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From: Commander, Naval Facilities Engineering Command (NAVFAC Criteria Office)
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Subj: INTERIM TECHNICAL GUIDANCE (ITG) - WOOD PROTECTION IN THE MARINE ENVIRONMENT

Encl: (1) "Current and Proposed Navy Practices for Wood Protection in the Marine Environment," TM-2159-OCN by David Pendleton, NFESC of Nov 95

1. Purpose: The purpose of this guidance is to advise facility engineers, planners, and maintenance personnel of environmentally acceptable protection measures for timber placed in the marine environment. Retain this guidance until it is incorporated into the criteria noted in paragraph 5.

2. Background: The Navy owns hundreds of waterfront structures built wholly or partially with timber components. One study noted over 200,000 bearing and fender timber piles in the Navy inventory. Designers usually protect these components from destructive marine organisms by arsenical salt pressure treatment, creosote pressure treatment, or plastic wrapping. However, several concerns have arisen recently regarding the environmental impact of treated timber in the delicate marine environment. Many designers have become reluctant to specify treated timber in waterfront structures due to concerns regarding environmental viability. Some locations on the west coast have restricted the use of certain types of pressure treatment due to local environmental regulations. However, inconsistent application of these regulations throughout the country has resulted in serious concerns over liability and responsibility. To respond to these concerns, the NAVFAC Criteria Office commissioned NFESC to determine the environmental viability of various timber protection systems.

3. Discussion: Enclosure (1) explains the results of the study conducted by NFESC on treated timber viability. In summary, Federal environmental regulations do not restrict the use of treated wood for its intended purpose - in this case, marine structural components. These components are normally pressure treated with the EPA-registered pesticides of arsenical salts or creosote. It also appears that wood products will continue to be treated in the future. One study conducted in 1994 by the Marine Resources Division, South Carolina Department of Natural Resources, indicates that wood preservative leachates from marine piling in tidal estuaries have no acutely toxic effects on the five types of marine life tested. In general, treated wood removed from service may be classified as hazardous waste according to some local regulations; but, it is not banned from landfills by Federal

regulations. The disparity stems from the fact that local jurisdictions frequently enforce more restrictive environmental laws. For example, in southern California, local water quality regulators fined one Navy activity for hazardous storm water discharges from creosote-treated sawcut shavings. Additionally, some local landfills have not accepted treated timber for disposal.

4. Criteria: The use of timber in the marine environment should be based on life-cycle economics. If timber is placed in the marine environment, it should be pressure treated according to American Wood Preservers Association Standards unless state and local regulations restrict its installation, cutting, use, or disposal. Conversely, the timber may be wrapped by plastic according to NFGS-02462, "Wood Marine Piling Flexible Plastic Encasement," (under development). Field Divisions and Activities should conduct site-specific risk assessments for each area containing a significant quantity of timber to determine the impact on the local marine environment. The risk assessment method may employ the software developed by the Western Wood Preservers Institute or other similar system. The assessment may also include a leachability analysis if required by the locale. Most Field Divisions and Field Activities have applied biologists on staff to assist engineers in the planning and design process.

5. Action:

a. Engineering Field Divisions (EFDs), Engineering Field Activities (EFAs), Officers in Charge of Construction (OICCs), Public Works Centers (PWCs), Public Works Departments (PWDs) shall plan, design, and construct timber waterfront structures according to the criteria stated herein. EFD and EFA Engineering and Environmental Divisions should work with state and local regulators to develop best management practices for each installation. This effort should be integrated into existing pollution prevention activities such as the Pollution Prevention (P2) Plan.

b. NAVFAC Criteria Office will coordinate revisions of the following criteria to incorporate the interim technical guidance stated herein:

Military Handbook 1025/6, "General Criteria for Waterfront Construction"
Military Handbook 1005/5, "Timber Structures"
NFGS - xxxxx, "Wood Marine Piling Flexible Plastic Encasement," (under development)
NFGS - 02461, "Wood Marine Piling"
NFGS - 02398, "Pier Timberwork"

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5. Coordination: In addition to the research coordination noted in the enclosure (1), this ITG has been coordinated internally within NAVFAC.

