Best Management Practices for the Use of Preservative-Treated Wood in Aquatic Environments in Michigan

With Special Provisions and Design Criteria for Engineers

2002

Adapted from Western Wood Preservers Institute and
Canadian Institute of Treated Wood's *Best Management Practices* Guide

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Developed under the Authority of the Michigan Timber Bridge Initiative

Abstract

Preservative-treated wood is used in the construction of decks, docks, bridges, landscape structures, fencing, shoreline protection walls, utility poles, building foundations, outdoor furniture, highway signs and posts, crash rail posts and a myriad of other outdoor uses. It is important that wood to be used in or near water is specified, treated, handled and installed in a manner that minimizes the amount of preservative chemicals entering the aquatic environment.

These Best Management Practices consist of such common sense advice as:

- ✓ Use the correct preservative process
- ✓ Make sure treated timbers are free of preservative-laden sawdust or soil on the surface
- ✓ Verify that the proper amount of preservative remains in the wood after the correct post-treatment procedure has been used to draw off the excess preservative
- ✓ Follow consumer safety guidelines for the handling and use of preservative-treated wood

This BMP guide describes the proper processes to be used at wood treating facilities.

The *Best Management Practices for the Use of Preservative-Treated Wood in Aquatic Environments in Michigan* was produced under the auspices of the Michigan Timber Bridge Initiative, as a joint effort of the Michigan Department of Natural Resources, the Michigan Department of Environmental Quality, Huron Pines Resource Conservation and Development Area Council, Inc., and Northwest Design Group, Inc.

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Au Gres, Michigan

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WOOD IN TRANSPORTATION

FOREST SERVICE US DEPARTMENT OF AGRICULTURE

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Introduction

This Best Management Practices (BMPs) guide is intended to: 1) serve as a reference to assist designers and end users of preservative-treated timber products with selection of the proper preservative-treated timber, and, 2) help determine the best management practices for the use of preservative-treated wood in aquatic environments. BMPs are management or structural practices that minimize the delivery of pollutants to the environment. Treated wood is used in the construction of decks, docks, bridges, landscape structures, fencing, shoreline protection walls, utility poles, building foundations, outdoor furniture, highway signs and posts, crash rail posts and a myriad of other outdoor uses. Proper treatment entails pressure-treating wood with chemicals, making it toxic to insects and decay fungi while minimizing chemical exposure to people, wildlife and the environment. The species of wood, the type of preservatives used and the respective Best Management Practices will vary according to the application. Consumer safety and the protection of Michigan's environment are the responsibility of those who specify, produce and use treated wood products. It is the responsibility of the treating facility to assure that the specified materials have been produced to American Wood-Preservers' Association (AWPA) standards.

These Best Management Practices incorporate guidelines that were developed by the American Wood Preservers Institute (AWPI) and the American Wood-Preservers' Association (AWPA), with adaptations for use in aquatic environments in Michigan made by Huron Pines Resource Conservation & Development Area Council, Inc., USDA Forest Products Laboratory, Michigan Department of Natural Resources, Michigan Department of Environmental Quality, Northwest Design Group, Inc., and the School of Forestry and Wood Products at Michigan Technological University.

The American Wood-Preservers' Association is the principal standards writing body for the wood preserving industry in the United States. AWPA standards help ensure that pressure-treated wood products perform satisfactorily for their intended use. The AWPA Book of Standards is used by the wood preserving industry as well as for guidance of the purchaser in specifying and obtaining pressure-treated wood products that will perform in the specific exposure conditions for which the material is treated. To acquire AWPA Book of Standards contact:

American Wood-Preservers' Association
PO Box 5690
Granbury, Texas 76049
(817) 326-6300
fax: (817) 326-6306
e-mail: awpa@itexas.net
web site: www.awpa.com
(Book of Standards, 2001 Edition and CD combined - $248)

Preservatives protect wood by inhibiting decay fungi and insects that destroy wood. In properly treated wood, preservatives are stable and minimal amounts are lost (leached). However, the biological risks associated with these potential releases from wood have caused concern within some government regulatory agencies. In response to these concerns, several agencies in Michigan have participated in the development of these Best Management Practices guidelines.

Preservative treatment of wood involves the introduction of chemical preservatives into the wood structure. To be effective, the treatment must provide sufficient preservative penetration and adequate retention. Creosote, pentachlorophenol, and the waterborne arsenicals that are used in treating wood are regulated by EPA. However, wood that has been treated with creosote, pentachlorophenol, the waterborne arsenicals or other regulated pesticides, is not currently regulated by the EPA.

There are two basic methods of treatment: pressure treatment and superficial treatment. Pressure treatment involves putting the wood into a tank where treatment chemicals are forced into the wood under pressure. When possible, all cutting and drilling of the wood should precede treatment. Superficial treatment involves some form of brushing, spraying, or dipping. Superficial treatment should be limited to field treating where wood members were opened by drilling or cutting. Avoid wood that is purported to be "treated to refusal" because such labeling does not indicate degree of treatment.

Wood preservatives are broadly classified as oil-type or waterborne. The three oil-type preservatives used in aquatic environments are creosote, pentachlorophenol (penta), and copper naphthenate. Most oil-type preservatives leave an oil film on the surface of the wood that cannot be painted. Oil-type treatments may also exhibit bleeding that can be minimized when BMPs for that treatment are followed. Oil-type preservatives are used almost exclusively for treating structural components and should not be used for applications that allow repeated human or animal contact. Wood treated with ACQ should be used where there is repeated human or animal contact. Recent EPA rules caution against the use of CCA for structures where there will be high human contact, such as decks or playground structures. For further reference see: *Timber Bridges – Design, Construction, and Maintenance*, USDA Forest Service EM 7700-8, June 1990. Available at: *(The link provided was broken and has been removed)*.

BMPs – A Shared Responsibility

While much of the wood treating industry supports and encourages the use of Best Management Practices (BMPs) for aquatic applications of its products, compliance cannot be assumed. The additional cost of treating wood in compliance with BMPs discourages some producers from taking the extra effort. It is the government agency regulators and project specifiers who must ensure BMPs are followed. Until a more standardized system is developed, BMP use can be immediately implemented by the:

- Regulators who approve projects and designers who specify materials, by requiring that the treated wood products are produced in accordance with the most current version of the *Best Management Practices for Preservative-Treated Wood in Aquatic Environments in Michigan*.

