it a highly effective method for ensuring fixation. After the final vacuum period, with heat, the retort door shall be opened and ambient air drawn through the treated wood charge from the door to the rear of the retort to a scrubber at a rate of 250 cfm, minimum, for a period of three hours. The treated wood product is then handled in the same manner as under "minimum plant holding time" described above except the minimum holding time is one week at ambient temperatures of 60˚ or more rather than three weeks.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

The ACZA/ACA treated product shall be visually inspected prior to leaving the treatment plant to insure that no excessive residual materials or preservative deposits exist.

TECHNICAL NOTES

Because of its ability to treat Douglas Fir (as well as other species), ACZA/ACA is most prevalent on the west coast for use in piling and aquatic applications.

"Fixation" is the term applied to the chemical reaction in which the active ingredients within the waterborne treating solution become fixed within the wood cells resulting in leach resistance and durability of the product. Failure to have achieved fixation at time of installation increases the potential for the treating chemicals to leach into the aquatic environment.

The key to the treating process for ACZA and ACA is the ammonia which facilitates carrying the active ingredients into the cell structure of the wood during the treatment process. When the ammonia is evaporated out of the product, the remaining ingredients become fixed and opportunity for leaching is minimized. If too much ammonia remains in the product when it is placed into an aquatic environment then chemicals can be released into the surrounding environment. The BMP procedures are designed to accelerate the removal of the ammonia and minimize the opportunity for chemical leaching.

MAXIMUM CHEMICAL LOADING -- Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES

for

ACQ

USES AND SPECIFICATIONS

ACQ (Alkaline Copper Quat) is accepted for a full range of salt and fresh water applications in the American Wood-Preservers' Association (AWPA) Book of Standards. The specific commodity standards that should be used to specify the preparation and use of various ACQ treated products used in and above aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C14 -- Wood for Highway Construction
C18 -- Material in Marine Construction

Specifiers and installers should follow the guidance in the ACQ treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA. Consumer Information Sheets are not required for ACQ.

BEST MANAGEMENT PRACTICES

The BMPs for ACQ are to assure that fixation occurs prior to installation of the material. In order to assure fixation, the following BMPs shall be followed:

TREATMENT PROCEDURES

• ACQ treating solutions should be used in accordance with AWPA Standard P5 and C2.

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

• Treat according to AWPA Standard C-1

POST TREATMENT PROCEDURES

Apply appropriate post treatment procedures to achieve fixation. Achieving fixation using one of the following technologies is a function of time, temperature and humidity and must be adjusted based on the characteristics of the material and the process.

• Air Seasoning
• Kiln Drying

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

The ACQ treated product shall be inspected visually prior to leaving the treatment plant to insure that no excessive residual materials or preservative deposits exist.

TECHNICAL NOTES

ACQ is considered an excellent treatment for many western softwoods including Hem-Fir and Douglas Fir because of its ability to achieve standard penetration and retention of preservative in these difficult to treat species.

ACQ is not recommended for saltwater immersion applications.

MAXIMUM CHEMICAL LOADING -- Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES
for
DUAL TREATED MARINE PILING

USES AND SPECIFICATIONS

Due to the extreme hazard from marine organisms in some waters, dual treated piling is often specified (C18). In dual treating, the piling is first treated with a waterborne preservative (CCA, ACZA or ACA) after which the piling is treated a second time with Creosote.

BEST MANAGEMENT PRACTICES

The BMPs for dual treating require that individual BMPs for each preservative be specified for the treatment unless the same objectives can be obtained through a combined practice. Dual treatment on the Pacific coast is generally only required or preferred in coastal areas south of San Francisco, California.

BEST MANAGEMENT PRACTICES
for
COPPER NAPHTHENATE

USES AND SPECIFICATIONS

Copper Naphthenate treated wood has limited uses in aquatic applications and is used more in above water applications. It is accepted for freshwater applications in the American Wood-Preservers' Association (AWPA) Book of Standards. Copper Naphthenate is not a restricted use pesticide and is commonly used for field treating holes and field fabrication cuts in treated wood applications. The specific commodity standards that should be used to specify the preparation and use of various Copper Naphthenate treated products used above freshwater aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 -- Piles
C14 -- Wood for Highway Construction

Specifiers and installers should follow the guidance in the Copper Naphthenate treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA. Consumer Information Sheets are not required for Copper Naphthenate.

BEST MANAGEMENT PRACTICES

The BMPs for Copper Naphthenate are to assure a clean product and minimize the potential for chemicals to enter the aquatic environment.

In order to minimize the amount of Copper Naphthenate material available to migrate into the environment, the following guidelines shall be used when treating material for use in marine applications:

TREATMENT PROCEDURES

• Treat using Copper Naphthenate which meets AWPA P8, Section 2. The solvent used shall meet the requirements of AWPA Standard P9, Hydrocarbon Solvent, Type A or Type C, depending on the product being treated and the specifications.

• Solution Filtration — The Copper Naphthenate solution in use shall be filtered or otherwise kept clean regularly to remove solids which may otherwise be deposited on the wood during treating.

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment.

POST TREATMENT PROCEDURES - OIL CARRIER

For Copper Naphthenate treated products with an oil carrier to be used in an aquatic environment, use one or both of the following BMPs:

• Expansion Bath — This process increases the temperature of the preservative solution surrounding the wood for the purpose of recovering excess preservative and improving surface cleanliness of the product.

Use a minimum expansion bath of one hour. The maximum temperature of the expansion bath shall be 220˚F or 230˚F depending on the specific commodity standard limitations.

The expansion bath shall be followed by a vacuum period using a minimum of 22" for a minimum of two hours.

• Final Steaming — Following the pressure period and once the Copper Naphthenate has been pumped back to the storage tank, a vacuum shall be applied for a one hour minimum at not less than 22" of vacuum to recover excess preservative. Following the vacuum period, the wood shall be subjected to steaming for a two-hour time period for lumber and timbers and three hours for piling per the limitations of the AWPA Commodity Standards. The minimum temperature during steaming shall be 200˚F and the maximum shall be 240˚F to 245˚F depending on the species being treated. After steaming, apply a final vacuum for a minimum of four hours at 22" of vacuum.

POST TREATMENT PROCEDURES - “LIGHT” SOLVENT CARRIER

For Copper Naphthenate treated products with a light solvent carrier, such as AWPA Standard P9, Type “C” solvent for aquatic environment applications, use the following BMP:

• A final vacuum shall be used for a minimum of 1 hour at a minimum of 22" vacuum.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

Prior to shipment and/or installation in aquatic environments, visually inspect the treated wood product and reject any pieces with excessive surface residue. Note, however, that an oil carrier may be detected in a surface wipe of a properly treated and acceptable product. Avoid excessive solids or grease-like deposits which can be scraped off the surface. Also, reject material where liquid preservative “bleeds” from the product.

FIELD TREATING GUIDELINES

Copper Naphthenate based solutions are commonly used in field treating of holes, cuts or injuries which occur to the treated product. The objective of field treatment is to assure complete product treatment.

The following guidelines should be followed in field treating aquatic projects:

- Follow the procedures outlined in AWPA Standard M4, Standard for the Care of Preservative-Treated Wood Products.
- When field treating by brushing, spraying, dipping or soaking do so in such a manner that the preservative does not drip or spill into the aquatic environment or onto the soil.
- Whenever possible, apply field treatments prior to assembling the structure over the body of water.
- Conduct the application of the preservative so that any overspray or drippage of preservative can be recovered or retained.

TECHNICAL NOTES

MAXIMUM CHEMICAL LOADING -- Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provided by treating.

BEST MANAGEMENT PRACTICES
for
PENTACHLOROPHENOL (PENTA)

USES AND SPECIFICATIONS

Pentachlorophenol (Penta) is a preservative that has limited uses in aquatic environments, but has a number of above water applications. The specific commodity standards that should be used to specify the preparation and use of various Penta treated products used in freshwater, or above the splash zone in marine aquatic environments are:

C2 -- Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 -- Piles
C14 -- Wood for Highway Construction
C28 -- Laminated Beams

Specifiers and installers should follow the guidance in the Pentachlorophenol treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by OSHA and use the product in conformance with the Consumer Information Sheet for Pentachlorophenol pressure treated wood.

BEST MANAGEMENT PRACTICES

The BMPs for Penta are to ensure responsible treatment and product use. Its use in marine projects should be limited to above the splash zone because Penta does not protect against marine organisms. In order to minimize the amount of Penta material available to migrate into the environment, use the following guidelines when treating material for use in marine applications:

TREATMENT PROCEDURES

Manage the treating plant's "in-use" Penta by continuous filtration or other available methods to maintain the solution with minimum particulate matter. Such processes will result in less surface deposits, minimizing the amount of material which may be released from in-service wood.

• Treating Recommendations — While there are various pressure and thermal treatment methods, a common wood treating process using Penta is called the "empty cell" process. The wood may be treated using the empty cell (Rueping or Lowry) process according to the applicable AWPA Standards, Sections C2, C3 and C4, including appropriate post treatment steps such as vacuums, expansion baths in oil, and post steaming to clean the wood surface.

• Follow good housekeeping practices to minimize sawdust and other surface residues on the wood products prior to treatment. If necessary, power wash to remove excess surface deposits.

• Conditioning — Remove the water prior to treatment. Reduce the wood's moisture content by one of several conditioning processes which includes air seasoning, kiln drying, in-cylinder steaming and subsequent vacuum, or heating under a vacuum in the presence of the treating solution followed by a vacuum (Boultonizing).

• Preservative Impregnation — With the dried wood in the treating cylinder, apply initial air pressure. The initial air amount is dictated by the dryness of the wood, the species of wood being treated, plant equipment capabilities and the target retention level. Initial pressures in the range of atmospheric to 50 psi are common.

After achieving the desired initial air pressure, pump the treating solution into the treating cylinder, and maintain the air pressure while filling the cylinder. Supply additional treating solution into to the cylinder until attaining a calculated gross injection.

POST TREATMENT PROCEDURES

Following injection, relieve pressure and remove excess solution from the cylinder followed by a vacuum application to encourage removal of excess preservative and pressurized air from the wood cells.

• Surface treatment — Incorporate one of the following procedures into the treating process to minimize the amount of residual treating which may occur on the treated product surface. Techniques may vary depending upon the product type and wood species.

> • Steaming — After applying the vacuum to the treating cylinder for a period of time, apply final steaming to remove excess preservative solution from the surface of the wood.
>
> • Expansion Bath — When final steaming is not utilized the treater may use an expansion bath. Perform this expansion bath in accordance with AWPA Specification 2.23 of C1.

Following the above procedures should result in a clean and dry treated wood product.

MAXIMUM CHEMICAL LOADING

Treating shall be conducted in such a manner as to seek to minimize the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements.

VISUAL INSPECTION

Visually inspect the Penta product to insure no excessive residual materials or preservative deposits exist. If the material does not appear clean and dry, it shall be rejected. Once on the site and prior to installation, visually inspect the materials in accordance with the above directions. Reject materials which have developed areas of “bleeding” or those that do not meet the clean and dry appearance criteria. Good housekeeping is essential to avoid surface deposits and keep the product clean until shipment and installation.

TECHNICAL NOTES

Surface Sheen — When driving Penta treated wood, a visible sheen may develop on the water surface. This sheen contains a negligible quantity of Penta as there is generally less than 1% Penta in Penta treated wood. In nearly all instances this sheen will cease in less than 24 hours through bio and photodegradation. Available data indicates that this sheen does not represent any harm to aquatic life nor will it enter the food chain. It is basically an aesthetic concern which decreases rapidly following installation.

MAXIMUM CHEMICAL LOADING -- Earlier efforts to set precise maximum chemical loading levels have proven technologically unachievable due to the inherent variability found in wood including cell structure and amount of sap versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards consistent with maintaining the needed protection provide by treating.

BEST MANAGEMENT PRACTICES
for
QUALITY CONTROL & PRODUCT ASSURANCE

BMPs — A SHARED RESPONSIBILITY

While the wood treating industry supports and encourages the use of the BMPs for aquatic applications of its products, it is a free enterprise industry and compliance cannot simply be assured. The significant increased cost of the BMPs create an incentive for some producers to avoid the extra efforts. **It is the government agency regulators and project specifiers who have the ability to ensure BMPs implementation. Until a more standardized system is developed (see discussion below), BMP use can be immediately implemented by:**

•Regulators, in approving projects, and designers, in specifying materials should require that "the treated wood products used in this project shall be produced in accordance with the most current version of the Best Management Practices for Treated Wood in Western Aquatic Environments, as per the Western Wood Preservers Institute and Canadian Institute of Treated Wood."

• The producer of the products should be required to provide a "written certification that BMPs were utilized including a description and appropriate documentation of the BMPs used."

FUTURE QUALITY ASSURANCE & THIRD PARTY INSPECTION

In addition to continuing efforts to improve and refine the BMPs, the treated wood industry is in the process of developing a BMP quality assurance identification mark linked with a third party inspection system. The inspection would provide oversight to ensure that the plants are properly and consistently utilizing the BMPs and that the products meet the BMP required results. It is WWPI's goal to implement such a system in 1997.

BEST MANAGEMENT PRACTICES

ENVIRONMENTAL CONSIDERATIONS FOR USING BMP TREATED WOOD IN AQUATIC PROJECTS

Preservatives protect wood by inhibiting fungal and borer attack. The effectiveness of these treatments is achieved by forcing naturally occurring metals (copper, chromium, zinc, arsenic) or polycyclic aromatic hydrocarbons (PAH) into the wood under pressure. In properly treated wood, preservatives are stable and minimal amounts are lost. However, the biological risks associated with these releases have caused concern within some government regulatory agencies. In response to these concerns, the Institutes have commissioned extensive literature reviews and environmental risk analyses associated with the major preservative treated wood products utilized in aquatic environments. Through these ongoing efforts, over 7000 pages of information regarding these risks have been reviewed and analyzed. This research effort resulted in the production of detailed risk assessment documents and computer risk assessment models for creosote, CCA and AZCA which discuss and quantitatively predict the environmental levels of preservatives associated with treated wood products. In addition to these currently available tools (see summary discussions below), a similar analysis and model is nearing completion for ACQ. These tools, available through the Institutes, are intended to allow the regulator or specifier to assess the potential environmental impact of using treated wood products where site specific information justifies such analysis. Such intense review and modeling is not considered appropriate for preservatives normally limited to above water uses such as Penta, and Copper Naphthenate.

