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

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