- Users of the products, by requiring a written certification from the producer that BMPs were utilized, including a description of and appropriate documentation of the BMPs that were used.

Utilizing the BMPs

The following four steps will assure that products utilized in aquatic environments in Michigan are produced in compliance with the Michigan BMPs:

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

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

3. Require written assurance from the treating facility that the products were produced in conformance with these BMPs.

4. Inspect the treated material both prior to and during installation.

Best Management Practices for Creosote

Uses and Specifications

The following Commodities Standards from the AWPA Book of Standards should be followed for the preparation and use of various creosote-treated products used in and above aquatic environments:

C2 – Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 – Piles, Pressure Treatment
C14 – Wood for Highway Construction, Pressure Treatment
C28 – Structural Glued Laminated Members and Laminations Before Gluing, Pressure Treatment

Specifiers and installers should refer to the creosote-treated wood Material Safety Data Sheets (MSDS) and hazard labels that are required by the Occupational Safety and Health Administration (OSHA) and should use the material in conformance with the EPA Consumer Information Sheet for creosote-treated wood. Creosote should not be used in those portions of projects subject to human or animal contact, e.g. handrails.

Best Management Practices

In order to minimize the amount of creosote material available to migrate into the environment, users and specifiers of treated wood should consider the following guidelines for treated material to be used in an aquatic environment:

Treatment Procedures

- Treat using preservative specified as AWPA Standard P1/13 *Standard for Creosote Preservative Used in Land, Fresh Water and Marine Application*s. This form of creosote preservative is preferred for aquatic applications.
- Follow good housekeeping practices to minimize sawdust and other surface residues on the wood prior to treatment. If necessary, power wash prior to shipping to the work site to remove excess surface deposits.
- The “in use” creosote inventory maintained by the treating firm at the plant shall be purchased, managed and/or processed such as to maintain a xylene insoluble (XI) level of 0.5% maximum. Exception: A xylene insoluble level of 1.5% will be allowed for facilities treating Ponderosa or Southern Pine due to the problems associated with the sap and resin in those species. (Low levels of xylene insolubles will minimize the contaminants on the surface of the finished product.)
- Conditioning and Treatment – the wood must be conditioned using one of the techniques recommended in Standard C2 *Lumber, Timbers, Bridge Ties and Mine Ties* or C3 *Piles* of the AWPA Book of Standards. Conditioning is the process used to reduce the moisture content of wood before preservative treatment.

Post-Treatment Procedures

At the end of the treating cycle, treated 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 10-20°F above press temperatures for a minimum of one hour. Pump creosote back to storage and apply a minimum vacuum of 24 inches of mercury for a minimum of two 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 mercury to recover excess preservative. Release vacuum back to atmospheric pressure and steam for a two-hour 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 inches of mercury.

Maximum Creosote Loading

AWPA treating standards provide minimum requirements for preservative penetration and retention. BMPs strive to meet these standards without using more chemical than necessary. Treating shall be conducted in a manner that minimizes the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements. The average retention of delivered BMP-treated material shall not exceed 150% of the required minimum retention by assay. Note: Creosoted glu-laminated beams will be treated to Standard C14 because the beams have a greater amount of sapwood.

Maximum Chemical Loading – Efforts to set precise maximum chemical loading levels have proven technologically difficult due to the inherent variability found in wood including cell structure and amount of sapwood versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards while maintaining the needed protection provided by treating.

Conformance to BMPs

The producer of the products shall provide documentation of the treatment process and results with each load of treated material, to assure that the products were produced in conformance with the BMPs. Such documentation shall be prepared in accordance with AWPA and ASTM standards. If more than 5% of the surface area of the delivered treated product is covered with preservative-saturated sawdust, soil, or other matter, it shall be rejected for use in or above aquatic environments. Materials that seep excessive amounts of preservative shall be rejected for use in or above aquatic environments.

Field Treating Guidelines

Copper naphthenate-based solutions are commonly used for field treating holes, cuts or injuries that occur to the treated product. The objective of field treatment is to provide limited surface preservative on exposed, untreated wood surfaces.

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

- Follow the procedures outlined in AWPA Standard M4 - *Standard for Care of Preservative-Treated Wood Products*.
- Collect all construction debris including sawdust and drill shavings or dust to prevent entry into the aquatic environment.
- 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.
- Whenever possible, make cuts and perform machining operations and subsequent application of preservative 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. Avoid using excessive amounts of field treating solution that may drip or overflow following assembly.

Notes

1. The purpose of BMPs for creosote is to minimize the amount of surface residues which are available to migrate to the environment. The use of low xylene insolubles creosote will minimize contaminants on the surface of the finished product. Post-conditioning (e.g. steaming or expansion bath) helps to assure that excess creosote is removed from the product. This must be done in a manner that does not reduce the amount of creosote in the assay zone (retention) below that specified for the particular product and application.

2. When creosote-treated wood is first placed into the water, a visible oil sheen will often develop on the water surface. This oil sheen represents a trace quantity of creosote and in nearly all instances will dissipate within 24 to 48 hours through evaporation, biodegradation or photodegradation. Available data indicates this sheen, which decreases rapidly following installation, will not harm aquatic life nor will it enter the food chain.

Best Management Practices for Pentachlorophenol (Penta)

Uses and Specifications

Pentachlorophenol (penta) is an oil-type preservative suitable for a number of above-water applications. The specific AWPA commodity standards that should be used to specify the preparation and use of various penta-treated products used in an aquatic environment are:

C2 – Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 – Piles, Pressure Treatment
C14 – Wood for Highway Construction, Pressure Treatment
C28 – Structural Glued Laminated Members and Laminations Before Gluing, Pressure Treatment

Specifiers and installers should refer to the pentachlorophenol-treated wood Material Safety Data Sheets (MSDS) and hazard labels that are required by the Occupational Safety and Health Administration (OSHA) and should use the material in conformance with the EPA Consumer Information Sheet for pentachlorophenol-treated wood. Penta should not be used in those portions of projects subject to human or animal contact, e.g. handrails.