ENVIRONMENTAL RISKS ASSOCIATED WITH CREOSOTE

The compounds of concern in creosote are called polycyclic aromatic hydrocarbons (PAH). These compounds are naturally produced and have been ubiquitous on earth since carbon was first fixed in organic compounds. Annual inputs of PAH to aquatic environments, from all sources, is estimated at half a billion pounds worldwide. Much of this input is from natural sources such as forest fires. However, inputs from cities and industry can result in the localized accumulation of PAH, in sediments, to levels that are toxic to aquatic organisms.

Polycyclic aromatic hydrocarbons are hydrophobic and rarely occur in the water column at levels that are toxic to aquatic organisms. In healthy sediments, with adequate oxygen, naturally occurring microbes metabolize PAH. However, where sediments are devoid of oxygen, these compounds can accumulate to levels that cause acute and chronic toxicity in a variety of fish and invertebrates.

The use of creosote treated piling in fast flowing water with sandy or gravely substrates generally poses no risk. However, the use of large amounts of creosote treated wood in very poorly flushed waterbodies, especially those with muddy sediments that lack oxygen, can result in the accumulation of toxic levels of PAH. To help identify these high risk areas, WWPI has sponsored the creation of computer models which predict the accumulation of PAH in sediments as a function of several important parameters. Testing the creosote model under two worst case studies in Canada demonstrated its ability to very accurately predict sediment levels of PAH.

These models suggest that maximum concentrations of PAH occur within a few inches of a piling. Further, these models can be used to determine the minimum current speeds required, as a function of the amount of oxygen in the sediments, to help protect our aquatic resources against toxic levels of PAH. Table 1 can be used to predict conditions where individual site assessments are warranted.

This table is based on a sediment Total Organic Carbon (TOC) content of one percent. Different levels of TOC will result in different requirements. In open marine or freshwater environments, maximum currents are generally greater than 8 to 10 centimeters per second. The RPD is the Reduction Oxidation Potential Discontinuity. This is the depth at which the sediment color turns from gray-green to black. It is measured in centimeters below the sediment surface.

Minimum current speeds required to protect aquatic life are significantly less in constantly flowing water. The use of moderate amounts of creosote treated wood (fewer than five piling in a row parallel with the currents) is not likely to effect aquatic resources where the current speed is greater than 10 cm/sec. Where sediments are well oxygenated (RPD > 3 cm), current speeds as slow as 3 cm/sec are adequate to protect aquatic life.

TABLE 1

Minimum current speeds necessary to prevent unacceptable levels of PAH from accumulating in marine sediments with varying levels of oxygen (measured by the depth of the Redox Potential Discontinuity in centimeters).

Depth of the RPD	Minimum Currents Required*
0.0 cm	31.0 cm/sec
0.1 cm	14.5 cm/sec
1.0 cm	8.0 cm/sec
2.0 cm	4.0 cm/sec
>3.0 cm	3.0 cm/sec

*These currents should be measured three hours before, or after, slack tide on a tidal exchange to mean low water (18.6 year average of all low tides).

For a more detailed examination of these issues, please refer to the Creosote Risk Assessment documents and the CREORISK model. Both of these documents are available through the Institutes.

The following briefly summarizes environmental concerns regarding the use of creosote:

1. Water column levels of PAH associated with creosote treated wood do not pose significant risks in open bodies of water.

2. An in-depth analysis of creosote use in association with drinking water fully supports the EPA Consumer Information Sheet which allows the incidental use of creosote treated wood in drinking water supplies.

3. When large creosote projects are contemplated in poorly circulated water bodies where sediments contain low oxygen levels, a site specific risk assessment should be undertaken.

ENVIRONMENTAL RISKS ASSOCIATED WITH CCA -TREATED WOOD

The waterborne preservative CCA relies on copper and arsenic to protect wood. These naturally occurring metals are fixed in the wood fibers by the presence of chromium. However, small amounts do leach from preserved wood during the early stages of immersion. The CCA risk assessment clearly shows that copper is the metal of concern in aquatic environments. While copper is not a human toxicant (the water pipes in our homes are made of copper), it can be toxic at levels as low as six parts per billion to the embryos of sensitive bivalves and echinoderms. An exhaustive review of the published literature indicates that the EPA's fresh and marine water quality criteria for copper are adequate to protect all aquatic life.

Unlike the sediment concerns with PAHs found in creosote, dissolved copper in the water column presents the highest risk to aquatic organisms. Literature reviews and the predictions made by the CCARISK computer model suggest that if water column levels of copper are maintained below 2.9 parts per billion, then sediment levels of copper, chromium and arsenic will be well below thresholds associated with stress or disease.

The CCA piling risk assessment model indicates that water column copper levels associated with the use of a single CCA piling are approximately 25% of the EPA criteria when maximum currents are as slow as 0.5 cm/sec. Maximum currents this slow are rarely encountered in open aquatic marine environments. Projects located in constantly flowing rivers pose even less risk and steady state current speeds as slow as 0.1 cm/sec are sufficient to protect aquatic life. Therefore, in nearly all open environments, we can predict that CCA treated piling will have little, or no, impact on aquatic resources.

Bulkheads treated with CCA pose a different problem and the models predict that the EPA marine quality copper standard can be exceeded when maximum tidal currents are less than 4.0 cm/sec. Maximum currents this slow can be encountered in residential canals and other poorly circulated bodies of water. We recommend site specific risk assessments when bulkheads are proposed in any poorly circulated body of water. However, when maximum current speeds are greater than 5.0 cm/sec, or in open water bodies with significant wave action, CCA treated bulkheads will not lose enough copper to exceed EPA water quality criteria, even during the first few days after installation.

Leaching data from a variety of sources accumulated over the last 28 years indicates that copper losses from CCA treated wood are time dependent and that losses are very small after 90 days. Recently completed leaching studies on piling that had been previously immersed in sea water for 16 months have confirmed previous predictions that long term copper losses are approximately 4% of the initial losses upon which environmental risks are based.

Where large surface area projects are proposed at poorly circulated sites, the project should be constructed during that time of year when sensitive bivalve and echinoderm larvae are not present (usually in late fall and winter). In addition, these are generally seasons of increased water circulation due to wind and wave action.

ENVIRONMENTAL RISKS ASSOCIATED WITH ACZA -TREATED WOOD

Ammoniacal Copper Zinc Arsenate (ACZA) is an improved preservative that replaces half of the arsenic in ACA with zinc. This preservative is suitable for treating difficult woods such as Douglas fir. The naturally occurring arsenic, copper and zinc metals used in ACZA are fixed to the wood fibers following evaporation of an ammonia carrier. However, small amounts of metal do leach from preserved wood during the early stages of immersion. The ACZA risk assessment clearly shows that copper is the metal of concern in aquatic environments. While copper is not a human toxicant (the water pipes in our homes are made of copper), it can be toxic at levels as low as six parts per billion to the embryos of sensitive bivalves and echinoderms. An exhaustive review of the published literature indicates that the EPAís fresh and marine water quality criteria for copper are adequate to protect all aquatic life.

Unlike the sediment concerns with PAHs found in creosote, dissolved copper presents the highest risk to aquatic organisms. Literature reviews and the predictions made by the ACZARISK computer model suggest that if water column levels of copper are maintained below EPA water quality copper criteria, then sediment levels of copper, zinc and arsenic will be well below thresholds associated with stress or disease.

Slightly more copper is lost from ACZA treated wood during the first week to 10 days than is lost from CCA treated piling. However, metal losses decline more quickly in ACZA treated wood, and reach very low values in less than two weeks. The ACZA model predicts that minimum current speeds (measured three hours before or after slack tide on an exchange to mean low water) of 1.0 cm/sec are sufficient to insure that copper losses from a single ACZA treated piling do not elevate marine water copper concentrations by an amount equal to the EPA marine water quality criteria (2.9 ppb). In constantly running water, such as rivers, a minimum current speed of 0.5 cm/sec is required to meet EPA fresh water quality criteria (assuming background copper levels are at 1.5 ppb. Very few rivers and streams have current speeds this slow. Even backwater estuaries typically have current speeds greater than three or four centimeters per second. The 1.5 ppb background copper level is typical of western rivers such as the Columbia River.

Bulkheads treated with ACZA pose a different problem and the models predict that EPA water quality standards can be exceeded during the first few days following installation when steady state current speeds are less than 18.5 cm/sec in fresh water and when maximum tidal currents are less than 13 cm/sec in marine environments. These are typical current speeds in open rivers and marine environments. However, currents slower than these can be encountered in quiet riverine backwaters and protected marine embayments. We recommend a site specific risk assessment whenever an ACZA bulkhead is proposed for use in the water.

Leaching data indicates that metal losses from ACZA treated wood are time dependent, and that losses are very small after one or two weeks. When large surface area ACZA projects are proposed at poorly circulated sites, the project should be constructed during that time of year when sensitive aquatic species, including migrating salmon, are not present (usually in winter). In addition, these are generally seasons of increased water circulation due to wind and wave action.

SUMMARY

It is the view of the Western Wood Preservers institute and the Canadian institute of Treated Wood that, based on the best available scientific information, the combination of the AWPA treating standards and BMPs for Creosote, CCA, ACZA, ACA, ACQ, Copper Naphthenate and Pentachlorophenol will produce products that provide excellent environmental performance in most open aquatic environments. Projects calling for large volumes of treated wood immersed in (i.e., below the splash zone) poorly circulating bodies of water should be evaluated on an individual basis utilizing risk assessment procedures. The Institutes will assist treated wood users in determining when a risk assessment is needed and in providing documentation to assist in the completion of a risk assessment, when required.

NOTE: USA AND CANADIAN VERSIONS

Both a USA and Canadian version of this document have been prepared. However, the differences are minimal, reflecting only the slight differences in the appropriate product standards between those of the American Wood Preservers Association and the Canadian Standards Association.

DISCLAIMER

The Western Wood Preservers Institute and the Canadian Institute of Treated Wood believes the information contained herein to be based on up-to-date scientific and economic information and intended for general informational purposes. In furnishing this information, the Institutes make no warranty or representation, either expressed or implied, as to the reliability or accuracy of such information; nor do the Institutes assume any liability resulting from use of or reliance upon the information by any party. This document should also not be construed as a specific endorsement or warranty, direct or implied, of treated wood products or preservatives, in terms of performance, environmental impact, or safety. The information contained herein should not be construed as a recommendation to violate any federal, provincial, state or municipal law, rule or regulation, and any party using or producing pressure treated wood products should review all such laws, rules or regulations prior to using or producing treated wood products.

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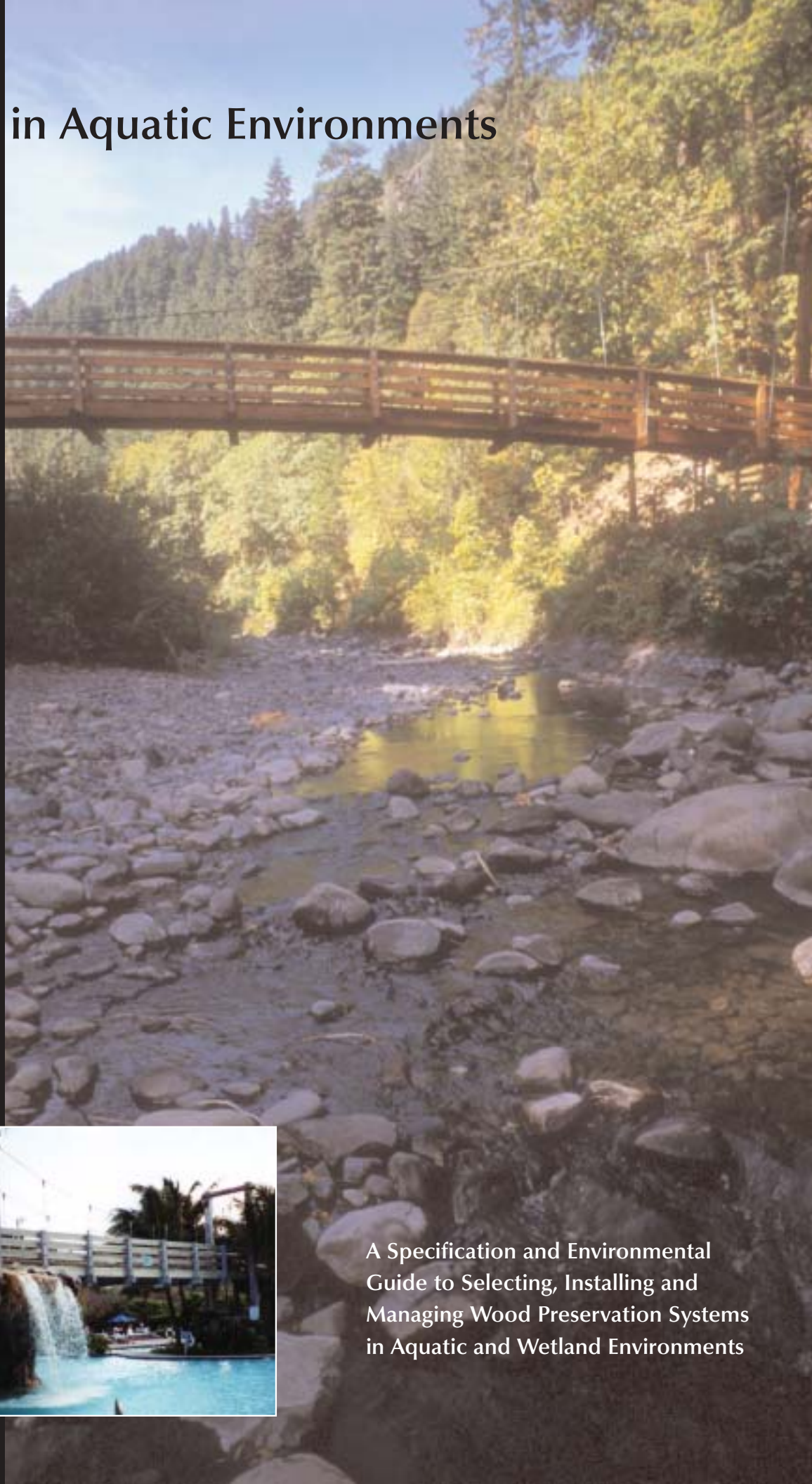
Volume II
Section IV
WWPI Documents

3. Treated Wood in Aquatic Environments. Semi-technical document. Has section on selection of preservative with retention recommendations. Also has WWPI risk matrix.