6. Points of Contact:

a. For clarification or additional information related to this subject, please contact the NAVFAC Criteria Office, Code 15C. The NAVFAC Criteria Office point of contact is Mr. David Curfman, P.E., DSN 262-4203/757-322-4203, fax 757-322-4416, Internet *CURFMAN@efdlant.navfac.navy.mil*.

b. For technical consultation related to this subject, please contact NFESC. The NFESC point of contact is Dr. David Pendleton, DSN 551-1070/805-982-1070, fax 805-982-1409, Internet *DPENDLE@nfesc.navy.mil*.

c. For the nearest NAVFAC Applied Biologist, please contact NAVFACENGCOM, Code 1341. The NAVFAC Code 1341 point of contact is Mr. William Gebhart, DSN 221-8183/703-325-8183, Internet *WGEBHART@hq.navfac.navy.mil*.

R.D. CURFMAN
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Technical Memorandum

TM-2159-OCN

CURRENT AND PROPOSED NAVY PRACTICES FOR WOOD PROTECTION IN THE MARINE ENVIRONMENT

by
David E. Pendleton

November 1995

EXECUTIVE SUMMARY

Because of increased environmental concerns, NFESC was asked by the NAVFAC Criteria Office to review current Navy practices in the usage of treated wood products in the marine environment, propose changes to those practices, and provide specific recommendations for changes to relevant NAVFAC criteria documents.

Current Navy practice is generally to avoid the use of wood in favor of other materials where practicable. In most cases this is due to performance considerations rather than environmental considerations.

Where wood is specified, current criteria documents are used and are technically up-to-date but quality assurance procedures have been inadequate. In a recent study it was found that 80 percent of Navy marine timber piling and 50 percent of timber pier components were below criteria standards.

Federal environmental regulations do not restrict the usage of treated wood for its intended purpose. A possible exception is the sheen created when creosoted piling are driven but this can be mitigated. Wood preservatives are EPA-registered pesticides and treated wood products will be widely available for the foreseeable future. Treated wood removed from service is not a hazardous waste and is not banned by federal law from landfills.

Local and state environmental regulations have restricted the marine use of treated wood. In San Diego the improper storage of creosote piling by Navy PWC was cited by the county because of concerns over "discharges." Similar local restrictions have not occurred at other Navy activities contacted but in many areas the landfilling of treated wood removed from service has been restricted or discouraged.

Ports in the Northwest have experienced increased environmental scrutiny of projects involving treated wood in aquatic environments because of perceived environmental risks that may or may not be accurate. The Western Wood Preserver's Institute (WWPI) has responded by sponsoring the development of a risk assessment computer program designed to estimate actual environmental risk. The program can be used by regulators and by project designers.

The following summarized best management practices are recommended where treated wood is specified for marine environments:

1. Specify treated wood in terms of performance in accordance with American WoodPreservers' Association Standards

2. If there is any cause for environmental concern, conduct a site-specific risk assessment.

3. Specify that wood treatments and handling methods comply with current industry best management practices.

4. Specify that treated wood be inspected by an independent agency and again on site before installation.

Recommendations for developmental work and technical guidance updates are summarized as follows:

1. Develop standard operating procedures (SOP) at a specific site that would help to assure compliance with QA policy. Envisioned are check lists, process flow charts, assignment of responsible parties, and training tailored to actual duties. The SOP can then be made available to other activities wishing to develop their own procedures.

2. Maintain a central point of expertise on wood usage issues that would involve providing advice and technical guidance for activities dealing with environmental issues related to treated wood usage in marine environments.

3. Develop a means of determining the actual environmental risk of treated wood. This includes a thorough assessment of the WWPI risk assessment model and the development of a method of determining the amount of treatment chemicals that will enter the water from treated wood (leachability analysis).

4. Consider the further development of specifications for plastic-covered wood to be used in lieu of treated wood.

Specific recommendations for changes to criteria documents, MIL-HDBK-1025/6 "General Criteria for Waterfront Construction," NFGS-0249IJ "Pier Timberwork," and NFGS-02483J "Wood Marine Piling" are in accordance with the recommended best management practices.