Best Management Practices

The BMPs for penta are intended to ensure responsible treatment and product use. The use of penta-treated wood for aquatic projects should be limited to “above the splash zone”. To minimize penta migration into the environment, use the following guidelines when treating material for use in aquatic 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, which will result in less surface deposits and thus the amount of penta which may be released from in-service wood.
- Use penta that meets the requirements of AWPA P8, Section 1, and an appropriate solvent carrier that meets the requirements of AWPA P9.
- Treating Recommendations – While there are various pressure and treatment methods, a common wood treating process using penta is called the “empty cell” process. The wood may be treated using an empty cell process according to the applicable AWPA Standards, including appropriate post-treatment steps such as vacuums, expansion baths in oil, and post-steaming to clean wood surfaces.
- 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.
- Prior to treatment, pre-condition wood according to acceptable methods for the species as indicated in AWPA Standards C2 and C3 to remove the water. Methods to reduce the wood’s moisture content include air seasoning, kiln drying, in-cylinder steaming with subsequent vacuum, or heating under a vacuum in the presence of the treating solution followed by a vacuum.
- 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 wood species being treated, plant equipment capabilities and the target retention level. Initial pressures in the range of atmospheric to 50 psi are common. (Preservative treaters generally know from experience the lowest initial air pressure needed to attain the desired levels of treatment.) After achieving the desired initial air pressure, pump the treating solution into the treating cylinder, maintaining the air pressure while filling the cylinder. Supply additional treating solution into the cylinder until attaining a calculated gross injection.

Post-Treatment Procedures

Following injection, relieve pressure and remove solution from the cylinder followed by an appropriate post-conditioning cycle to remove excess preservative from the surface of the wood and to remove excess preservative and pressurized air from the wood cells.

Excess preservative must be removed from the surface of the wood. Incorporate one of the following procedures into the treating process to minimize the penta residue on the treated product surface. Techniques may vary depending upon the product type and wood species, and treating parameters:

- Steaming – After applying the vacuum to the treating cylinder for a period of time suitable to the load, apply final steaming to remove excess preservative solution from the surface of the wood. Steam flash shall not exceed the temperature or time limit set forth in AWPA Standards.
- Expansion Bath – Perform expansion bath in accordance with AWPA Specification C1, 2.3.

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

Maximum Penta Loading

AWPA treating standards provide minimum requirements for preservative penetration and retention. BMPs strive to meet these standards without using more chemical than necessary. Treating shall be conducted in a manner that minimizes the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements. The average retention of delivered BMP-treated material shall not exceed 150% of the required minimum retention by assay.

Maximum Chemical Loading – Efforts to set precise maximum chemical loading levels have proven technologically difficult due to the inherent variability found in wood including cell structure and amount of sapwood versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards while maintaining the needed protection provided by treating.

Conformance to BMPs

The producer of the products shall provide documentation of the treatment process and results with each load of treated material, to assure that the products were produced in conformance with the BMPs. Such documentation shall be prepared in accordance with AWPA and ASTM standards. If more than 5% of the surface area of the delivered treated product is covered with preservative-saturated sawdust, soil, or other matter, it shall be rejected for use in or above aquatic environments. Materials that seep excessive amounts of preservative shall be rejected for use in or above aquatic environments.

Field Treating Guidelines

Copper naphthenate-based solutions are commonly used in field treating holes, cuts or injuries that occur to the treated product. The objective of field treatment is to provide limited surface preservative on exposed, untreated wood surfaces.

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

- Follow the procedures outlined in AWPA Standard M4 - *Standard for Care of Preservative-Treated Wood Products*.
- Collect all construction debris including sawdust and drill shavings or dust to prevent entry into the aquatic environment.
- 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.
- Whenever possible, make cuts and perform machining operations and subsequent application of preservative 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. Avoid using excessive amounts of field treating solution that may drip or overflow following assembly.

Notes

1. When penta-treated wood is first placed into a body of water, a visible oil sheen will often develop on the water surface. This oil sheen represents a trace quantity of penta and in nearly all instances will dissipate within 24 to 48 hours through evaporation, biodegradation or photodegradation. Available data indicates this sheen, which decreases rapidly following installation, will not harm aquatic life nor will it enter the food chain.

2. Penta contains trace levels of chlorinated dioxins. Although dioxins are a family of chemicals comprising 75 different types of dioxin compounds, the term “dioxin” generally refers only to one specific compound: 2,3,7,8-TCDD. TCDD is the most toxic form of dioxin to laboratory animals and therefore, has been the subject of the greatest scientific scrutiny. This dioxin is not found in penta. The small quantities of other dioxins found in penta are strictly regulated by EPA, and do not render the wood dangerous for use when proper care is exercised in handling and application.

Best Management Practices for Copper Naphthenate

Uses and Specifications

Copper naphthenate-treated wood is accepted for freshwater applications and above-water applications. Copper naphthenate is not a restricted use pesticide and is commonly used for field treating holes and field fabrication cuts made in treated wood during construction. The specific AWPA standards used to specify copper naphthenate-treated products are limited to above-water applications only. Only wood species listed in the appropriate AWPA standard can be treated with copper naphthenate.

C2 – Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 – Piles, Pressure Treatment
C14 – Wood for Highway Construction, Pressure Treatment
C28 – Structural Glued Laminated Members and Laminations Before Gluing, Pressure Treatment

Specifiers and installers should follow the guidance in the copper naphthenate-treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by the Occupational Safety and Health Administration (OSHA).

Best Management Practices

The BMPs for copper naphthenate are to ensure responsible treatment and product use. The use of copper naphthenate-treated wood for aquatic projects should be limited to “above the splash zone”. To minimize copper naphthenate migration into the environment, use the following guidelines when treating material for use in aquatic applications:

Treatment Procedures

- Treat using copper naphthenate that 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 that may otherwise be deposited on the wood during treating. AWPA, M20 guidelines should be followed to minimize the formation of solution solids, particulate and residues.
- 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.

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

  The expansion bath shall be followed by a vacuum period using a minimum 22 inches of mercury 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 inches of mercury 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 temperatures during steaming shall be 200º F and the maximum shall be 240º F with time limitations, depending on the species being treated. After steaming, apply a final vacuum for a minimum of four hours at 22 inches of mercury.