Treated Wood in Aquatic Environments



TimberPilingCouncil
FOUNDATION & MARINE PILING

A Specification and Environmental Guide to Selecting, Installing and Managing Wood Preservation Systems in Aquatic and Wetland Environments

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Your Internet Companion Additional materials and references are provided throughout this document and are all available via the Internet at www.WWPInstitute.org, www.spta.org, www.timberpilingcouncil.org

- **If you are** *viewing this document online*, **you need only double click on the reference indicated by blue or green print and a number (1).**
- **If you are** *working from a hard copy* **and want to check the referenced materials: Go to one of the sites, select "Treated Wood in Aquatic Environments" and then select "Guide Companion." Simply click on the number (1), (2) etc. of the text reference and it will take you to the document and/or specific reference area.**

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5 Best Management Practices Mark

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Terminology

To take full advantage of this guide, it will be important to understand critical terminology referred to throughout the publication. Following are definitions you'll need to know.

Standards The American Wood-Preservers' Association (AWPA) is the national standards-setting organization for treated wood in the U.S. and its counterpart in Canada is the Canadian Standards Association (CSA). The consensus standards of these two organizations establish what preservatives and chemical formulations are appropriate for common applications; set treating procedures; establish wood species requirements and testing procedures. The AWPA standards establish treatment requirements for wood products in Standard U1, "Use Category System: User Specification For Treated Wood." Section 2 of the standard will guide users to the appropriate Commodity Specifications in Section 6. These include the specifications for sawn products, posts, crossties and switchties, poles, round timber piling, wood composites, marine (salt water) applications, fire retardants and nonpressure applications.

Best Management Practices (BMPs) These are a set of environmental guidelines established by the Western Wood Preservers Institute and Wood Preservation Canada for products used in aquatic applications. They are formally known as the *Best Management Practices for the Use of Treated Wood in Aquatic Applications* (BMPs). Inspection services and a BMP Certification Mark program are available for BMP materials.

Consumer Information Sheets or Consumer Safety Information Sheets For wood treated with restricted-use preservatives, EPA has approved Consumer Information Sheets (CIS) and Consumer Safety Information Sheets (CSIS) to provide guidelines for safe and appropriate use of these materials. In addition, producers will provide Material Safety Data Sheets (MSDS) for the treated wood.

Incising Many species, such as western softwoods, do not accept pressure treating easily and must be *incised* to ensure adequate penetration to meet the treating standards. Incising is a process where small cuts are made on the wood surface in a regular pattern to enhance preservative penetration. Incising does *not* need to be specified since the requirements for each species are included in the AWPA C Standards. For aesthetic reasons, designers may choose species which do not require incising in the standards; others may forego incising on non-structural components of a project, recognizing the wood will not meet AWPA standards, although this practice is not recommended.

Penetration In general, only a shell of material around the perimeter of the wood is treated. *Penetration* is the measure of how deep the treatment extends into the wood. Required minimum penetration depths and percentage of sapwood treated are stipulated for each wood species, type of preservative and end use by AWPA standards. Project engineers and end users *do not* need to specify penetration depth, but instead merely the acceptable wood species, preservatives, AWPA Standard U1, and applicable Use Category.

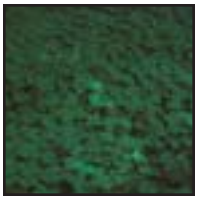
Pressure Treatment The term *pressure treated wood products* generally refers to wood products that have been treated in a pressure cylinder, called a *retort*, in a highly controlled process using pressure to force the needed amount of preservative chemical into the wood. Depending upon the preservative system, the wood may be conditioned prior to treatment through drying or in the retort using steam and vacuum processes. Finally, the retort is filled with the treating solution in either a water- or oil-based carrier; then pressure is applied and held for a set amount of time. At the end of the treating cycle, the cylinder is drained and excess preservative is drawn off with vacuum before the wood is removed to the drip pad area, where it is held until free of preservative drippage. Sample borings are taken and tested to be sure the material *penetration* and *retention* standards have been met.

Quality Assurance Structural materials produced by the industry are subject to plant quality control procedures and third-party inspection to assure compliance with the AWPA standards. Building codes require that all treated wood used in structural applications must be inspected by an American Lumber Standard Committee (ALSC) accredited third-party agency.

Registered Preservatives Wood-treating chemicals are pesticides and as such go through rigorous periodic review by the Environmental Protection Agency, Health Canada's Pesticide Management Regulatory Authority (PMRA), and/or state agencies. These detailed scientific health and environmental studies establish if the chemical will be registered as a wood preservative, and if so, what conditions apply. They may be classed, as most are, as restricted-use pesticides that can only be used by certified applicators in approved treating plants and only for certain uses. Alternatively, they may be classified as a general use pesticide and available for treatment of wood used for non-industrial applications as well as for field treating of drill holes or abrasions in treated materials.

Retention Retention is a measure of the amount of treatment chemical present in the portion of wood called the assay zone. It is measured in *pcf* – pounds of preservative per cubic foot – or kg/m^3 of the assay zone. Retention is cited in the Standards both as pcf and in kilograms per cubic meter, but this document will use only pcf. In AWPA standard U1, minimum retention values are defined by reference to the applicable Use Category in each commodity specification. Although retention values are included in this document for your information, when specifying, reference the applicable Use Category to ensure the proper retention level.

Treated to Refusal Sometimes hard-to-treat materials are placed in the treating cylinder (retort) for a long period at a given pressure to force as much preservative into the wood as possible. Often such materials *do not* meet the penetration and/or retention requirements. *Treated to Refusal* material should *not* be accepted in lieu of material inspected and marked as meeting the specified retention.



Why Treated Wood?

Wood's structural, economic, environmental and aesthetic benefits make it the preferred building product in a wide variety of construction applications – including bridges, boardwalks, piers and structures in or near our waterways and wetlands.

Wood's one weakness is its susceptibility to attack by natural enemies - marine borers, insects, decay and fungus. For most species, this means its useful life in open environments can be measured in terms of only a few years. Over the past century a variety of wood preserving treatments have been developed that introduce a small controlled amount of protective preservative into wood cells. The life of treated wood products can now be measured in terms of decades, not years.

For well over a century, treated wood has played an essential role in the economic prosperity and quality of life in North America. From the ties that carry the trains; to the poles that carry communications and power; to bridges that cross our rivers; to docks and piers that support recreation and commerce; to boardwalks that allow school children to view the wonders of sensitive wetland habitats, treated wood has been the preferred, time-proven material.

The environmental awakening of our society in the second half of the twentieth century brought an appropriate and continuing review of treated wood. Wood-treating chemicals became regulated by the environmental agencies, which produced guidelines intended to protect human health and the environment.

It was not until the 1990s that the potential impacts of treated wood used in our most sensitive ecosystems – aquatic environments – was the focus of close scientific study. Various governmental agencies, universities and the wood treating industry have undertaken extensive efforts to understand the potential effects of treated wood in aquatic environments. This continuing work has produced a substantive base of scientific knowledge about the behavior of treated wood and the level of risk it represents when used in aquatic environments. A worldwide review failed to find a single case where appropriately produced and installed treated wood products resulted in a significant adverse environmental impact. Studies of treated wood in the most sensitive aquatic environments have shown that the risks associated with treated wood are small and easily manageable.

Protection of water quality and diversity of various life forms found in the lakes, streams, estuaries, bays and wetlands of North America is a responsibility shared by every private and corporate citizen. The treated wood industry is committed to actively supporting this important societal value. The purpose of this guide is to help you understand the facts and provide the tools and guidance to ensure that treated wood products are selected, specified and used in an environmentally appropriate manner.

Five Steps to Appropriate Use of Treated Wood in Aquatic Environments

This guide will help you understand the science and learn how to select and manage your use of treated wood to achieve the performance your project requires while minimizing the potential for any adverse environmental impacts. The process begins at project conception and tracks all steps through installation and maintenance.

The five basic steps are:

1. **Selecting the Proper Preservative and Retention Level**
2. **Environmental Considerations and Evaluations**
3. **Specifying the Best Management Practices**
4. **Providing Quality Assurance and Certification**
5. **Appropriate Handling, Installation and Maintenance**

Step 1: Selecting an Appropriate Preservative and End Use Category

(8) *U.S. Forest Products Lab*

To use treated wood appropriately, you need to fully understand your treatment options and how to select and specify material for different uses. A more extensive discussion of Wood Preservation can be found in the U.S. Forest Products Lab (FPL) Wood Handbook.

The initial step in specification for a particular application (piling, decking) is to determine the desired preservative for the project and select the appropriate End Use Category. These judgments should be made in conjunction with the environmental evaluation in Step 2.

Treatments Available for Use in Aquatic and Wetland Projects

While AWPA has identified 27 different preservative systems, only seven are commonly available and designated for freshwater and/or marine aquatic uses by AWPA standards and governmental registrations. These preservative systems can be divided into two general categories – Waterborne and Oil-type systems. The distinctions between them follow.

Waterborne Systems

(8A) *U.S. Forest Products Lab*

In waterborne systems, water is the carrier for the preservative chemicals. The chemicals react or precipitate into the wood substrate and become attached to wood cells, minimizing leaching. There are five main waterborne preservatives used in aquatic applications:
CCA – Chromated Copper Arsenate; **ACZA** – Ammoniacal Copper Zinc Arsenate;
ACQ – Alkaline Copper Quat; and **CA-B** – Copper Azole.

(9) *Preservative-specific Links*

Waterborne preservatives leave a dry, paintable surface and are commonly used in aquatic projects such as docks, boardwalks and bulkheads. For a detailed discussion of the preservative formulations in waterborne systems, refer to the U.S. Forest Products Lab Handbook or specific chemical manufacturer's web sites.

Oil-type Preservatives

In oil-type systems the preservative is 100 percent active (creosote) or dissolved in an oil-based solvent. The mixture then fills or coats the wood cell walls during treatment. There are three oil-type preservatives that are used in aquatic or wetland applications: **Creosote, Pentachlorophenol** and **Copper Naphthenate**.

(6) *Consumer Information Sheets or Consumer Safety Information Sheets*

Oil-type preservatives are commonly used to treat round, solid-sawn and laminated products used in aquatic applications for piling, timbers, bulkheads, bridges and boardwalks. Because of their oil carrier and possible aroma, they are not acceptable for applications involving frequent or prolonged skin contact or interior uses unless the wood is sealed.

(8B) *U.S. Forest Products Lab*

The oil present in these preservative systems also acts as a water repellant and can help limit checking and splitting. You may select the type of carrier oil to meet specified uses – such as selecting light solvents where a clear untreated appearance is desired with Penta or Copper Naphthenate. For a detailed discussion of the preservative formulations for oil-type preservatives, refer to the U.S. Forest Products Handbook.

Selecting the Appropriate End Use Category

AWPA Standard U1, The Use Category System: User Specification for Treated Wood, is based on the end use hazard, similar to other international standards for wood treatment. The Use Category System (UCS) is used to specify the wood treatment based on the desired wood species and the environment of the intended end use. There are six Use Categories which describe the exposure conditions that wood may be subject to in service. Use categories 3, 4 and 5 have multiple risk levels.

Use Category UC1 Wood and wood-based materials used in interior construction not in contact with the ground or foundations.
Use Category UC2 Wood and wood-based materials used for interior construction that are not in contact with ground, but may be subject to dampness. These products are continuously protected from the weather but may be exposed to occasional sources of moisture.
Use Category UC3A Wood and wood-based materials used for exterior construction that are coated and not in contact with the ground. Such products may be exposed to the full effects of weather, such as vertical exterior walls or other types of construction that allows water to quickly drain from the surface.
Use Category UC3B Wood and wood-based materials used in exterior construction and not in contact with the ground. Materials do not require a coating, but may be finished to achieve a desired aesthetic appearance. (Retentions above the minimum specified for materials in the use category may be required for products where the individual components are difficult to maintain, repair or replace and are critical to the performance and safety of the entire system).
Use Category UC4A Wood and wood-based materials used in contact with the ground, fresh water, or other situations favorable to deterioration.
Use Category UC4B Wood and wood-based material used in contact with the ground either in a severe environment, such as horticultural sites, in climates with a high potential for deterioration, in critically important components such as utility poles, building poles and permanent wood foundations, and wood used in salt water splash zones.
Use Category UC4C Wood and wood-based material used in contact with the ground either in a severe environment, or climates demonstrated to have extremely high potential for deterioration, in critical structural components such as land and fresh water piling and foundation piling, and utility poles located in a semi-tropical or tropical environment.
Use Category UC5A Wood and wood-based materials exposed to salt and brackish water generally to the north of New Jersey on the East Coast and north of San Francisco on the West Coast to the extent that the marine borers can attack them.
Use Category UC5B Wood and wood-based materials exposed to salt and brackish water between New Jersey and Georgia on the East Coast and south of San Francisco on the West Coast to the extent that the marine borers can attack them.
Use Category UC5C Wood and wood-based materials exposed to salt and brackish water south of Georgia and along the Gulf Coasts in the Eastern U.S. as well as Hawaii and Puerto Rice, to the extent that the marine borers can attack them.

WWPI Abbreviated Guide 2

Use Category System 3

Which Preservative to Use?

Given the proper standard, many factors enter into your decision on which specific preservative meets your needs best. You will likely weigh the economics, type of project, wood species, aesthetics and availability as well as being sensitive to environmental concerns. These decisions are a matter of personal preference, organization policy, professional knowledge and the specific environment in which your project will be placed. To help you make your selection, you may want to investigate the links to manufacturers' preservative information.