CONTENTS

INTRODUCTION

The use of treated wood in the marine environment has come under increasing scrutiny mainly because of increasing environmental concerns. In addition, there have been serious questions raised about the relative efficacy of treated wood compared to other materials such as concrete, steel, and plastics. The NAVFAC Criteria Office, recognizing these concerns, developed the following scope of work to be completed by NFESC:

1. Investigate current Navy practices of treating wood to be used in the marine environment

2. Based on current practices, review current and proposed environmental regulations to determine whether those practices are in the best interests of the Navy.

3. Investigate and report on improved practices or methods vs. current wood treatment practices.

4. Determine if a technical guidance update to the fleet is warranted.

5. Provide specific recommendations for changes to existing criteria documents based on findings.

Tasks 1 through 4 constitute the main body of this paper and involve two main topics: quality assurance and environmental concerns. These issues are best considered jointly because as the performance of materials is improved the need for its replacement and consequent environmental impact are reduced. In addition, poor or improper treatment practices cause the wood product to be more directly damaging to the environment.

Task 5 is provided by Appendix A-

CURRENT NAVY PRACTICES

Current Navy practice for new shoreside construction has generally been to avoid the use of wood components in favor of other materials, mainly concrete. For smaller projects such as small boat docks, for the repair of older wood structures, and for the replacement of wood fender piles, treated wood is still often the material of choice mainly because of considerably lower costs.

Recommended Navy practices for the use of preservative-treated wood is described in considerable detail in NAVFAC MO-312 “Wood Protection.” Specific criteria for design and construction of waterfront wood piling and timber structures are contained in NFGS 2483 “Wood Marine Piling,” NFGS 2491 “Pier Timberwork,” Mil Hdbk 1002/5 "Timber Structures," and Mil Hdbk 1025/6 “General Criteria for Waterfront Construction.” These recommendations and criteria reference the American Wood Preservers' Association (AWPA) Standards for treated

wood. These standards specify a number of details including proper wood species, acceptable preservatives and minimum preservative retentions and penetrations. If these standards are followed, the industry, in effect, guarantees the performance of treated wood products. Currently, only two preservative types, creosotes and the arsenical salts are recommended for pressure treatment of wood for use in the marine environment. In addition to following AWPA standards, Navy criteria documents require independent inspections of treated wood to verify compliance with these standards.

When wood is treated to AWPA standards, the material will provide excellent service. Actual industry compliance with their own standards, however, continues to be a problem. In 1987, the results of a joint Navy (NAVFAC)-AWPB survey of treated wood products indicated that about 50 percent of the pier components and 80 percent of the piling in marine environments did not conform to AWPA standards. In recent interviews, NAVFAC Applied Biologists have stated that treatment noncompliance continues to be a serious and costly issue throughout DOD.

In addition to pressure treatment guidelines, Navy criteria specifications and MO-312 address in-place remedial treatment methods for wood in the marine environment. For field treatment with a wood preservative, AWPA Standard M4 is followed. It should be noted, however, that application restrictions apply and the treatments are not nearly as effective as pressure treatments. Field cuts of treated wood must be avoided whenever possible!

NAVFAC MO-312 and NAVFAC MO-104, "Maintenance of Waterfront Facilities," provide recommendations for alternatives to the replacement of borer-damaged load-bearing piling. The most cost-effective alternative calls for the installation of plastic barriers which eliminates further marine borer damage. Interim guide specifications for installing plastic barriers are provided in NCEL Technical Note N-181, "Plastic Coatings and Wraps for New Marine Timber Piling." Although potentially very cost effective, the use of plastic barriers by the Navy is limited.

CURRENT PRACTICES AND ENVIRONMENTAL REGULATIONS

What has apparently caused a great deal of confusion and frustration on the part of those who would use treated wood in the marine environment are the environmental regulations. And indeed there appears to be a growing number of regulatory citations that agencies could and have used to derail projects involving treated wood. A summary of federal environmental regulations that could impact treated wood usage is considered herein. Of greater apparent concern, however, are the state, county, municipal and other local rules and regulations. A detailed review of these rules is beyond the scope of this work but some generations and examples are given.