Post-Treatment Procedures – “Light” Solvent Carrier

For copper naphthenate-treated products with a light solvent carrier, use AWPA Standard P9, Type C solvent. The following BMP for aquatic environment applications is invoked:

- A final vacuum shall be used for a minimum of one hour at a minimum of 22 inches of mercury.

Maximum Copper Naphthenate Loading

AWPA treating standards provide minimum requirements for preservative penetration and retention. BMPs strive to meet these standards without using more chemical than necessary. Treating shall be conducted in a manner that minimizes the amount of chemical placed into the wood while assuring conformance with the AWPA retention and penetration requirements. The average retention of delivered BMP-treated material shall not exceed 150% of the required minimum retention by assay.

Maximum Chemical Loading – Efforts to set precise maximum chemical loading levels have proven technologically difficult due to the inherent variability found in wood including cell structure and amount of sapwood versus heartwood. Industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards while maintaining the needed protection provided by treating.

Conformance to BMPs

The producer of the products shall provide documentation of the treatment process and results with each load of treated material, to assure that the products were produced in conformance with the BMPs. Such documentation shall be prepared in accordance with AWPA and ASTM standards. If more than 5% of the surface area of the delivered treated product is covered with preservative-saturated sawdust, soil, or other matter, it shall be rejected for use in or above aquatic environments. Materials that seep excessive amounts of preservative shall be rejected for use in or above aquatic environments.

Field Treating Guidelines

Copper naphthenate-based solutions are commonly used for field treating holes, cuts or injuries that occur to the treated product. The objective of field treatment is to provide limited surface preservative on exposed, untreated wood surfaces.

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

- Follow the procedures outlined in AWPA Standard M4 - *Standard for Care of Preservative-Treated Wood Products*.
- Collect all construction debris including sawdust and drill shavings or dust to prevent entry into the aquatic environment.
- 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.
- Whenever possible, make cuts and perform machining operations and subsequent application of preservative 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. Avoid using excessive amounts of field treating solution that may drip or overflow following assembly.

Best Management Practices for CCA - Type C

Uses and Specifications

Chromated Copper Arsenate (CCA) – Type C is accepted for a full range of water applications in the American Wood-Preservers' Association (AWPA) Book of Standards. The specific standards specified for CCA used in and above an aquatic environment in Michigan are:

C2 – Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment
C3 – Piles, Pressure Treatment
C14 – Wood for Highway Construction, Pressure Treatment
C28 – Structural Glued Laminated Members and Laminations Before Gluing, Pressure Treatment

Specifiers and installers should follow the guidance in the CCA-treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by the Occupational Safety and Health Administration (OSHA) and should use the product in conformance with the EPA Consumer Information Sheet for inorganic arsenical pressure-treated wood.

Best Management Practices

In the CCA treating process, water is the carrier that moves the metals into the wood where they become fixed to the wood as it is dried. Once the chemical reaction called "fixation" occurs, the active ingredients become highly insoluble. The BMPs for CCA are intended to assure that fixation occurs prior to the material leaving the treating facility and that the material leaves the facility free of surface residues.

Treatment Procedures

- CCA-C treating solutions should be prepared and used in accordance with AWPA Preservative Standard P5 Section 6.
- Follow good handling practices to minimize sawdust and other surface residues on the wood products prior to treatment. If necessary, power wash to remove excess surface deposits.

Post-Treatment Procedures

Appropriate post-treatment must be conducted to achieve fixation. Achieving fixation by using one of the following wood moisture-reduction methods 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

If the Chromotrophic Acid Test shows that fixation has not been completed, the material shall be withheld from shipment and/or installation until fixation is confirmed.

Maximum CCA Loading

Treating shall be conducted in a manner that minimizes the amount of chemical placed into the wood while assuring conformance to the AWPA retention and penetration requirements. Earlier efforts to set precise maximum chemical loading levels have proven technologically difficult due to the inherent variability found in wood including cell structure and amount of sapwood versus heartwood. The wood treatment industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards while maintaining the needed protection provided by treating.

Conformance to BMPs

The producer of the products shall provide documentation of the treatment process and results with each load of treated material, to assure that the products were produced in conformance with the BMPs. Such documentation shall be prepared in accordance with AWPA and ASTM standards. If more than 5% of the surface area of the delivered treated product is covered with preservative-saturated sawdust, soil, or other matter, it shall be rejected for use in or above aquatic environments. Materials that seep excessive amounts of preservative shall be rejected for use in or above aquatic environments.

Field Treating Guidelines

Copper naphthenate-based solutions are commonly used for field treating holes, cuts or injuries that occur to the treated product. The objective of field treatment is to provide limited surface preservative on exposed, untreated wood surfaces.

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

- Follow the procedures outlined in AWPA Standard M4 - *Standard for Care of Preservative-Treated Wood Products*.
- Collect all construction debris including sawdust and drill shavings or dust to prevent entry into the aquatic environment.
- 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.
- Whenever possible, make cuts and perform machining operations and subsequent application of preservative 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. Avoid using excessive amounts of field treating solution that may drip or overflow following assembly.

Best Management Practices for ACQ - Type D

Uses and Specifications

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

C2 – Lumber, Timbers, Bridge Ties and Mine Ties, Pressure Treatment

Specifiers and installers should follow the guidance in the ACQ-treated wood Material Safety Data Sheets (MSDS) and hazard labels as required by the Occupational Safety and Health Administration (OSHA).

Best Management Practices

In the ACQ treating process, water is the carrier that moves the metals into the wood where they become fixed to the wood as it is dried. Once the chemical reaction called "fixation" occurs, the active ingredients become highly insoluble. The BMPs for ACQ are intended to assure that fixation occurs prior to the material leaving the treating facility and that the material leaves the facility free of surface residues.

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. If necessary, power wash to remove excess surface deposits.