Preservative-specific Links 9

Guide to Retentions for Treated Wood End Uses

	AWPA STANDARD	OIL-TYPE PRESERVATIVES Minimum Retentions – Pounds Per Cubic Foot[1]		
USE	Use Category System	Copper Naphthenate	Creosote	Pentachlorophenol
BEAMS & TIMBERS, glue laminated before or after treatment				
Interior, dry	1	0.04	8.0	0.30
Interior, damp	2	0.04	8.0	0.30
Exterior, above ground	3B	0.04	8.0	0.30
Exterior, ground contact	4A	0.06	10.0	0.60
Highway construction	4B, 4C	0.080 – 0.15* *after gluing	9.0 – 12.0	0.45 – 0.60
HIGHWAY MATERIAL				
Lumber and timbers for bridges, structural members, bridge decking, cribbing and culverts	4B	0.075	10.0	0.50
Structural lumber, beams and timbers:				
– In saltwater use and subject to marine borer attack	5A, 5B, 5C	Not Listed	25.0	Not Listed
– Piles, foundation, land and fresh water use	4C	0.10 – 0.14	12.0 – 17.0	0.60 – 0.85
– Piling in saltwater use and subject to marine borer attack	5A, 5B, 5C	Not Listed	16.0 – 20.0	Not Listed
– Posts: Round, half-round, quarter-round (General const. – fence posts, sign posts, handrails)	4A	0.055	6.0 – 8.0	0.40
– Posts: Round, half-round, quarter-round (Guardrails, spacer blocks, critical structural members	4B	0.069	10.0	0.50
– Posts: Sawn (General const. – fence posts, sign posts, handrails	4A	0.06	10.0	0.40
– Posts: Sawn (Guardrails, spacer blocks, critical structural members	4B	0.075	10.0	0.50
LUMBER AND TIMBERS				
Above ground	3B	0.04	8.0	0.40
Ground contact and freshwater use	4A	0.06	10.0	0.50
MARINE LUMBER AND TIMBERS				
Members above ground and out of water but subject to saltwater splash	4B, 4C	0.06, 0.075	10.0, 12.0	0.50, 0.60
In brackish or saltwater use and subject to marine borer attack	5A, 5B, 5C	Not Listed	25.0	Not Listed
PILES				
Foundation, land and freshwater use (round)	4C	0.10 – 0.14	12.0 – 17.0	0.65 – 0.85
Marine (round) in salt or brackish and subject to marine borer attack	5A, 5B, 5C	Not Listed	16.0 – 20.0	Not Listed
Marine, dual treatment (round) for maximum protection	5B, 5C	Not Listed	20.0	Not Listed
Sawn timber piles	4B, 4 C	.075	10.0 – 12.0	0.50
PLYWOOD				
Sub-floor, damp, above ground	2	0.04	8.0	0.40
Exterior, above ground	3B	Not Listed	8.0	0.40
Soil contact	4A	Not Listed	10.0	0.50
Marine	5A, 5B, 5C	Not Listed	25.0	Not Listed

NOTE: *This is a summary document only; for complete information, see AWPA Book of Standards.*

[1] Retentions vary because of differences in wood species or project location.
[2] Alkaline Copper Quat
[3] Ammoniacal Copper Zinc Arsenate
[4] Copper Azole
[5] Salt water splash only; sawn members must be 2″x 8″ or 3″x 6″ in nominal dimension or larger.
[6] Chromated Copper Arsenate
[7] It is generally recognized that Douglas fir is extremely difficult to treat with CCA to required penetration and retention.

Guide to Retentions for Treated Wood End Uses

USE	WATERBORNE PRESERVATIVES Minimum Retentions – Pounds Per Cubic Foot[1]			
	ACQ[2]	ACZA[3]	CA-B[4]	CCA[6,7]
BEAMS & TIMBERS, glue laminated before or after treatment				
Interior, dry	0.25	0.25 – 0.30	Not Listed	0.25*
Interior, damp	0.25	0.25 – 0.30	Not Listed	0.25*
Exterior, above ground	0.25	0.25 – 0.30	Not Listed	0.25*
Exterior, ground contact	0.40	0.40 – 0.60	Not Listed	0.40*
Highway construction	Not Listed	0.40 – 0.60* *before gluing	Not Listed	0.40* *before gluing
HIGHWAY MATERIAL				
Lumber and timbers for bridges, structural members, bridge decking, cribbing and culverts	0.60	0.60	0.31	0.60
Structural lumber, beams and timbers:				
– In saltwater use and subject to marine borer attack	Not Listed	2.50	Not Listed	2.50
– Piles, foundation, land and fresh water use	Not Listed	0.80 – 1.0	Not Listed	0.80 – 1.0
– Piling in saltwater use and subject to marine borer attack	Not Listed	1.50 – 2.50	Not Listed	1.50 – 2.50
– Posts: Round, half-round, quarter-round (General const. – fence posts, sign posts, handrails)	0.40	0.40	0.21	0.40
– Posts: Round, half-round, quarter-round (Guardrails, spacer blocks, critical structural members	0.50	0.50	0.31	0.50
– Posts: Sawn (General const. – fence posts, sign posts, handrails	0.40	0.40	0.21	0.40
– Posts: Sawn (Guardrails, spacer blocks, critical structural members	0.50	0.50	0.31	0.50
LUMBER AND TIMBERS				
Above ground	0.25	0.25	0.10	Not Listed
Ground contact and freshwater use	0.40	0.40	0.21	Not Listed
MARINE LUMBER AND TIMBERS				
Members above ground and out of water but subject to saltwater splash	0.60	0.60	0.31	0.60[5]
In brackish or saltwater use and subject to marine borer attack	Not Listed	2.50	Not Listed	2.50
PILES				
Foundation, land and freshwater use (round)	0.80	0.80 – 1.0	Not Listed	0.80 – 1.0
Marine (round) in salt or brackish and subject to marine borer attack	Not Listed	1.50 – 2.50	Not Listed	1.50 – 2.50
Marine, dual treatment (round) for maximum protection	Not Listed	1.0	Not Listed	1.0
Sawn timber piles	0.60	0.60 – 0.80	Not Listed	0.60 – 0.80
PLYWOOD				
Sub-floor, damp, above ground	0.25	0.25	0.11	0.25
Exterior, above ground	0.25	0.25	0.11	0.25
Soil contact	0.40	0.40	0.21	0.40
Marine	Not Listed	2.50	Not Listed	2.50

NOTE: *This is a summary document only; for complete information, see AWPA Book of Standards.*

[1] Retentions vary because of differences in wood species or project location.
[2] Alkaline Copper Quat
[3] Ammoniacal Copper Zinc Arsenate
[4] Copper Azole
[5] Salt water splash only; sawn members must be 2″x 8″ or 3″x 6″ in nominal dimension or larger.
[6] Chromated Copper Arsenate
[7] It is generally recognized that Douglas fir is extremely difficult to treat with CCA to required penetration and retention.

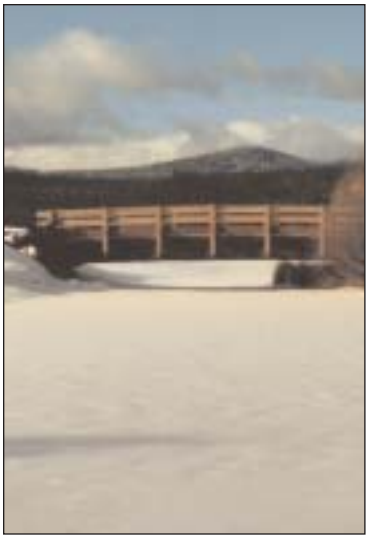
STEP 2: Environmental Considerations and Evaluations

Understanding Risk and Treated Wood

To protect wood from attack by insects and decay, materials must be treated with controlled amounts of preservatives. Like most chemicals (natural or man-made), they can be "toxic" to life forms at high enough concentrations. To manage the risk, society has turned to the Federal Environmental Protection Agency (US EPA) and other state or provincial agencies to conduct expansive scientific reviews of wood-treating preservatives to evaluate the risks to human health and the environment versus the benefits.

This process determines which treating preservatives will not be allowed, which will be allowed under strict application restriction and which will be allowed for more general use. The results are expansive regulations governing the handling and application of preservatives in the treating process and guidelines for the use of the products. Ongoing US EPA and Canadian registration processes are the first level of Risk Management.

The purpose of this document is to provide guidance to a second level of Risk Management for treated wood that is to be used in the most sensitive environments – waterways and wetlands.



After identifying a preferred preservative, you need to review your project for its potential environmental impacts. In rare instances, this review will cause you to change the preservative you have selected.

Environmental Concerns with Treated Wood

Nearly all materials, man-made or natural, placed in an aquatic environment will introduce chemicals which, if present in large enough concentration, will either immediately or over time pose a potential threat to plant and animal life forms dependent upon that environment.

A certain quantity of the chemicals used to preserve wood will leach or migrate from treated wood structures built in aquatic and wetland areas into the water column and surrounding sediments. The question is how much and when will the preservatives move into the environment and under what circumstances might they represent a significant risk. Section B of this report concentrates on the science behind this question. The following summarizes the issues.

Chemicals of Potential Environmental Concern

For all practical purposes only three compounds used in common preservative systems could potentially cause concern in aquatic environments. Understanding these chemicals will help assure that the products you specify and handle will avoid risk to the aquatic and wetland environments.

Copper

Copper is a commonly used component in several wood preservatives. Many preservatives classified "general use" by the EPA rely on copper as the principal component for biocidal activity. For waterborne systems and for oil-based copper naphthenate, the chemical of concern is copper. Fishes and aquatic organisms are much less tolerant of copper than are people or other mammals. If the levels of copper from treated wood are appropriately managed for aquatic use, other chemicals used in waterborne preservative systems such as arsenic, zinc, chromium, tebucoazole and quaternary compounds simply are not present at levels of concern. Extensively reviewed and published information is available on the effects of copper in the environment and the biological importance of copper.

CCA Assessment (10)

ACZA Assessment (11)

ACQ Assessment (12)

Copper Information (13)

CA-B Assessment (14)

PAH

The toxic compounds in creosote are called polycyclic aromatic hydrocarbons or PAH. These naturally occurring substances are also generated by forest fires, volcanoes, coal deposits and oil seeps. They are formed whenever there is combustion. Power generation, automobiles and asphalt paving are common sources of PAH associated with human activity. PAHs are not water soluble and are generally of little concern in the water column. However, they can accumulate in sediments to levels of 10 to 20 parts per million (ppm) that have been associated with cancer in fish.

PAHs are rarely found at concentrations that are acutely toxic to aquatic organisms except in association with historic industrial activities. Because they have been part of our environment long before mankind, they are metabolized by most organisms. In fact, bacteria efficiently break them down in healthy environments where there is sufficient oxygen, and they decompose more slowly in the absence of light or in anaerobic environments.

Creosote Assessment (15)

Pentachlorophenol

Pentachlorophenol (Penta) from treated wood may be dissolved in the water column and sorbed to matter in bottom sediments. Penta readily degrades in the environment by chemical, microbiological, and photochemical processes. Penta-treated materials used in aquatic applications are limited to above-water structures and freshwater pole or piling structures. If present in large enough quantities, penta may be toxic to fish and other aquatic life. Accumulation in fish and other animals is not a concern for penta.

Penta Assessment (16)

Where Are Preservatives a Concern?

The safety of treated wood products is confirmed by their long history of use without a single documented instance in which treated wood products have jeopardized natural environments. However, wood preservatives do leach or migrate from pressure treated wood at very low rates. Previous research has accurately defined these loss rates allowing industry to produce guidelines and risk assessment models that insure the continued safe use of these products. For example, Figure 1 on page 12 describes the loss of copper from CCA-C treated wood. Risk assessments are based on the first few days of immersion because that is when preservative loss rates are highest. These rates decline very quickly over time and are generally undetectable in the water after the first few weeks.

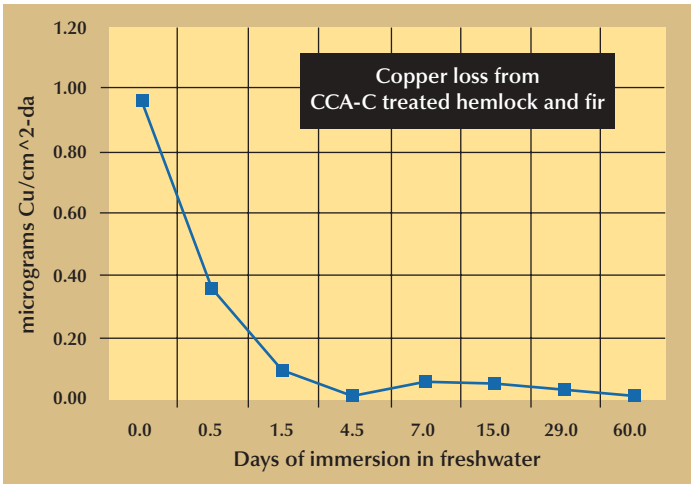


Figure 1

Because of the very low amounts of chemical that will move into the environment, the appropriate use of treated wood will not represent an adverse risk except in cases where the sites were previously contaminated from other sources, or in very sensitive environments with almost no water current where very large projects are planned.

Environmental Evaluation and Risk Assessment

Knowledge of preservative loss rates from properly treated wood, when coupled with site-specific environmental data (such as water current speeds and background levels of metals and organics), allow the industry to use relatively simple computer models to predict the environmental response to any project you might design. These models have been peer-reviewed, repeatedly field-tested and proven to protect the environment. They are used by the U.S. Forest Service, U.S. Park Service, Environment Canada and Canadian Department of Fisheries & Oceans as well as a host of local and state regulatory bodies.

(17) WWPI Risk Assessment Models

Examples of Typical Models

Example 1: The models have also been used to define categories of projects that should require no risk assessment and those where additional assessment should be carried out during the preliminary design phase. As an example, Tables A and B below describe the number of CCA-C, ACZA, ACQ-B, CA-B or Copper Naphthenate piling or timber that can be placed in a row paralleling freshwater currents without jeopardizing the environment. The tables were constructed assuming a receiving water pH of 6.5, hardness of 75 mg $CaCO_3$/L, and a background copper concentration of 1.5 µg Cu/L. These values are typical of many rivers and lakes in the country.

Most large lakes have current speeds greater than 2.0 cm/sec and river speeds greater than 10 cm/sec. Most projects being permitted today involve fewer that four piling placed in a row parallel to the currents (i.e. along the shore) and all four of the preservatives listed in the table are acceptable in most applications.