Federal Environmental Regulations

Federal EPA action that could have severely impacted Navy practices with regard to the use of treated wood in the marine environment involved the registration of wood preservatives as pesticides. The EPA, however, published its conclusions in the Federal Register of January 10, 1986 that the economic impact did not justify the ban of these chemicals as wood preservatives. The creosote and arsenical salts are duly registered restricted-use pesticides and treated products

must come with a consumer information sheet. There appears to be no recent revisit of that issue by EPA.

A serious potential concern is EPA regulations that address "discharges" into U.S. waters that would violate federal clean water standards. To our knowledge, however, the placement of treated wood in the marine environment has not been challenged by the federal EPA on these grounds nor does it appear likely based on our review of the FR. However, an oil sheen on the water occurs when driving creosote piling in apparent violation of these regulations. This can be mitigated by the use of oil booms or other approved means but consultation with local environmental authorities may be advisable.

It should be noted that proper treatment "fixes" or renders insoluble the arsenical salts and that proper procedures minimizes the bleeding of creosote from the wood. The long-term efficiency of the preservative treatment is dependent on minimizing the leaching or bleeding of preservatives. Some loss, however, does occur especially when the treatment process has not adequately "fixed" the arsenical salts or there is a large amount of creosote on the wood surface. In any case, preservative loss is greatest immediately after installation and diminishes with time. The potential for salt leaching and creosote migration into the water is the greatest concern of local agencies and generally is the focus of regulatory action.

In terms of EPA hazardous waste regulations, wood preservatives such as creosote and arsenical salts to be discarded are considered hazardous wastes but treated wood products removed from service are not. The treated wood is considered a non-RCRA solid waste and can be placed in a landfill. A review of recent publications of the Federal Register has provided no indication that EPA will alter the status of waste creosote-treated or arsenical salt-treated wood in the immediate future. The EPA established an exemption for arsenical-treated wood that fails the TCLP procedure used to define toxicity characteristic hazardous wastes. TCLP testing of creosote-treated wood has consistently revealed that it is far below toxicity characteristic limits.

A review of recent pertinent industry publications and wood products journals revealed that the only imminent change in federal environmental regulations that would impact the use and disposal of treated wood products involved wood treated with pentachlorophenol (penta). Penta, however, is not used for marine wood treatments. There has been some concern expressed, however, that cradle-to-grave requirements for treated products may be coming. This cradle-to-grave requirement may be related to landfill restrictions rather than a redefinition of treated wood as hazardous waste.

Local Environmental Considerations

To determine if current practices are in the best interests of the Navy in light of current and potential future environmental regulations is a complex question. In consideration of current federal regulatory compliance and the economics of -wood usage, it would appear to be in the Navy's best interest to continue wood usage for the foreseeable future. When local environmental rules are applied there can be no generalization and it may very well be in the Navy's best interest to not attempt to use treated wood at those sites.

It is obvious that where local environmental regulatory agencies directly impact the usage of treated wood, local decisions must be made. These seem to be happening with increasing frequency. For example, the Navy Public Works Center in San Diego has reported that they were cited and threatened with fines up to $500K by the County of San Diego Department of Public

Health for violating storage requirements for creosote-treated wood. The rationale for the citations was apparently that creosote components of the piling "improperly" stored on the ground prior to installation would leach into the ground and harbor during rainfall events. The creosote-treated piling installed in the harbor was not cited by the regulators. Because of these citations, PWC San Diego understandably no longer wishes to store and use treated wood piling and are looking for alternatives such as plastic piling.

There are a number of other instances where state, county, city, or other agencies have successfully restricted the use of treated wood in the marine environment. For example, local or state agencies may require time consuming and costly environmental assessments for projects involving the use of treated wood in aquatic environment whereas alternative materials usage will not. The concern is that the treated wood will produce a "discharge" that will not meet local water quality standards or cause sediment contamination in violation of sediment standards. In addition, states such as California and Washington are proposing to regulate the disposal of treated wood under state hazardous-waste regulations.

IMPROVED PRACTICES AND METHODS

In any case, whether or not regulatory agencies are scrutinizing local treated wood usage practices or whether or not there is high potential environmental risk, the use of best management practices (BMP) is required. BMP will minimize environmental risk and ensure the greatest return on investment dollars by addressing quality assurance issues.