Post-Treatment Procedures

Apply appropriate post-treatment procedures to achieve fixation. Achieving fixation by using one of the following wood moisture-reduction methods 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 ACQ Loading

Treating shall be conducted in a manner that minimizes the amount of chemical placed into the wood while assuring conformance to the AWPA retention and penetration requirements. Earlier efforts to set precise maximum chemical loading levels have proven technologically difficult due to the inherent variability found in wood including cell structure and amount of sapwood versus heartwood. The wood treatment industry remains focused on conducting the necessary research to reduce required chemical levels in the AWPA standards while maintaining the needed protection provided by treating.

Conformance to BMPs

The producer of the products shall provide documentation of the treatment process and results with each load of treated material, to assure that the products were produced in conformance with the BMPs. Such documentation shall be prepared in accordance with AWPA and ASTM standards. If more than 5% of the surface area of the delivered treated product is covered with preservative-saturated sawdust, soil, or other matter, it shall be rejected for use in or above aquatic environments. Materials that seep excessive amounts of preservative shall be rejected for use in or above aquatic environments.

Field Treating Guidelines

Copper naphthenate-based solutions are commonly used in field treating holes, cuts or injuries that occur to the treated product. The objective of field treatment is to provide limited surface preservative on exposed, untreated wood surfaces.

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

- Follow the procedures outlined in AWPA Standard M4 - *Standard for Care of Preservative-Treated Wood Products*.
- Collect all construction debris including sawdust and drill shavings or dust to prevent entry into the aquatic environment.
- 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.
- Whenever possible, make cuts and perform machining operations and subsequent application of preservative 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. Avoid using excessive amounts of field treating solution that may drip or overflow following assembly.

Environmental Risks Associated with Creosote

Creosote is not fixed within the wood so constituents of creosote may seep from the wood into the environment. The compounds of concern in creosote are polycyclic aromatic hydrocarbons (PAH). These compounds have always been present in the environment and rarely occur at levels toxic to aquatic organisms. However, inputs from cities and industry can result in the localized toxic accumulation of PAH in sediments. In normal sediments, with adequate oxygen, naturally occurring microbes consume PAH. However, where sediments are devoid of oxygen, these compounds can accumulate to levels that can cause acute and chronic toxicity in aquatic organisms.

The use of creosote-treated piling in fast flowing water with sandy or gravely substrates generally poses little risk to the environment. However, research models suggest the use of large amounts of creosote-treated wood in very poorly flushed water bodies, especially those with muddy sediments that lack oxygen, can result in the accumulation of toxic levels of PAH within a few inches of pilings. When large creosote projects are considered in poorly circulated water bodies where sediments contain low oxygen levels, a site-specific risk assessment should be undertaken.

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

Environmental Risks Associated with Pentachlorophenol

Technical-grade pentachlorophenol (PCP) contains many impurities, including polychlorinated dibenzodioxins (PCDDs), polychlorinated dibenzofurans (PCDFs), and hexachlorobenzene (HCB). The solution penetrates into the wood, but does not chemically bind with it. Therefore, the PCP can be expected to slowly bleed from the wood. Treated poles will undergo a “gravity-down” process, whereby downward migration of PCP within the wood results in simultaneous reduction in concentration in the upper pole and increase in concentration in the lower pole. Localized soil contamination around such PCP-treated poles has been demonstrated.

At low concentrations in water, PCP appears to be quite readily degraded by microbial action (in water treatment facilities) and, in clear water, it photolyzes rapidly. The degradation products include various chlorinated organic compounds. Turbid conditions or extreme concentrations could inhibit these two processes. The persistence of PCP in natural waters is estimated to be one week in conditions that are optimal for photolysis. For systems in which biodegradation is the primary removal mechanism, the persistence will be greater and extremely variable, depending on environmental conditions. Absorption onto sediments and suspended organic matter is also likely to occur, with potential re-release to water. PCDD and PCDF, contaminants of technical grade PCP, are extremely persistent in the environment.

The primary concerns with the contamination of surface water with very low levels of technical grade PCP are the aquatic toxicity of PCP and the persistence and carcinogenicity of some of its contaminants. PCP is moderately bioaccumulative and highly toxic to aquatic life. Ambient concentrations in the low ppb range may be problematic for many aquatic species. Therefore, although the solubility of PCP is relatively low, it is still sufficient to allow concentrations of PCP in solution that can result in adverse effects to aquatic life.

The other risk of concern is the presence of the carcinogenic and environmentally persistent contaminants HCB and hexachlorodibenzo-p-dioxin (HxCDD) in technical grade PCP. Although EPA has taken regulatory action to limit the amount of HxCDD in PCP, the continued presence of this and other chlorinated organic contaminants warrant caution regarding the placement of treated lumber directly into surface water.

Environmental Risks Associated with CCA

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 highly toxic to humans, it is highly toxic to aquatic life. Unlike the sediment concerns with PAHs found in creosote, dissolved copper in the water column presents the highest risk to aquatic organisms. Copper and arsenic losses from CCA-treated wood are time dependent and losses are very small after 90 days. Where large surface area projects are proposed at poorly circulated sites, the project should be constructed during that time of year when sensitive bivalve larvae are not present (usually in late fall and winter).

Environmental Risks Associated with Other Treating Chemicals

The environmental risks associated with other treating chemicals are not addressed herein. The reader should refer to other sources of information in order to understand the environmental risks associated with other treating chemicals.

Appendix A

EPA Consumer Information Sheets

EPA Consumer Information Sheets for three major groups of preservative pressure-treated wood.