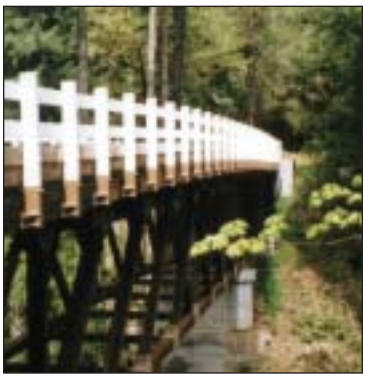


Table A: Guide for number of CCA-C, ACZA or Copper Naphthenate piling (see UCS 4C) that can be placed in a row paralleling freshwater currents without jeopardizing the environment.

Preservative	Day 0.5 loss rate micrograms Cu/cm²	Maximum Current Speed (cm/sec)							
		0.5	1.0	1.5	2.0	3.0	5.0	7.5	10.0
CCA-C	3.98	66	132	198	264	397	661	992	1322
ACZA	39.60	7	13	20	27	40	66	100	133
CuN	17.37	15	30	45	61	91	151	227	303

Table B: Guide for number of ACQ-B or CA-B timbers (see UCS 4A) that can be placed in a row paralleling freshwater currents without jeopardizing the environment.

Preservative	Day 0.5 loss rate micrograms Cu/cm²	Maximum Current Speed (cm/sec)							
		0.5	1.0	1.5	2.0	3.0	5.0	7.5	10.0
ACQ-B	44.10	6	12	18	24	36	60	90	119
CA-B	40.30	7	13	20	26	39	65	98	131

Example 2: Creosote-treated projects are typically located in marine environments and their evaluation is somewhat more complex. The figure below describes projects where creosote-treated wood should not be used without a risk assessment (red); where it is not likely to have an effect but caution suggests an individual risk assessment should be completed (yellow); and where creosote-treated projects are not likely to affect the environment and require no additional assessment (blue or green). The values in each cell are the maximum predicted sediment concentrations of PAH.

Creosote is broken down by microbes in sediments and microbes need oxygen to start that process. Therefore, the suitability of creosote in an environment depends in part on the availability of oxygen – as measured by the depth of the reduction-oxidation potential discontinuity (RPD) in this chart. The RPD in healthy environments is generally greater than 3 cm and typical maximum current speeds present in most projects will be > 3 to 5 cm/sec. In sum: the typical small creosote-treated piling project is not likely to affect healthy marine environments.

Table C: Creosote Guide for determining need for Risk Assessment (RA).
Red: RA recommended; Yellow: RA advised; Green or Blue: no RA needed

	Depth of Reduction-Oxidation Potential Discontinuity (cm)						
Maximum current speed (cm/sec)	0.0	0.5	1.0	1.5	2.0	3.0	4.0
0.5	262.96	120.25	66.79	43.83	33.05	25.50	24.57
1	131.48	60.13	33.40	21.91	16.52	12.75	12.29
2	65.74	30.06	16.70	10.96	8.26	6.37	6.14
3	43.83	20.04	11.13	7.30	5.51	4.25	4.10
4	32.87	15.03	8.35	5.48	4.13	3.19	3.07
5	26.30	12.03	6.68	4.38	3.30	2.55	2.46
6	21.91	10.02	5.57	3.65	2.75	2.12	2.05
7	18.78	8.59	4.77	3.13	2.36	1.82	1.76
8	16.43	7.52	4.17	2.74	2.07	1.59	1.54
9	14.61	6.68	3.71	2.43	1.84	1.42	1.37
10	13.15	6.01	3.34	2.19	1.65	1.27	1.23
11	11.95	5.47	3.04	1.99	1.50	1.16	1.12
12	10.96	5.01	2.78	1.83	1.38	1.06	1.02
13	10.11	4.63	2.57	1.69	1.27	0.98	0.95
14	9.39	4.29	2.39	1.57	1.18	0.91	0.88
15	8.77	4.01	2.23	1.46	1.10	0.85	0.82

When Is a Full Risk Assessment Needed?

A Starting Point

To be conservative, an individual Risk Assessment is recommended in the general cases that follow.

You can access on-line the actual guidelines that apply and the Microsoft EXCEL™ computer models that allow you to conduct your Risk Assessment. It should be emphasized that the criteria below are very conservative and it is likely that fewer than five percent of all typical projects will actually require a complete Risk Assessment.

- Projects involving greater than 100 piling
- Substantial projects having large treated wood surface areas such as bulkheads

- Projects in industrial areas where there may be high background levels of metals or polycyclic aromatic hydrocarbons
- Projects in close proximity (<50 feet) to other projects involving more than 20 piling that are treated with a similar preservative (creosote, copper based, etc.)

The industry is proud of the improvements in production processes and its history of environmentally appropriate product performance. The use of these guidelines and risk assessments is intended to insure that this history of safe use continues into the future.

Aquatic Use and Selection Guides for In-water Applications

In addition to running the models just described, the following preservative-specific criteria should be considered to determine if a full Risk Assessment is called for in water projects:

17 Risk Assessment Models

NOTE: For each preservative, select the model that fits your specific application.

Creosote (freshwater or marine)
- The sediments are black and smell of hydrogen sulfide
- Maximum current speeds are less than three cm/sec
- Project involves more than four piling placed in a row parallel to the currents

Pentachlorophenol (freshwater only)
- Maximum current speeds less than 2.5 cm/sec
- Project involves more than four piling placed in a row parallel to the currents

Copper Naphthenate (freshwater)
- Maximum current speeds less than 1.0 cm/sec
- Project involves more than six piling paralleling the currents

Waterborne treatments (freshwater)
- Maximum current speeds less than 1.0 cm/sec or:

  CCA-C. Project involves more than 100 piling parallel to the currents

  ACZA. Project involves more than 25 piling parallel to the currents

  CA-B. Project involves more than two timbers parallel to the currents

  ACQ-B. Project involves more than two timbers parallel to the currents

  The pH of the receiving water is less than 5.5

Waterborne treatments (marine environments)
- Maximum current speeds less than 1.5 cm/sec or:

  CCA-C. Project involves more than four piling parallel to the currents

  ACZA. Project involves more than two piling parallel to the currents

Over-water Considerations

While the greatest potential environmental exposure is with in-water use of treated material where direct contact and higher retention levels exist, the large volume of wood used in above-water structures and decking also merits risk consideration and sound chemical management. Splash and rain runoff represent potential paths for treating chemicals to move from treated wood into the environment. Experience has shown that where environmental concerns have been raised, any adverse impacts found were caused by improper specification, treating or installation.

CONCLUSION *It should be emphasized that these recommendations are very conservative from an environmental point of view. Pressure treated wood has a long history of safe use in aquatic environments with no published report describing a significant loss of biological integrity associated with its proper use. Adverse impacts, where they have occurred, have been linked to significant concentrations of the preservative chemicals at old treating facilities and not with use of the treated product. The industry is proud of the improvements in production processes and its track record of environmentally appropriate product performance. The use of these guidelines and risk assessments is intended to insure that this history of safe use continues into the future.*

STEP 3: Specifying the Best Management Practices

The treating industry believes the potential for any adverse environmental impact is reduced when certain conditions are met:

- Materials are specified with the minimum retention needed for their application
- Best Management Practices (BMPs) are mandated with certification of inspection
- Proper field guidelines are followed

Best Management Practices

Protecting the lakes, streams, bays, estuaries and wetlands of North America is a responsibility shared by every citizen. The pressure treated wood products industry is committed to ensuring that its products are manufactured and installed in a manner which minimizes any potential for adverse impacts to these waters. To achieve this objective, the industry developed and encourages the use of the **Best Management Practices** or **BMPs**. BMPs are *in addition to the AWPA standards* and contain guidelines specific to each preservative system related to the treating process. These include technical guidance on the handling and use of the treating preservative, wood preparation and treating procedures, post treatment processes and inspection. The BMPs are designed to:

Complete BMP Document 4

- Minimize the amount of preservative placed into the wood while assuring conformance with AWPA standards
- Maximize fixation or stabilization in waterborne systems
- Minimize surface residues and bleeding from oil-type, preservative-treated products.

The specification for treated wood products used in aquatic and wetland applications should contain language to the effect: *These products are to be produced in accordance with the Best Management Practices for Treated Wood in Aquatic Environments issued by the Western Wood Preservers Institute, Wood Preservation Canada, and The Timber Piling Council.* Using such a reference, you will not need to list the specific requirements of the BMPs.

STEP 4: Providing Quality Assurance and Certification

Treating Quality and BMP Assurance

Sound project management will provide for quality control to assure that the treatment and BMP specifications have been met. Third-party independent inspection procedures are in place to meet these needs.

Treating Quality

7 *Quality Assurance Information*

To assure products meet the specified AWPA standards, the presence of a quality mark or letter of certification from a third-party inspection agency should be required in the specification. Building codes require all treated wood used in structural applications must be inspected by an American Lumber Standard Committee (ALSC) accredited third-party agency. The presence of the CheckMark logo on structural materials notifies the user that the inspection agency and materials were under the ALSC Treated Wood Enforcement program to assure compliance with AWPA standards.

BMP Assurance

18 *BMP Quality Assurance*

Specifications for material intended for use in aquatic or wetland applications should require that the material be produced in accordance with the BMPs. Conformance should be certified by third-party inspection documented by written certification or the presence of the BMP Certification Mark. Check on-line for details.

Work with the Treater

It is strongly recommended that, once a supplier has been selected, the specifying organization and/or contractor contact the wood treating company directly to review the project, specifications and material expectations. Direct contact with the treating firm should be made even if the material is being purchased through a third-party wholesale firm. Experience has shown that where treated materials have *not* met the purchaser's expectations it has been the result of a lack or breakdown in communications. In addition to going over the treating requirements, calling the treater affords you an opportunity to review lumber grades and framing requirements that may have been part of the specification.

STEP 5: Appropriate Handling, Installation and Maintenance

The most critical time in the life of a treated wood project – in terms of potential environmental impacts – is during and immediately following construction. Specification of BMP materials will provide assurance that materials at the job site meet fixation requirements (for waterborne preservatives) and are free of excessive surface preservative. This minimizes initial risks.

There are several additional actions that can be taken to ensure the project is completed in an environmentally safe manner:

- **Framing, sawing, cutting and drilling.** To the maximum degree possible, framing, sawing, cutting and drilling should be done before treatment. Most treaters are able to provide these services or the work can be done prior to the material going to the treating plant. This may require more engineering and product coordination, but it assures the best treated product, minimizes the need for field treating and yields the more efficient installation.
- **Field inspection.** The materials should be visually inspected when they arrive on site. Materials which display excessive bleeding (oil-type) or surface deposits should be rejected and the supplier contacted for replacement.
- **Re-treatment.** If the materials do not meet the retention or penetration specifications, caution should be taken before agreeing to re-treat. This is especially true with oil-type preservatives, since re-treatment can lead to excessive retentions and increased potential for environmental impact.
- **Fasteners.** Fasteners for preservative-treated wood shall be hot dipped galvanized in accordance with ASTM A-153, silicon bronze, copper or 304 or 316 stainless steel. Stainless steel fasteners should be used below grade in Permanent Wood Foundations and are recommended for use with treated wood in other corrosive exposures such as in or near salt water.
- **Field fabrication.** All sawing and drilling should be done away from the water when practical, taking steps to collect, contain and prevent dust and shavings from entering the water or soil. Dispose of all scraps and sawdust in an appropriate landfill.
- **Field treating.** All field cuts and drill holes should be field treated. Field treating (as well as applying sealers) should be done well away from the water if at all possible. If over-water treatment is necessary, steps should be taken (such as using tarps) to collect any surplus treatment for removal and disposal.
- **Absorbent booms.** When oil-type materials are first placed into the water a sheen may appear on the water. While generally environmentally benign, a visual concern exists until the sheen evaporates or dissipates. You should consider installing absorbent materials to contain the sheen, and booms should remain in place until the sheen ceases.
- **Demolition.** Removal of old or abandoned treated wood structures from the water can disturb sediments, creating a greater potential concern than if left alone. Alternative strategies such as cutting them off at the sediment line or leaving them as fish habitat should be considered.
- **Worker safety.** The treated wood material supplier will provide an EPA-approved Consumer Information Sheet (CIS) or Consumer Safety Information Sheet (CSIS) and a Material Safety Data Sheet (MSDS) for the treated material. Be sure employees are aware of the information in the CIS or CSIS and follow the guidelines.

Fastener Information 19

Disposal of Treated Wood 20

Field Treating 21

For another perspective on using treated wood in sensitive environments, it is suggested you access: ***Guide for Minimizing the Effect of Preservative-Treated Wood on Sensitive Environments*** *published by the USDA Forest Products Laboratory.*

FPL Environmental Guide 22

Consumer Information Sheets or Consumer Safety Information Sheets 6

The Environmental Impact of Treated Wood – What Does the Science Say?

by Dr. Kenneth M. Brooks
President, Aquatic Environmental Sciences

Dr. Books heads up a leading biological laboratory located in Port Townsend, Wash. Under his guidance, extensive North American aquatic-oriented research in the areas of intensive fish and shellfish aquaculture and environmental response to pressure treated wood products is conducted. His work modeling and evaluating the environmental response to treated wood has been used by Environment Canada, the U.S. Forest Service and industry. Prior to forming the Aquatic Environmental Sciences Laboratory, Dr. Brooks, a doctor of Physics and Marine Biology, was a Navy researcher at Lawrence Livermore Laboratories. He worked extensively with conservation districts, the National Resource Conservation Service and state extension service; and served as chairman of both the Washington State Conservation Commission and Agriculture-Natural Resources Forum.

Over the last several decades, a great deal of research has been undertaken by scientists from around the world to understand the environment's response to pressure treated wood structures. Much of this work focused on the performance of pressure treated wood and on human health concerns. In addition, several laboratory studies were undertaken to understand the transport and fate of wood preservative chemicals that are slowly leached from wood projects in natural environments. Each Risk Assessment contains bibliographies for this literature.

When large blocks of treated wood were placed in small bowls of water, laboratory studies demonstrated adverse effects on a number of freshwater and marine animals. Missing from the literature were real world studies that measured and evaluated the impacts of large treated wood structures on natural biological communities. However, in recent years, a number of major field studies have been sponsored by the Canadian and U.S. governments to fill this knowledge gap. This Report focuses on the overall conclusions of this extensive research. You are encouraged to review the complete documents for a detailed discussion.