A full discussion of recommended BMP for specifying and using marine treated wood follows below. Appendix B provides a summary of BMP and how they should be implemented. An adjunct to Appendix B is Appendix C which outlines potential problems that activities may face when using treated wood and possible means of resolving the problems.

1. **Proper Performance**. The greatest improvement in Navy practice related to the use of treated wood in the marine environment would be the full implementation of Navy quality assurance policy and marine construction standards as outlined in Navy criteria documents and MO-312. AWPA commodity standards which proscribe acceptable preservatives, treatment methods, treatment results in terms of retention and penetration, and appropriate use of the treated material must be used. Full compliance by all contractors and federal agencies involved must be insisted upon. Premature failure of treated wood can almost invariably be attributed to either (1) the use of wood that does not meet strict treatment standards, or (2) improper construction and installation practices that expose untreated wood. The primary treatment standards are penetration and retention of the preservative. If the penetration is too shallow or the level of retention is too low, then poor performance will result.

Consideration should be, given to the use of plastic-covered wood piling in lieu of treated wood. Experimental polyurethane coating and polyethylene wraps on treated and untreated fender piling in Los Angeles Harbor continues to provide excellent service after 11 years of use. The plastic prewrapped or coated piling have the advantages of wood, i.e., flexibility and strength, are environmentally acceptable, and, as long at the coating or wrap remains intact, impervious to marine borer damage. If these experimental piling are to be used as fenders, then polyethylene rub strips or other means should be used to prevent abrasion damage to

the plastic covering that would expose untreated wood to marine borers. For load-bearing piling this would not likely be required.

2. **Environmental Risk**. Where a project involves the installation of a large volume of treated wood in an area of low water volume and limited flushing action or where there is any reason for environmental concern, a site specific evaluation should be completed to assure an acceptable level of environmental risk. Such a proactive stance may preclude adverse action on the part of potential environmental regulators. The cost of such an evaluation should be added on to any economic analysis when comparing the costs of different materials. Consideration should be given to the use of software developed for the Western Wood Preservers Institute (WWPI) that is designed to establish the level of environmental risk in a variety of situations.

The WWPI, in response to environmental challenges to its products has sponsored research designed primarily to promote the responsible use of treated wood. To that end, risk modeling research that estimates the actual quantities and fate of preservatives in the marine environment at specific locations has been completed. The idea being that in some locations, the actual environmental risks are small and do not warrant restrictions, while in other locations, the use of treated wood has a higher environmental risk and should be restricted. In some cases, it appears that local regulators are taking action against perceived risks not actual risks.

3. **Treatment Certification**. Use third party inspections in all cases to certify compliance with treatment standards as required by NAVFAC guide specifications. All preservative-treated wood, but especially creosote products shall be inspected visually to ensure that there are no excessive residual materials or preservative deposits. If the material is not clean and dry it must be rejected because of environmental concerns.

During inspections at treatment facilities, one can assure proper fixation of salt treatments. Arsenical salts are “fixed” or attached in its insoluble form to the wood. If this is not properly done then the salt can leach out of the wood adversely effecting performance and creating unacceptable environmental risk. Improper “fixation” cannot be detected by visual inspections. For chromated copper arsenate (CCA) treatments, the Chromotropic Acid test (AWPA Standard A3-11) is an acceptable method used for evaluating fixation during treatment. For ammoniacal copper zinc arsenate (ACZA) and ammoniacal copper arsenate (ACA) proper treatment procedures that assures that the ammonia has evaporated are the only means of assuring that proper “fixation” has occurred.

Unfortunately, proper fixation cannot be reliably determined by inspection at the end use site. Some means of assuring acceptable leachability of newly procured arsenical-treated wood at the end use site would be desirable.

Creosote is not “fixed” or attached to the wood. It enters into wood spaces and can "bleed" or migrate out of the wood if mishandled or improperly treated. Visual inspection can determine if this has occurred. A means of assuring excessive “bleeding” of creosote does not occur after installation would also be environmentally sound.