	Creosote	Pentachlorophenol	Inorganic arsenicals
Consumer Information	This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing creosote to protect it from insect attack and decay. Wood treated with creosote should be used only where such protection is important. Creosote penetrates deeply into and remains in the pressure-treated wood for a long time. Exposure to creosote may present certain hazards. Therefore, the following precautions should be taken both with handling the treated wood and in determining where to use the treated wood.	This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing pentachlorophenol to protect it from insect attack and decay. Wood treated with pentachlorophenol should be used only where such protection is important. Pentachlorophenol penetrates deeply into and remains in the pressure-treated wood for a long time. Exposure to pentachlorophenol may present certain hazards. Therefore, the following precautions should be taken both when handling the treated wood and in determining where to use and dispose of the treated wood.	This wood has been preserved by pressure-treatment with an EPA-registered pesticide containing chromated copper arsenate (CCA) to protect it from termite attack and decay. Wood treated with CCA should be used only where such protection is important. CCA penetrates deeply into and remains in the pressure treated wood for a long time. However, some chemical may migrate from treated wood into surrounding soil over time and may also be dislodged from the wood surface upon contact with skin. Exposure to CCA may present certain hazards. Therefore, the following precautions should be taken both when handling the treated wood and in determining where to use and dispose of the treated wood.
Handling Precautions	Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with state and Federal regulations. Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.	Dispose of treated wood by ordinary trash collection or burial. Treated wood should not be burned in open fires or in stoves, fireplaces, or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers rated at 20 million BTU/hour or greater heat input or its equivalent in accordance with state and Federal regulations. Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations of airborne sawdust from treated wood.	Dispose of treated wood by ordinary trash collection. Treated wood should not be burned in open fires or in stoves, fireplaces or residential boilers because toxic chemicals may be produced as part of the smoke and ashes. Treated wood from commercial or industrial use (e.g., construction sites) may be burned only in commercial or industrial incinerators or boilers in accordance with state and Federal regulations. Avoid frequent or prolonged inhalation of sawdust from treated wood. When sawing, sanding, and machining treated wood, wear a dust mask. Whenever possible, these operations should be performed outdoors to avoid indoor accumulations or airborne sawdust from treated wood.

	Creosote	Pentachlorophenol	Inorganic arsenicals
Handling Precautions, continued	Avoid frequent or prolonged skin contact with creosote-treated wood; when handling the treated wood, wear long-sleeved shirts and long pants and use gloves impervious to the chemicals (for example, gloves that are vinyl coated). When power-sawing and machining, wear goggles to protect eyes from flying particles. After working with the wood, and before eating, drinking, and the use of tobacco products, wash exposed areas thoroughly. If oily preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing. Coal tar pitch and coal tar pitch emulsion are effective sealers for creosote-treated wood-block flooring. Urethane, epoxy, and shellac are acceptable sealers for all creosote-treated wood.	Avoid frequent or prolonged skin contact with pentachlorophenol-treated wood; when handling the treated wood, wear long-sleeved shirts and long pants and use gloves impervious to the chemicals (for example, gloves that are vinyl coated). When power-sawing and machining, wear goggles to protect eyes from flying particles. After working with the wood, and before eating, drinking, and use of tobacco products, wash exposed areas thoroughly. If oily preservatives or sawdust accumulate on clothes, launder before reuse. Wash work clothes separately from other household clothing. Urethane, shellac, latex epoxy enamel and varnish are acceptable sealers for pentachlorophenol-treated wood.	When power sawing and machining, wear goggles to protect eyes from flying particles. Wear gloves when working with the wood. After working with the wood, and before eating, drinking, toileting, and use of tobacco products, wash exposed areas thoroughly. Because preservatives or sawdust may accumulate on clothes, they should be laundered before reuse. Wash work clothes separately from other household clothing.
Use site Precautions	Wood treated with creosote should not be used where it will be in frequent contact with bare skin (for example, chairs and other outdoor furniture) unless an effective sealer has been applied. Creosote-treated wood should not be used in residential interiors. Creosote-treated wood in interiors of industrial building should be used only for industrial building components which are in ground contact and are subject to decay or insect infestation and wood block flooring. For such uses, two coats of an appropriate sealer must be applied. Sealers may be applied at the installation site.	Logs treated with pentachlorophenol should not be used for log homes. Wood treated with pentachlorophenol should not be used where it will be in frequent or prolonged contact with bare skin (for example, chairs and other outdoor furniture), unless an effective sealer has been applied. Pentachlorophenol-treated wood should not be used in residential, industrial, or commercial interiors except for laminated beams or for building components which are in ground contact and are subject to decay or insect infestation and where two coats of an appropriate sealer is applied. Sealers may be applied at the installation site.	All sawdust and construction debris should be cleaned up and disposed of after construction. Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such sites would be use of mulch from recycles arsenic-treated wood, cutting boards, counter tops, animal bedding, and structures or containers for storing animal feed or human food. Only treated wood that is visibly clean and free of surface residue should be used for patios, decks and walkways. Do not use treated wood for construction of those portions of beehives which may come into contact with honey.

	Creosote	Pentachlorophenol	Inorganic arsenicals
Use Site Precautions, continued	Wood treated with creosote should not be used in the interiors of farm buildings where there may be direct contact with domestic animals or livestock which may crib (bite) or lick the wood. In interiors of farm buildings where domestic animals or livestock are unlikely to crib (bite) or lick the wood, creosote-treated wood may be used for building components which are in ground contact and are subject to decay or insect infestation if two coats of an effective sealer are applied. Sealers may be applied at the installation site. Do not use creosote-treated wood for farrowing or brooding facilities. Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such use would be structures or containers for storing silage or food. Do not use treated wood for cutting-boards or countertops. Only treated wood that is visibly clean and free of surface residue should be used for patios, decks and walkways. Do not use treated wood for construction of those portions of beehives which may come in contact with the honey. Creosote-treated wood should not be used where it may come into direct or indirect contact with public drinking water, except for the uses involving incidental contact such as docks or bridges. Do not use creosote-treated wood where it may come into direct or indirect contact with drinking water for domestic animals or livestock, except for uses involving incidental contact such as docks and bridges.	Wood treated with pentachlorophenol should not be used in the interiors of farm buildings where there may be direct contact with domestic animals or livestock which may crib (bite) or lick the wood. In interiors of farm buildings where domestic animals or livestock are unlikely to crib (bite) or lick the wood, pentachlorophenol-treated wood may be used for building components which are in ground contact and are subject to decay or insect infestation and where two coats of an appropriate sealer are applied. Sealers may be applied at the installation site. Do not use pentachlorophenol-treated wood for farrowing or brooding facilities. Do not use treated wood under circumstances where the preservative may become a component of food or animal feed. Examples of such sites would be structures or containers for storing silage or food. Do not use treated wood for cutting-boards or countertops. Only treated wood that is visibly clean and free of surface residue should be used for patios, decks and walkways. Do not use treated wood for construction of those portions of beehives which may come in contact with the honey. Pentachlorophenol-treated wood should not be used where it may come in direct or indirect contact with public drinking water, except for uses involving incidental contact such as docks and bridges. Do not use pentachlorophenol-treated wood where it may come into direct or indirect contact with drinking water for domestic animals or livestock, except for uses involving incidental contact such as docks and bridges.	Treated wood should not be used where it may come into direct or indirect contact with drinking water, except for uses involving incidental contact such as docks or bridges. CCA-treated wood should be sealed if used for decks, playground structures, or other uses where humans or animals are in contact.