ACZA

ACQ-B

CCA-C

The Wildwood Study

Wildwood Study (23)

In 1996 the U.S. Forest Service and Bureau of Land Management constructed a massive boardwalk system through wetlands created by a series of beaver dams in an abandoned channel of the Salmon River on the western slopes of Mount Hood in Oregon.

For background information on specific preservatives see:

CCA Assessment (10)

ACZA Assessment (11)

ACQ Assessment (12)

The 1,800-foot long boardwalk was built to provide public access to this pristine, otherwise inaccessible environment. Different sections of the boardwalk were constructed with ACZA, ACQ-B or CCA-C preserved wood. Soils, wetland sediments, the water and invertebrates living around the structures were carefully sampled and analyzed before construction began and periodically afterward for one year. Conditions at varying distances from the structures were compared with those at a similar control structure built of untreated wood in an isolated part of the wetland. The results of this study were published by the U.S. Forest Service in 2000.

The Wildwood site was chosen for this evaluation because the project was large and the environment sensitive. The soft and very slow-moving water, fine-grained sediments and heavy rainfall, combined with the massive scale of the boardwalk, led the authors to conclude this was a worst-case study. If adverse effects were to be found in sensitive invertebrate communities, they would be found here.

Each of the structures behaved differently but their metal loss rates were consistent with laboratory leaching studies. The full report contains a detailed description of the metal concentrations observed in the water and sediments within 12 meters of each structure during the entire study. For waterborne systems, copper is the metal of concern because aquatic organisms, unlike humans, are much less tolerant of copper than they are of arsenic, zinc or chromium. If the levels of copper from treated wood were maintained at less than toxic thresholds, then other chemicals used in waterborne preservatives would simply not be present at concentrations causing concern. The following discussion will focus on the results for the CCA-C structure because this preservative is the most commonly used product in the U.S.

What is intuitive for most people is the biological response. Wildwood is a "buggy" place: 86,144 bugs, snails, clams and worms were collected and identified in the 424 samples collected by the researchers. One hundred fifty-one different kinds of animals were identified from sediments, vegetation and on artificial substrate collectors used to sample the "drift community." Scientists have numerous ways of analyzing databases developed in these kinds of studies and many of those analytical techniques were used here. Figures 2 and 3 on page 20 show four common ways of assessing animal communities. For each metric in the figures, higher values are associated with healthier communities.

No adverse effects on the sensitive invertebrate community were evident in this study at the structures built using ACZA, ACQ-B or CCA-C-treated wood.

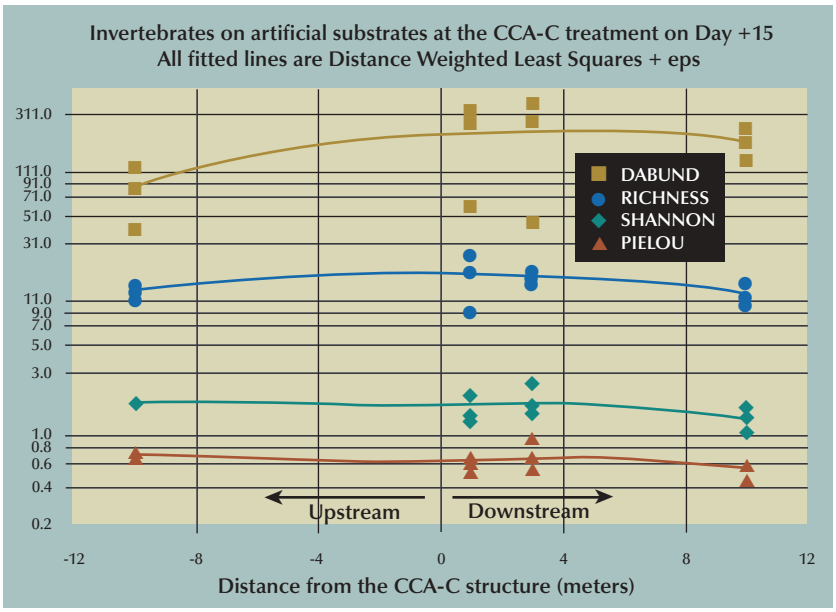


Figure 2

Figure 2 describes the response of invertebrates most exposed to the peak concentrations of dissolved copper observed two weeks after construction of the CCA-C viewing platform. Copper declined dramatically in all subsequent samples confirming that this first two-week period represented the worst case for this part of the insect community.

As many or more invertebrates were collected from the artificial substrates located immediately next to the treated wood (0 to 4 meters distance on chart) as were observed at the upstream control (–10 meters distance on chart). All of these indices (which measure the numbers and kinds of invertebrates and how well integrated they are in the community) showed no significant changes caused by the structure.

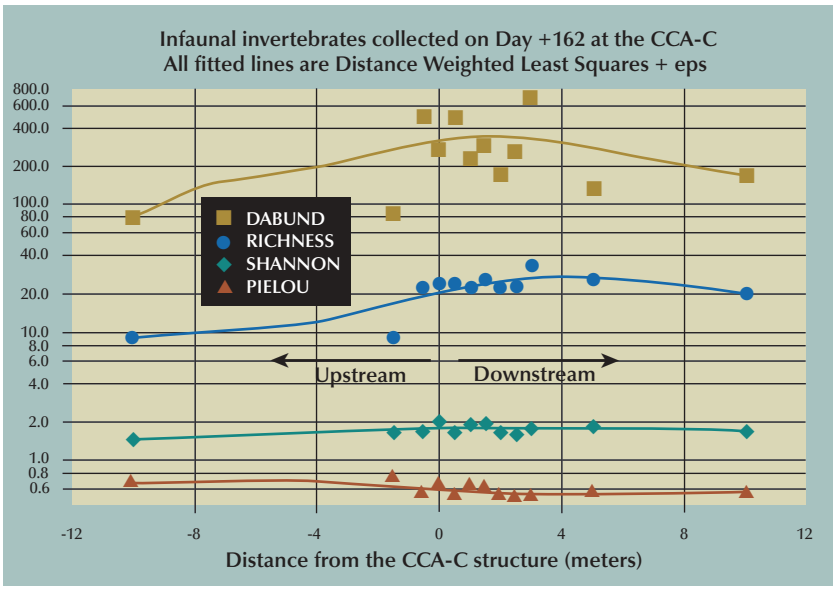


Figure 3

Figure 3 above describes the community of animals that live in the sediments (infauna) at the end of the study when sediment concentrations of all metals had reached their peak. Again, there is no indication that the CCA-C structure resulted in a compromise of these infauna, which are sessile (stationary) and had been exposed to the pressure treated wood structure for a year. The same results were obtained for the other two preservatives. It is impossible to prove a negative and therefore we cannot state that there could never be an adverse effect associated with these structures. *What we can say is that this worst case study did not reveal any adverse environmental effects and these results indicated that these preservatives can safely be used in sensitive wetland areas.*

New creosote-treated dolphin used to evaluate creosote in Sooke.

Sooke Basin Creosote Evaluation

At sufficiently high concentrations, polycyclic aromatic hydrocarbons (PAH), that make up 80 percent of creosote oil, can be acutely toxic. At moderate concentrations of 7.5 to 20 parts per million (ppm) in sediments, PAH have been associated with tumors in fish.

Polycyclic aromatic hydrocarbons are ubiquitous in our environment, including many natural sources such as volcanoes, forest fires, coal deposits, plants, peat bogs and oil seeps. Petroleum refining and distribution, asphalt paving, vehicle exhaust, coal, home fireplaces, power generating facilities, tires, BBQ's and a host of other human activities also contribute PAH to our environment.

Sooke Basin Study (24)

The natural sources have been present since before there were humans, and all living creatures have developed enzyme systems that break down these compounds. In fact, some strains of bacteria thrive on PAH as a food source and can very efficiently destroy even high concentrations. All PAH are eventually broken down to carbon dioxide and water, leaving no trace of their pre-existence. The fact is that no matter how hard we try, it is not possible or necessary to eliminate PAH from our environment. What we need to do is manage anthropogenic sources of PAH so they do not reach toxic levels and do not degrade valuable environments.

For background see:

Creosote Assessment (15)

In 1994, the Canadian Department of Fisheries and Oceans and Environment Canada initiated a long-term study to evaluate the environmental effects associated with creosote-treated wood used in marine environments. Because most creosote structures are located in harbors (where there are many confounding sources of PAH), this evaluation was conducted in an isolated portion of Sooke Basin, British Columbia, where low PAH background levels were observed and where there were minimal other sources.

The Sooke Basin site had very slow currents and fine-textured sediments supporting a healthy community of sessile invertebrates. Three dolphins were constructed with six class "A" piling in each structure. One of the dolphins was constructed of untreated wood, the second of eight-year-old piling pulled from a pier in Vancouver Harbor, and the third of new BMP piling that were over-treated to 27 pounds per cubic foot with marine-grade creosote. This over-treatment insured that the Sooke Basin Study would represent a worst-case evaluation.

The loss of PAH and their accumulation in sediments was modeled before constructing the dolphins. The environment around these dolphins was intensively monitored for four years, documenting the loss of PAH to the water and their accumulation in sediments. The biological response was evaluated in an exhaustive series of in-situ and laboratory bioassays coupled with thorough documentation of the invertebrate community living within 100 feet of each of the structures.

What Did This Study Find?

25 *Creosote Model (Marine)*

- Creosote did migrate from the piling and accumulate in sediments downcurrent from the piling. As shown in Figure 4 below, the actual accumulation of PAH in sediments (red line) was less than that predicted in the model (blue line). These sediment concentrations also peaked earlier and declined faster than predicted. These models have been field-verified repeatedly over the last six years. In every case, they have proven conservative from the environment's point of view – that is, predictions of PAH accumulation were higher than what was actually observed.

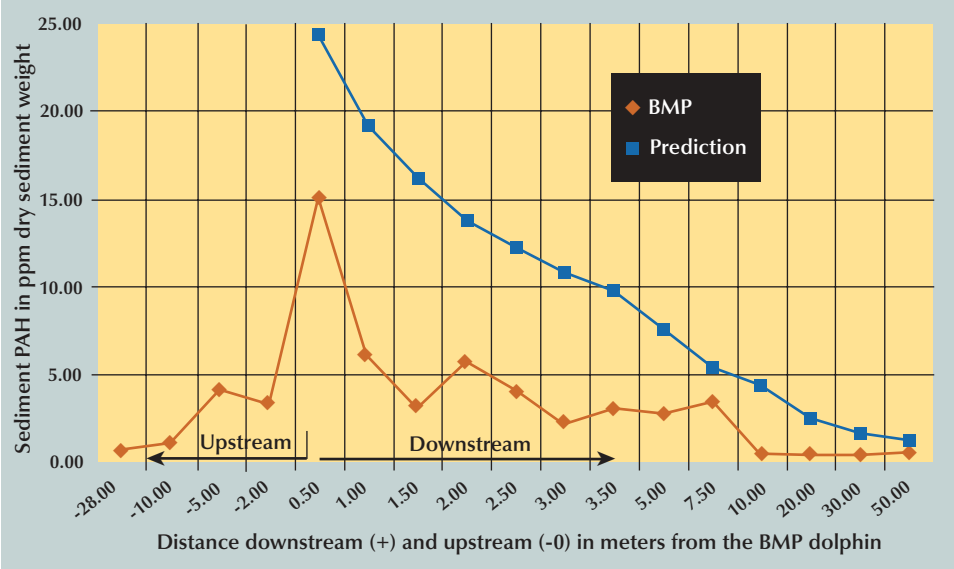


Figure 4

- Even at the peak of PAH accumulation, concentrations did not diminish the natural invertebrate community growing as close as one-half meter from the piling. However, evidence from the extensive suite of bioassays did indicate toxicity in sediments located within 0.65 meters of the dolphins. Mussels grown in cages within 15 cm of the piling did not accumulate significant amounts of PAH. Tissue concentrations peaked 14 days after construction at levels that were safe for human consumption. The same was true for mussels growing directly on the piling at the end of the study.

  As previously noted, concentrations of PAH in the sediments peaked earlier and declined more quickly than predicted by the models. The fact that there were lower-than-expected levels of PAH is an important environmental observation. Perhaps more important was the fact that the piling provided habitat for an astounding array of aquatic life with no significant or lasting adverse impact from the creosote treatment.

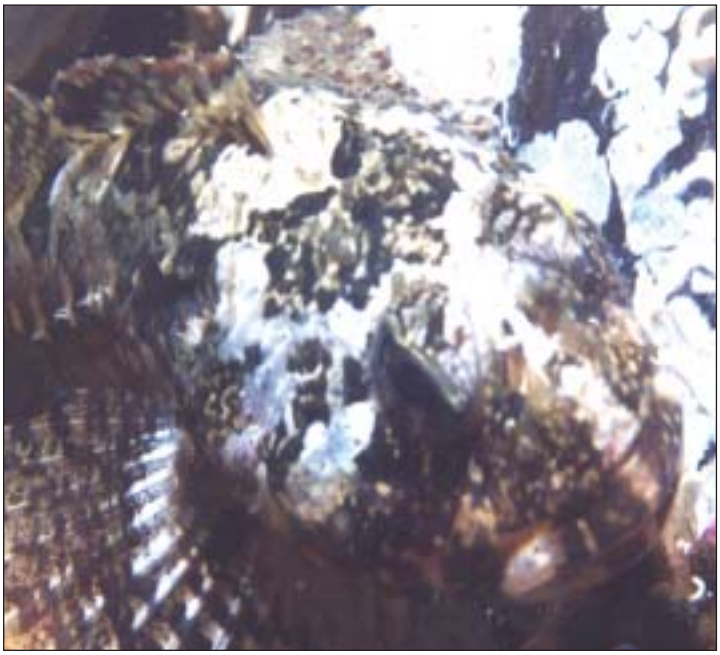
Blue mussels growing on creosote-treated piling

- Based on the evidence observed in Sooke Basin and on unpublished laboratory studies, the authors hypothesized that most of the creosote lost from the piling was transported as tiny droplets of oil – much of which likely originated from above the water line on hot summer days. As the piling aged, the air-exposed portion of the piling developed a hard covering of asphalt-like tar. This covering may have sealed the surface reducing further loss of creosote.