4. **Installation and Maintenance**. Care in the handling and use of treated wood can help to ensure personnel safety and environmentally acceptable, long-lasting products. Where the cutting or boring of treated wood cannot possibly be avoided, field treatments must be prescribed

in accordance with AWPA Standards. If the treated wood is cut or bored and the untreated portion of the wood is thus exposed and not properly preserved, premature failure will occur.

Record keeping is apparently rarely done but is essential in determining if poor performance or premature failure of treated wood products is occurring. This information is vital for proper maintenance and for making materials choices for ongoing projects.

5. **Eventual Disposal**. Disposal of treated wood often occurs decades after initial use. Although no federal law now prohibits the land filling of treated wood, landfill disposal regulations (especially state and local) are expected to be more restrictive with time. It would be prudent to consider alternatives to land filling and to consider the costs of these options when selecting construction materials.

Cradle-to-grave responsibilities for treated wood usage and disposal may soon be required by federal regulations. Project costs should include projections for the eventual removal of the wood from service.

6. **Assignment of Responsibilities**. Many decades may pass between project conception and final demolition and removal of treated wood. Many different federal personnel and contracting agencies are involved in the process. These entities need to be clearly stated and their responsibilities clearly defined for the activity. Continuous training in wood protection specific to assigned responsibilities is needed.

7. **Centralized Treated Wood Usage Guidance**. It has been recommended by a recent Defense Analysis and Studies Office Report that DOD (we can read Navy) should develop a source of wood products technical expertise for the installations to draw upon. In the past, the Navy's Applied Biology program included wood protection guidance to Navy activities. Recent cutbacks, however, have severely limited their ability to provide such consultation-

RECOMMENDATIONS FOR DEVELOPMENTAL WORK AND TECHNICAL GUIDANCE UPDATES

Quality Assurance

Technical guidance that will assure strict adherence to Navy quality assurance policy for the use of treated wood has proven to be elusive. Responsibility for assuring the wood meets specifications is shared among wood treaters, project designers, materials purchasers, installers, inspectors, and maintenance personnel. Required information that would help to assure treated wood quality can be found in NAVFAC criteria documents, and AWPA Standards and is thus available to personnel involved but apparently that is not sufficient.

In response to these difficulties, NAVFAC attempted to initiate a program in cooperation with the Defense Contract Management Area Operations (DCMAO) to develop a standard operating procedures that an activity could use to assure compliance with QA policy. Envisioned was a checklist and process flow chart that would detail actions required and the person or agency responsible for each step. Such a program, once developed, could be adapted to each facility that uses wood products. A training course was outlined and pertinent activity personnel were defined

but the work ended because of a lack of funding. In fight of the tremendous cost of improper wood usage, it would be wise to resurrect the program for a specific Navy facility to be used as a model for other activities.

Environmental Compliance

Technical guidance updates to ensure environmental compliance must be given on an activity specific basis. The development of a central point of expertise that could provide technical advice and guidance for those activities wishing to take a proactive stance or those facing imminent local environmental restrictions on the use of marine treated wood should be considered. For activities facing regulatory restrictions, information on similar situations occurring elsewhere and the actions taken by the regulators, the regulated, and other affected entities can be centralized, summarized, and made available to those faced with difficult choices. For those activities wishing to take a proactive approach to minimizing environmental risk at reasonable cost, the summary information would be valuable. In addition, the development and implementation of procedures that activities could use to estimate related costs and environmental impacts for various options from the banning of treated wood and the use of alternative materials to the unrestricted use of wood should be considered.

The WWPI program for estimating treated wood impact in aquatic environments could prove extremely useful in estimating environmental risk for various options. An evaluation of its efficacy and utility should be given high priority.

End-Use Leachability Determinations

Since salt-treated wood leachability and creosote "bleeding" are central to their performance and environmental acceptability, consideration should be given to the development and implementation of additional quality assurance procedures that would address that issue. This can be done at the activity level or Navywide. Factors to consider include (1) determining maximum acceptable leachate levels or creosote loss, (2) required sampling and testing procedures, (3) assigning responsibilities, and (4) writing additional procurement specifications.