Appendix B

Proposed Timber Bridge Design Criteria

7.09

TIMBER STRUCTURES & TREATMENTS

7.09.01

General

For timber structures, selection of superstructure and substructure type and the preservative treatment specification shall be considered at the Scoping or TS&L phase. Timber species, structure type, and treatment type must be chosen together to maximize economy, minimize maintenance and protect the environment.

7.09.02

Site Environmental Criteria

A. Bridges over Water

The type of preservative treatment (and therefore timber species and superstructure type) best suited for the site, should be considered early in the design stage, to minimize aesthetic or environmental problems, such as oil sheens on the water surface, caused by leaching preservative or carrier.

1. Fast Moving Rivers & Streams

   Fast moving rivers and streams dissipate leached preservatives and solvents, so heavy oil borne preservatives are generally acceptable.

2. Slow Moving Waters

   The use of heavy oil borne carriers or preservatives that tend to leach from the superstructure should be avoided on slow moving streams, or still waters, to avoid unsightly sheens on the water surface. Oil borne preservatives that tend not to leach, such as penta in light oil can be used successfully.

3. Riparian Land Uses

   Neighboring land uses must be considered while selecting structure type and treatment type. Some preservative treatments, especially oil borne treatments, tend to emit objectionable odors, that can cause negative impacts on neighboring land uses, such as residential or recreation areas. The likelihood of pedestrian skin contact with the various parts of the structure must be considered. Penta and creosote should not be used for members, such as handrails, that are frequently in contact with skin.

4. Natural, and Wild and Scenic Rivers

   Structures spanning rivers designated as Natural, or Wild and Scenic, by state or federal statute are carefully regulated and aesthetic and environmental issues are even more important on these sites. Contact Michigan Department of Environmental Quality staff at the Scoping or TS&L stage to define specific legal or policy requirements. Consider the regulatory and aesthetic goals of the agency having jurisdiction, early in the design process.

B. Bridges over Roadways/Sidewalks

Avoid the use of structure types, and preservative treatment types, that tend to leach preservatives and solvents.

C. Site Equilibrium Moisture Content

Site equilibrium moisture content must be considered when selecting bridge type and

treatment type. Oil borne preservatives and open type structures should be considered preferable on sites that are likely to have a relatively high equilibrium moisture content.

7.09.03

Aesthetic Criteria

A. Bridge Type

Consider the bridge's appearance while selecting the type of timber superstructure. Generally, a slender, but strong, flowing appearance is desirable. Analyze several economically feasible types of timber superstructure, for the required span, and compare aesthetics. Solicit input from architects and landscape architects. Do not limit superstructure options to mass produced types.

Select the span to blend with the site. Avoid high (more than 3 meters) abutments, by increasing span and by designing approach fills that blend well with the site.

Design wingwalls with various angles, and to extend to the point where approach embankment slopes meet stream, or underside slopes.

B. Treatment Type

Specify preservative treatment types with aesthetics in mind. Avoid creosote over concrete abutments or piers.

Consider the use of light oil carriers, penta, and CCA. CCA is available, in Michigan, with colored stain additives.

7.09.04

Superstructure Type vs. Span

A. References

Consult the following references, and others.
Standard Specifications for Highway Bridges, American Association of State Highway and Transportation Officials, (AASHTO)

Timber Bridges, Design, Construction, Inspection and Maintenance, USDA Forest Service

Wood Handbook, Wood as an Engineering Material, USDA Forest Service

Timber Construction Manual, American Institute of Timber Construction (AITC)

National Wood in Transportation Information Center web-site; www.fs.fed.us/na/wit

B. Typical Types/Spans

Refer to references listed above for more detailed information. In general, common superstructure types and approximate reasonable simple spans are as follows.

Type	Span Range(m)
Solid Sawn Beam	<8
Longitudinal Glu-lam Panel	<9
Spike-lam	<8
Solid Sawn, Stress-lam	<8
Glu-lam, Stress-lam	8 to 12
Glu-lam Beam	6 to 25
Stress-lam Box	12 to 20
Glu-lam Arch	18 to 60
Truss	25 to 75

7.09.05

Material Selection

A. Structural Considerations

Lumber is a commodity, subject to price fluctuations, with varying market conditions. Research current market conditions, and specify the minimum grade necessary for the structural performance required. Strike a balance between member size and grade, for maximum economics.

B. Preservative Treatments Available

Certain wood species accept certain types of preservative treatment(s) better than others.

Some species cannot be successfully treated with some types of preservatives.

Currently CCA, creosote, and penta are available and feasible for use on bridges in Michigan. Consult references for more information.

C. Mixing Species & Treatment

Minimize the number of wood species and preservative treatment types on a project. Design with the performance of the entire structure, and each element, in mind, and mix woods and treatments where durability advantages and structural performance benefits outweigh the cost. Since some wood species cannot be successfully treated with some preservative types, it is sometimes advantageous to mix wood species and therefore preservative treatment types in a structure. An example might be to specify oak for certain structrual components where high compression perpendicular to grain allowable stresses provide a significant advantage. Since oak does not treat well with CCA, but treats well with creosote, the designer might have only the oak parts treated with creosote, while other parts of the structure (say southern pine) are CCA treated.

Use CCA or other waterborne treatments wherever possible, especially on low moisture sites, or in structures or parts of structures not subject to rapid wetting or drying or intense sunlight.

Use oil borne preservatives where intense sunlight may cause checks and splits of primary structural members.

Use creosote where an economical oil borne treatment is desired.

Use penta in heavy oil (Type A), where an oil borne treatment, other than creosote is desired. Especially in ground contact or for glu-lams treated after gluing.

Use penta in light oil (Type C), where an oil borne treatment, not likely to leach, is required, as with glu-lam arches, and where treatment before gluing of glu-lam members is deemed necessary.