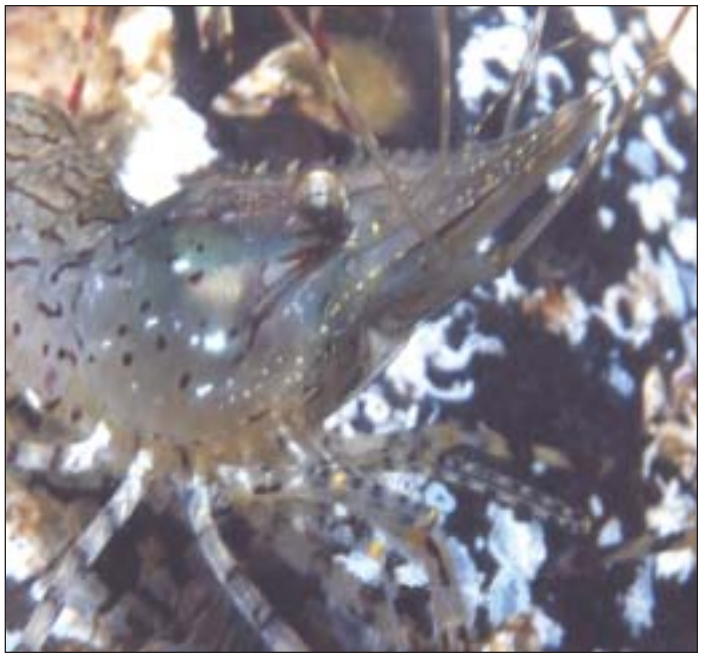
Tunicate growing on creosote treated piling

- The continually immersed portions of the creosote-treated piling were quickly overgrown with a rich and abundant community of fouling organisms. The full-page photograph on the next page shows one of the newly treated creosote piling at the end of the study. Dozens of species were identified including fish, shrimp, nudibranchs and tunicates such as *Cnemidocarpa finmarkiensis* shown at left. From an intuitive point of view, this luxuriant fouling community does not suggest that these piling were creating a toxic environment.

Invertebrate community growing on a new creosote-treated marine piling in Sooke Basin



Red Irish Lord



Coonstripe shrimp (Pandalus danae)

Many of these fouling organisms are considered highly sensitive to pollution and are used by regulatory agencies like the Environmental Protection Agency in setting water quality standards. The Red Irish Lord (*Hemilepidotus hemilepidotus*) shown above was resting on a clump of mussels attached to the piling, oblivious to the divers who were collecting samples.

Polycyclic aromatic hydrocarbons are hydrophobic – i.e. they don't like water. They bind to organic tissues that contain lipid. The mussels and other animals living on these piling generated a mat of lipid-rich organic detritus at the base of the fouling community. This detritus was being decomposed by bacteria. It is likely that it also intercepted much of the creosote oil still migrating from the treated wood. The microbial communities are expected to metabolize the creosote caught in this organic matrix. The point is that this luxuriant fouling community was likely reducing the migration of creosote to the sediments. Note that this appears to have been accomplished without the animals themselves becoming contaminated as evidenced by the lack of PAH in mussels.

Starfish (Pisaster ochraceus) foraging on the fouling community

Another possible hypothesis explaining the significant reduction in sediment PAH around the piling was also associated with the fouling community. The community was continually being devoured by predators like the Ochre Stars seen in the figure at left. This predation resulted in a raining down of enormous quantities of biological debris that collected around the base of the piling. This food attracted hundreds of Dungeness crab (*Cancer magister*), sea cucumbers (*Parastichopus californicus*) and a variety of anemones.

By the end of the study, all of this biological activity had exceeded the assimilative capacity of the sediments around the piling. They were anaerobic and contained very high levels of sulfide. The resulting sediment toxicity had nothing to do with the creosote treatment. In fact, these conditions were as bad or worse at the untreated control dolphin. Why? Because the untreated wood was quickly being consumed by marine borers (toredos, bankia and limnoria). Few fouling organisms were found on these piling because as soon as a community established itself, the wood failed and the organisms fell to the bottom where they were consumed by predators.

The untreated piling were deteriorating and did not support a vibrant fouling community

Dungeness crabs foraging on mussels dislodged by starfish around the new creosote-treated dolphin

It also appeared that the biological debris was diluting the sediment concentrations of PAH. All three of these factors were likely responsible for the unexpectedly quick decline in sediment PAH associated with the creosote-treated structures. Whatever the cause, the result was that the PAH lost from creosote appeared to have little long-term effect on the biology of the sediments – even within a few feet of the structures.

CREOSOTE SUMMARY *During the first year of the Sooke Basin study, creosote migrating from the piling did accumulate in sediments within 7.5 meters of the structures. The concentrations did not appear toxic to the local fauna because the infaunal community remained stable. However, toxicity was observed in laboratory bioassays of sediments located within two feet of the piling using sensitive species. The accumulation of PAH was overestimated by the model and the sediment concentrations declined more quickly than expected. At four years and presumably for the remainder of the 50- to 75-year life span of creosote-treated wood in this area, the major effect was caused not by the preservative, but by the flourishing community of animals that took up residence on the piling. By the end of the study, the creosote structures did not diminish marine life in this area – they enhanced it. Treated wood structures do typically attract large communities of organisms.*

The personal use pier shown here is constructed of creosote-treated piling with ACZA-treated walkways

Timber Bridge Study

(26) Timber Bridge Study

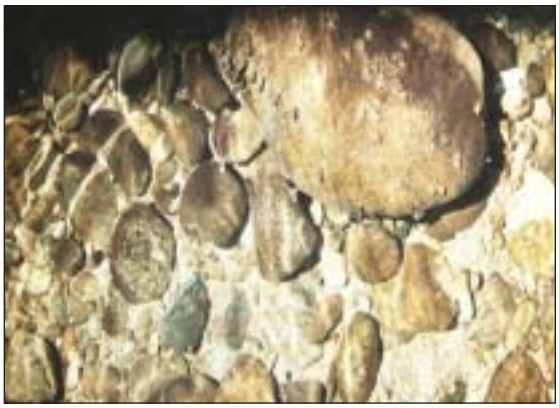
In 1997, the U.S. Forest Service initiated a study to examine the environmental response to the construction of timber bridges preserved with creosote, pentachlorophenol or CCA-C. Timber bridges are lightweight, long lasting and relatively inexpensive to build in rural areas carrying light to moderate traffic loads. The Timber Bridge study compared preservative concentrations in the water and in sediments under and downstream from two creosote-treated bridges in Indiana, two CCA-C-treated bridges in Florida and two pentachlorophenol-treated bridges on the West Coast. Invertebrate communities were carefully evaluated along with laboratory bioassays to determine the biological response to each bridge.

Measurably increased concentrations of metals, creosote or pentachlorophenol were not observed in the water under or downstream from any of these bridges. However, the active ingredients in each preservative were observed in sediments under each bridge – albeit at very low levels – and no decreases in the number of invertebrates or restrictions in the kinds of invertebrates were observed under or downstream from any bridge when compared with reference stations.

Pentachlorophenol-treated Timber Bridges

Dairy Creek Bridge

New York State has established a freshwater sediment quality criterion for pentachlorophenol. The maximum sediment pentachlorophenol concentration observed at the Satsop River bridge was 19 μg/kg (parts per billion or ppb), representing 4.5 percent of the New York State standard of 420 ppb. The maximum concentration observed at the Dairy Creek Bridge was 1.98 percent of the sediment standard. At these low concentrations, no adverse biological effects were anticipated at either bridge and none were observed.



Example of substrate in the Satsop River where salmon spawn

These two bridges were located over salmon-spawning rivers with sand-gravel and cobble substrates supporting a vibrant community of pollution-intolerant aquatic insects in the Orders Ephemeroptera (mayflies) and Trichoptera (caddis flies). The larvae of these Orders are generally associated with fast-moving oligotrophic streams and rivers. The biological response of this sensitive community is illustrated in the figure below. It describes sediment pentachlorophenol concentrations (μg/kg) in red; the proportion fine-grained sediments (sand, silt and clay) in blue; biological response described by the number of species (green); and the abundance of invertebrates (brown).

Note that the number of species and the total abundance of invertebrates were much higher three feet downstream from the bridge's drip line where the proportion of fine sediments dropped from 70 to 80 percent to about 40 percent. Also note that invertebrate abundance peaked where the proportion of fines decreased to between five and 12 percent. There were as many species and as many animals downstream from the bridge as there were at the upstream control. And there was essentially no correspondence between invertebrate community and the small amount of pentachlorophenol observed under the bridge and at the station located three feet downstream. Amphipod (*Hyalella azteca*) bioassays also found no evidence of toxicity in sediments from either of these pentachlorophenol-treated bridges. The invertebrate community was far more influenced by the substrate type than by the bridge.

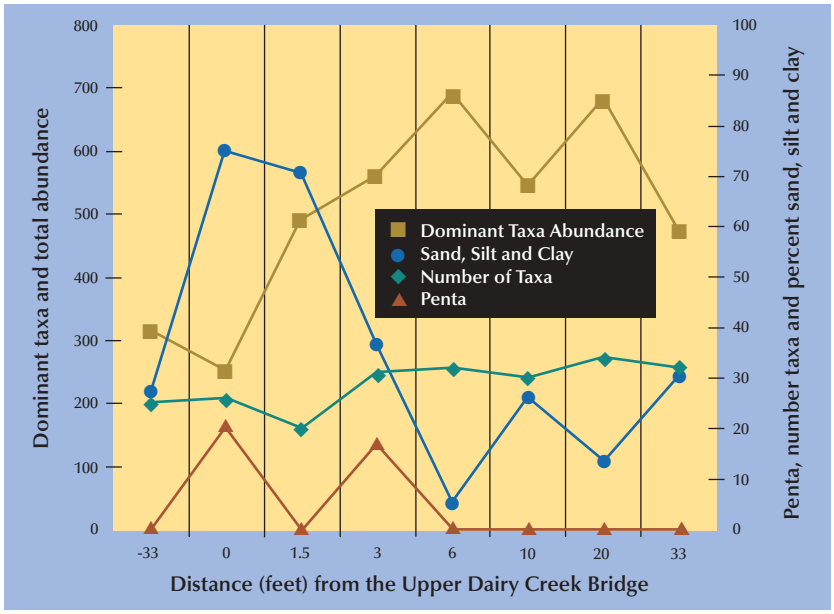


Figure 5

CCA-C-treated Timber Bridges

Horseshoe Bayou Bridge

Two bridges, each constructed entirely of CCA-C-treated wood, were evaluated in Sandestin, Florida. The Horseshoe Bayou Bridge, the largest, was designed to carry a 20-ton load. Its 160-foot span crossed a pristine marine estuary at the entrance to Horseshoe Bayou. Construction was just being completed when the survey was conducted. This timing was considered important to observing any increase in the concentration of dissolved metals during the period right after immersion when leaching is greatest from CCA-C-preserved wood.

As seen in Figure 6 below, copper and chrome concentrations were essentially the same along the sampling transect with no significant changes. Dissolved arsenic concentrations actually increased slightly with distance from the CCA-C-treated bridge.

It should be noted that all metals were below their respective water quality criteria of 3.1 µg copper/L, 36 µg arsenic/L and 50 µg chromium (VI)/L. As shown in Figure 7, increased sediment concentrations of all three metals were observed within 10 feet of the bridge.

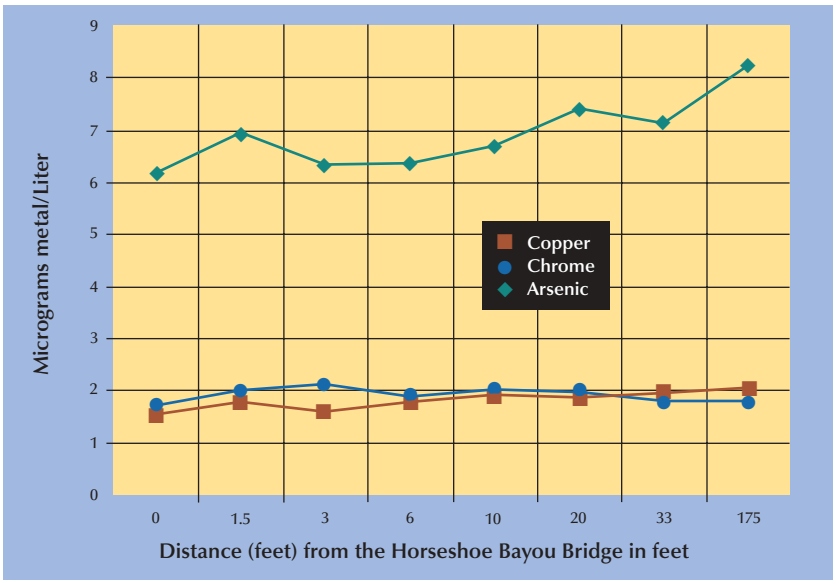


Figure 6

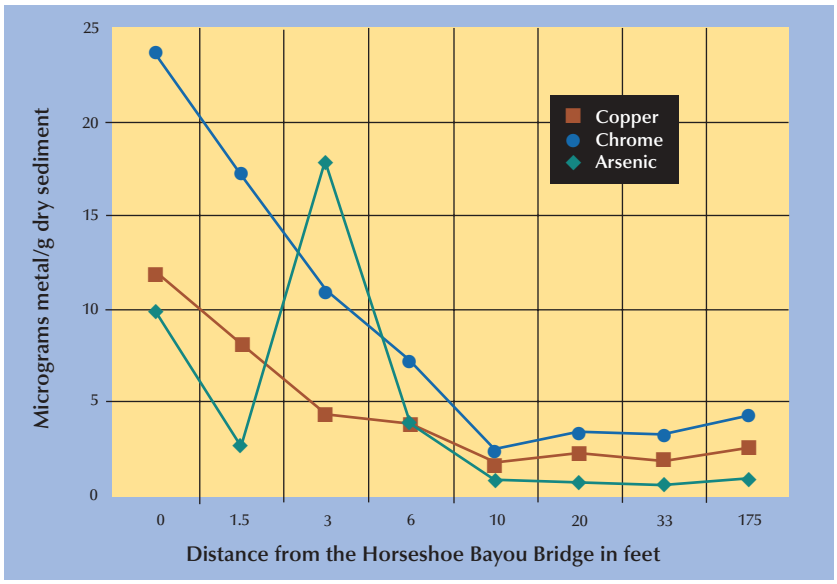


Figure 7

The reason for the increase illustrates an important point in the construction of treated-wood structures. As previously noted, this is a truly massive bridge. One thousand four hundred fifty-eight holes were drilled in the bridge to bolt together the heavy-duty treated-wood railing. Each hole was 3/4″ in diameter and approximately 14″ long. The drill shavings were not contained and they blew into the estuary where they could be seen on the bottom all around the bridge.