Consider oak or other hardwoods for components subject primarily to compression perpendicular to grain stresses.

Consider glu-lams for large members. Relatively large solid sawn members are more costly and less available than in the past, as our nation's large diameter timber resources become more valuable.

7.09.06

Preservative Treatment Specifications

A. Waterborne Preservatives

Specify (by special provision) drying after treatment for waterborne preservative treated material, where shrinkage is likely to cause detrimental effects. Require testing and certification of results of drying.

B. Creosote

Specify (by special provision) empty cell process, post treatment cleaning, and in some cases, maximum retention values. Specify the type of oil carrier. See references.

C. Penta

Specify penta in accordance with published references. Use light oil carrier wherever possible, since it tends to leach less than the heavy oil solvents. More volatile light oil solvents' effectiveness can diminish with time.

Appendix C

Model Timber Bridge Special Provision

MICHIGAN
DEPARTMENT OF TRANSPORTATION

SPECIAL PROVISION
FOR
STRUCTURE, TIMBER (MODIFIED)

XX/NDG/HJH

11/13/01

A. **Description**: This work shall be in accordance with Section 709 of the Michigan Department of Transportation, 1996 Standard Specifications for Construction, including any supplemental specifications, except as modified herein.

This work includes all miscellaneous hardware and accessories for the timber structure.

All piling and excavation will be considered to be separate and will be measured and paid for in accordance with the units and unit prices set forth in this contract.

B. **Materials**: Materials shall meet the requirements specified in Subsection 709.02 of the 1996 Standard Specifications for Construction. In addition, materials shall meet the requirements listed below:

All timber materials shall be pressure treated with Creosote, Pentachlorophenol (Penta) Type C, Penta Type A, or CCA, as required by plan details.

Preservative treatments, and treated timber materials shall comply with the following AWPA standards:

Preservatives	
Creosote	P1
Pentachlorophenol	P8 & P9
CCA	P5
Commodities	
Wood for Highway Const.	C14

Penta Type C and CCA treated glued laminated (glu-lam) members shall be treated **before** laminating, unless specifically noted otherwise on the plans, or approved by the engineer. Creosote or penta in heavy oil treated glu-lam shall be treated after gluing. All glu-lam members shall be treated per AWPA C28, for ground contact.

Creosote treated glu-lam members shall be treated per AWPA C28, ground contact; **not per C14**.

Oil borne preservative (creosote and penta) treated members shall be treated using an empty cell process, and shall be cleaned after treating by either final steaming or expansion bath, per AWPA C1, 2.3.

Techniques shall be incorporated into the treating process to minimize the amount of residual treatment on the surface of treated timber members, and to avoid excessively high retentions. To assure that there are a minimum of contaminants on the surface of finished creosote treated members, low levels of xylene shall be maintained by the treating firm. The "in-use" creosote inventory maintained by the treating firm at the plant shall be purchased, managed and/or processed so as to maintain a xylene insoluble (XI) level of 0.5% maximum. For Ponderosa and Southern Pine, xylene levels of 1.5% will be allowed. To assure that treated timber members are not treated to excessively high retentions, the average retentions shall not exceed 150% of the AWPA specified minimums.

CCA treated members shall be subjected to specific fixation processes. Specific fixation processes include air seasoning, kiln drying, steaming, or hot water baths (per AWPA C1). CCA treated materials shall be dried to a moisture content of 19% or less before shipping. Individual laminations of glued laminated members shall be dried before gluing.

Failure to remove excess creosote or penta from the surface of treated timber members will result in rejection of the material. This item will be inspected at the treatment facility (per AWPA M2), and again at the construction site. Excessive residual treatment chemical bleeding from the surface of members will result in rejection at the construction site. Excessive residual treatment chemical is defined as free preservative chemical or preservative-saturated soil or sawdust on more than 5% of the surface area.

The preservative treatment process shall be inspected per AWPA M2. The contractor shall employ and pay for the required inspections and tests at the treatment plant.

In addition to the certifications required by Section 912, the contractor shall submit the following certifications demonstrating compliance with preservative treatment specifications.

1. Certification that treatment and post treatment processes meet the requirements of this contract.
2. The final inspection report per AWPA M2, Part A, Section 6, including a statement by the inspector that any materials or work not conforming with these contract requirements has been rejected.
3. Certification that the material moisture contents have been tested and found to comply with contract requirements.

The contractor shall furnish all treatment certifications for approval of the engineer prior to shipping. Approval of the certifications does not constitute final acceptance.

Glu-lam members shall be a combination symbol or manufactured from timber species and with the structural properties specified on the plans. Glu-lams shall be manufactured in accordance with ANSI/AITC A190.1-1992. Members shall be marked with a Quality Mark and, in addition, a Certificate of Conformance shall be provided to indicate conformance with ANSI/AITC A190.1-192.

In addition to the certification required by Section 912 of the 1996 Standard Specifications for Construction, the contractor will be required to submit written certification that the glu-lam members meet the allowable bending stress, and modulus of elasticity specified on the plans. Written certification must be approved by the Engineer prior to cutting for fabricating of glu-lam members.

All structural steel, miscellaneous metals, and hardware shall be **galvanized** in accordance with ASTM A153. Bolts shall be ASTM A307 unless otherwise specified on the plans.

C. **Construction Methods**: Construction shall meet the requirements specified in subsection 709.03 of the 1996 Standard Specification for construction. In addition, construction shall meet requirements listed below.

The diameter and depth of holes in timber members, for drift pins, drive spikes, bolts, and lag bolts shall be as recommended by the American Institute for Timber Construction (AITC).

All drilling, cutting, and fabricating of timber members, other than glu-lams treated before laminating, shall be done prior to treatment, unless otherwise approved by the Engineer.

The contractor shall submit five sets of shop drawings for approval, prior to fabrication.

D. **Measurement and Payment**: The completed work as measured for STRUCTURE TIMBER, (MODIFIED) will be paid for at the contract unit price for the following contract item (pay item).

Pay Item	Pay Unit
Structure, Timber (Modified)	LS

Payment for all miscellaneous steel, hardware, and accessories is included in this pay item.