There are at least two reasons why the drill shavings, although an esthetic problem, did not result in measurable environmental damage. First, because the metals remained fixed in the wood shavings, they were expected to slowly leach out over time. Second, the resulting concentrations did not exceed commonly accepted sediment benchmarks of 63.4 μg copper/g; 16.2 μg chromium/g; or 24.4 μg arsenic/g dry sediment. This poor housekeeping practice resulted in what should be recognized as unnecessary environmental risk. There is no reason for those shavings to be there.

No adverse biological effects were anticipated at the low metal levels observed at Horseshoe Bayou and none were observed. As many or more species and numbers of animals were observed in sediments collected under and in the immediate vicinity of the bridge as were found at the reference station. Survival of *Menidia berylina* was excellent in all of the bioassays completed for this site, and no significant differences were observed when comparing stations close to the bridge with either the local reference station or laboratory controls.

The second bridge examined in San Destin was the 8-year-old Fountain Bridge, which crossed a freshwater marsh. This older bridge was examined to evaluate the accumulation of metals in sediments around the bridge and their effect on infauna. Increases in dissolved metals were not observed in the vicinity of the bridge in this essentially stagnant body of water.

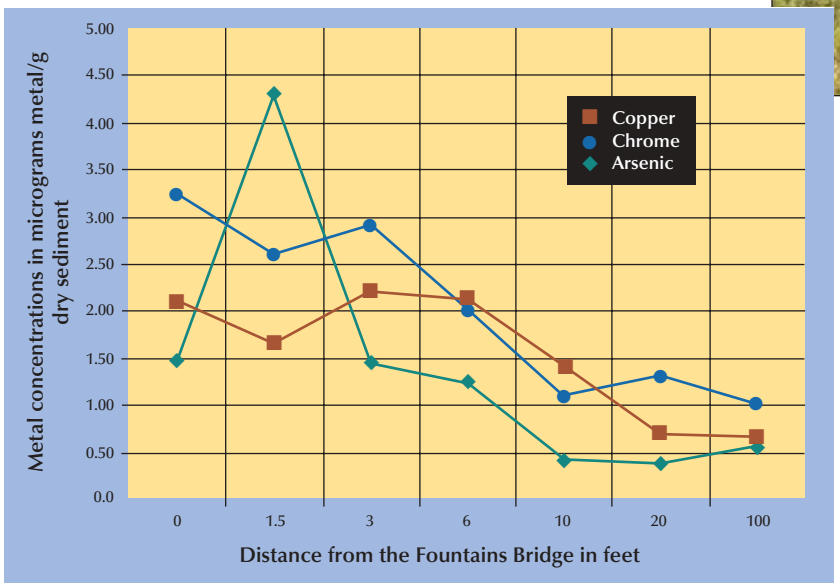


Figure 8

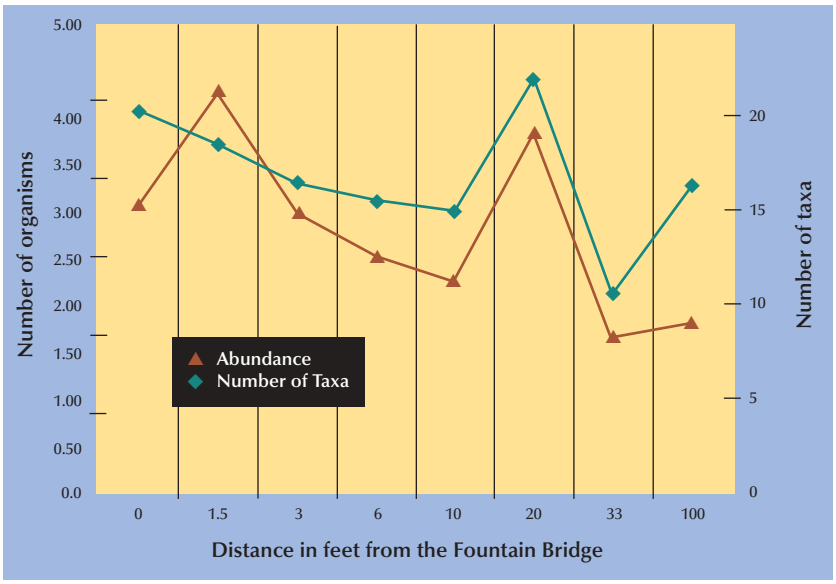


Figure 9

Figure 9 describes sediment concentrations of metals under and adjacent to the bridge. Sedimented metal concentrations were all very low (<4.25 μg/g). However, the bridge has left a definite signature in the muddy substrate that extends to a distance of between six and ten feet from the piling. Having said that, the maximum observed concentration of each metal was less than background concentrations in most parts of North America. No biological effects whatsoever could be expected at these concentrations and, as seen in Figure 9, none were observed. The abundance and diversity of invertebrates was as high under and immediately adjacent to the bridge as they were further away.

CCA-C SUMMARY *Metal losses from CCA-C-treated wood have been well known and predictable for at least 30 years. Losses from the bridges surveyed in this evaluation were so low as to be undetectable in the water. Metals did accumulate in sediments but to levels that were so low as to have no predicted or observed adverse biological effect. The CCA-C evaluation did point out the need to develop and use Construction Best Management Practices to insure that all waste is cleaned up and properly disposed of in a landfill. The drill shavings present in Horseshoe Bayou should not have been there: They represented unnecessary environmental risk and were an eyesore.*

Creosote-treated Timber Bridges in Cass County, Indiana

Creosote is the most common preservative used in the construction of timber bridges. Two creosote-treated bridges were evaluated on Pipe Creek in Indiana. Both bridges are substantial structures. They each sit on 20 Class A piling treated to a nominal retention of 17 pounds creosote per cubic foot (pcf) in the treated zone (outer 1.5″). Support beams, crossbeams, decking and guardrails were all similarly treated with creosote oil to a retention of 8 or 10 pcf in the treated zone.

Pipe Creek Bridge

Pipe Creek flows through corn country and carries a heavy load of sediment. Current speeds along the chosen sampling transects were very slow at <1.0 cm/sec. From an environmental point of view, both bridges behaved similarly. Slightly higher PAH concentrations were observed in sediments near the 2-year-old Bridge 146 than were found under the 8-year-old Bridge 148. The following discussion describes the results at new Bridge 146.

Creosote is a complex mixture of hundreds of compounds including many types of naturally occurring organic compounds called polycyclic aromatic hydrocarbons or PAH. Each of these PAH compounds degrade at different rates in the environment and they have different effects on biological organisms. This discussion will focus on the sum of the concentrations of all the PAH (TPAH) observed in Pipe Creek sediments. The parent report contains an evaluation of individual compounds and the results are not different from those presented here.

Sediment concentrations of polycyclic aromatic hydrocarbons (PAH) are described in Figure 10. This graph also includes sediment quality benchmarks described as the Threshold Effects Level (TEL), a value below which adverse biological effects are not generally observed under any condition, and the Probable Effects Level (PEL), a value above which increasingly severe biological effects should be anticipated in most environments. The mean of these values or MEL is also displayed. This mean is increasingly used as a reasonably protective benchmark for assessing environmental risk. Maximum sediment PAH concentrations between 1.5′ and 6.0′ downstream from the bridge exceeded the Threshold Effects Level for TPAH but not the Mean Effects Level. This suggests that adverse effects could be anticipated in a community of the most sensitive organisms.

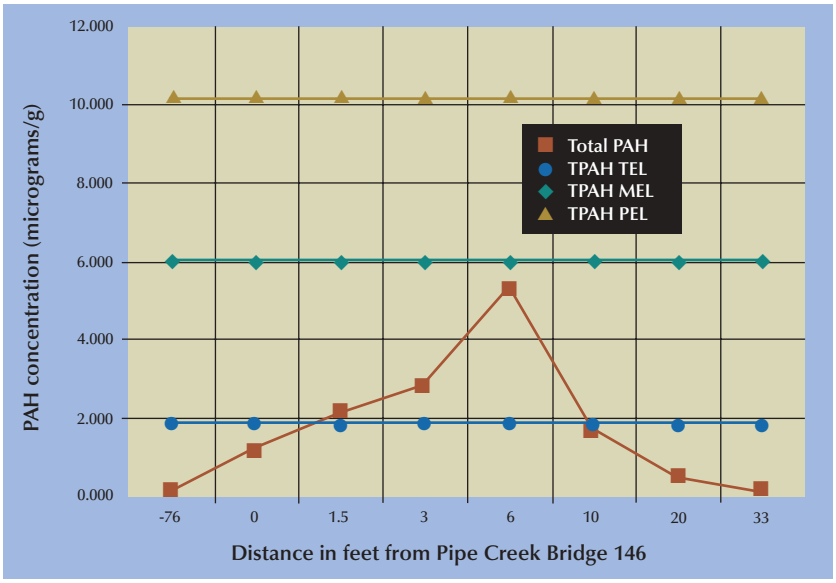


Figure 10

As previously discussed, Pipe Creek is a slow-moving stream flowing through cropland. It carried a significant bedload of sand, silt and clay. Like the Wildwood wetland, this is a naturally stressful environment and the invertebrate community was dominated by annelids (worms) and chironomids (midges). Both groups are generally robust and typically dominate other taxa in stressful environments. Therefore, it could be anticipated that the moderate levels of PAH observed in these sediments would not adversely affect this robust resident invertebrate community – and they did not.

Figure 11 compares the abundance (blue) and richness (green) of invertebrates observed in sediment samples from Pipe Creek Bridge 146 with the TPAH concentration in each sample. More species in greater abundance were observed with increasing TPAH concentrations. It might appear logical to conclude that the PAH were enhancing the invertebrate community. However, some other unmeasured factor in the environment was more likely responsible.

The point that should be made is that neither of these bridges lost enough PAH to affect the creek's invertebrate community. The results of this study were also consistent with those obtained in Sooke Basin. Lower sediment TPAH concentrations were observed at the older bridge and higher concentrations at the new bridge. Experience has shown that creosote- and pentachlorophenol-treated bridges are most likely to lose preservative during the first year following construction – particularly during extended periods of high ambient temperatures. Oil-type preservative losses decline significantly with time.

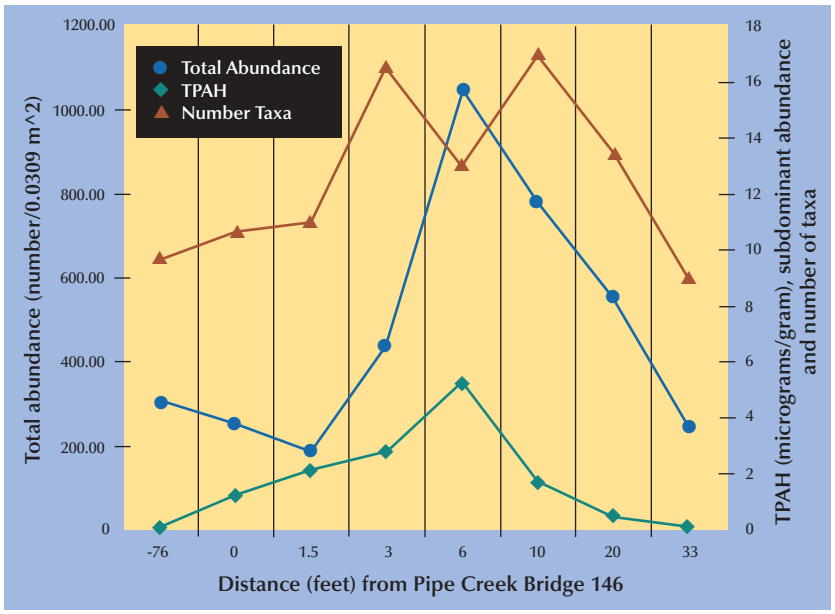


Figure 11

SUMMARY

A variety of types of treated wood have been used in aquatic environments for over half a century with no scientific reports documenting adverse environmental affects. These three studies have looked at a range of preservatives used to treat wood for constructing large structures in a range of sensitive marine and freshwater environments. Each of these studies was designed to conduct the assessments in worst-case conditions.

The following statements summarize the results of these three "real world" studies, describing the use of pressure treated wood in aquatic environments:

- Despite the production and use of billions of board feet of preserved wood, there are no published reports describing environmental damage associated with the use of these products in such structures.
- Small quantities of wood preservatives leached or migrated from all types of pressure treated wood. Using modern analytical techniques, small amounts of preservatives could be detected in the sediments but not in the water column around the treated-wood structures.
- The detailed studies discussed here were conducted to determine if treated-wood projects might be creating environmental damage on a scale so small as to have been previously ignored. No adverse effects were documented in association with the use of pentachlorophenol or the waterborne preservatives ACQ-B, CCA-C, CA-B or ACZA.
- Laboratory bioassays using very sensitive species indicated toxic effects in sediments collected within two feet of a large creosote-treated structure constructed in a worst-case marine environment. However, the resident infauna suffered no apparent harm.
- The longest-lasting effect of the installation of creosote-treated dolphins in Sooke Basin was a proliferation of life on and around the structures – creating a remarkable artificial reef.
- Models designed to assess the risks associated with very large treated-wood structures in sensitive environments have repeatedly been found to be conservative from the environment's point of view. These models can be used as a valuable tool in managing society's use of treated wood in aquatic environments.
- Most of the concern expressed by regulators regarding the use of pressure treated wood occurs during construction and/or demolition. Simple management practices can be used to eliminate the unnecessary risks sometimes created at the beginning and end of the 50- to 75-year life span of pressure treated wood structures. Best Management Practices (BMPs) are available to minimize preservative loss during the first year following construction of pentachlorophenol- or creosote-treated wood projects exposed to high ambient air temperatures.
- Based on the literature (including the detailed studies discussed here), there is no scientifically defensible reason to prohibit the use of treated wood in aquatic environments. Like many other human activities, treated wood simply needs to be managed.

27 *Link to Science and Assessment*

28 *BMP-related Information*

29 *Using Treated Wood in Aquatic Environments*

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