Cradle-to-Grave Responsibilities

Alternatives to land disposal of treated wood must be explored. There is apparently no choice in some areas now because of state and local regulations and this may soon be the norm. In addition, landfill managers, concerned about shrinking landfill space, are promoting mandatory waste reduction and recycling programs. Life cycle management techniques for treated wood may include (1) reuse as landscape timber, fence posts, etc., (2) resawing to recover untreated wood portions, (3) recycling as fuel, (4) decontamination procedures such as chemical extraction or biological breakdown, and (5) reconstitution of chipped treated wood.

Alternatives to Preservative Treatment for Wood

Even if it is determined that preservative-treated wood is unacceptable for a specific marine environment or the life cycle cost of treated wood use is too high, the use of wood may

still be an option. The wood can be covered with plastic instead of treated with a preservative. Although at least 20 years of successful exposure testing is generally required to instill confidence in waterfront users, enough information on the performance of plastic-covered wood piling is now available to warrant the development of interim technical guidance on its usage. The program should consist of (1) the development of Navy specifications since there are no industry standards, (2) the use of these specifications to treat and install specified prewrapped and precoated piling, and (3) an evaluation of the practicality of adapted specifications.

Appendix A

RECOMMENDATIONS FOR CHANGES TO CRITERIA DOCUMENTS

MIL-HDBK-1025/6 GENERAL CRITERIA FOR WATERFRONT CONSTRUCTION

2.2.1.3 Untreated timber piles shall not be used in salt or brackish water where they will be exposed to marine borers except for the following: (1) untreated fender piles where an analysis of pile replacement or maintenance records clearly demonstrates that such use is justified, or (2) plastic coated or wrapped piling as specified in NCEL TN-1811, Plastic Coatings and Wraps for New Timber Piling.

2.2.1.4 Special care in the handling and driving of plastic-covered piles is necessary to avoid damaging the plastic protection. Periodic inspections and immediate repairs of any plastic tears or abrasions is imperative since any exposure of untreated wood will likely result in rapid borer damage. Cutoff pile tops must be kept permanently dry or protected in the same manner as treated timber piling. No other field cuts including bolt holes are allowed.

2.2.2 Treated Timber Piles

2.2.2.1 Preservative Treatment. Treated marine piling shall conform to current American Wood Preservers' Association (AWPA) Standards C 1, C3, and C 18 that specify proper wood species, acceptable preservatives and minimum preservative retentions and penetrations. Treatment choices are (1) creosote or creosote-coal tar solution, (2) arsenical salts (ACA, ACZA, or CCA), or (3) dual treatment. In those areas where *Teredo* and pholad are present and *Limnoria tripunctata* is absent, creosote will provide adequate protection. In those areas where *Teredo* and L. *tripunctata* attack is expected and pholad attack is not, either dual treatment or an arsenical salt is recommended. In those areas where *Sphaeroma terebrans is present* or where *L tripunctata* and *pholad* attack are expected, dual treatment is recommended. The attached map (from AWPA Standard C3) provides general guidance on the location of marine borers. Consult the nearest NAVFAC EFD Applied Biologist or other knowledgeable person for site-specific information on marine borers. Refer to para. 5.9 for properties of treated wood.

2.2.2.2 Records. Include in the pile driving log the wood species, preservative type, retention, and producer of installed treated piles.

2.2.2.3 Environmental Considerations. Consult with your environmental office for possible local regulations that restrict the use of treated wood in aquatic environments. Where a project involves the installation of a large volume of treated wood in an area of low water volume and limited flushing action or where there is any reason for environmental concern, a site specific environmental risk assessment may be advisable. Treated wood should be visually inspected

before installation to assure no excessive residual materials or preservative deposits exist. Maximum chemical loading should not exceed 1.4 times the minimum retention specified for creosote treatments and 1.25 times the minimum for arsenical salt treatments. Plans for handling the treated wood upon dismantling of the structure should be considered in the design phase, especially in areas where the disposal of treated wood may become restricted.

2.2.2.4 Quality Assurance. Each treated pile must be branded by the producer in accordance with AWPA M6. An inspection report by an independent inspection agency accredited by the American Lumber Standard Committee should accompany each pile shipment. All treated piles should be stored and handled in accordance with AWPA M4.

2.2.2.5 Safety Requirements. Specifiers and installers must follow the guidance in the 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 that must be provided by the treated wood supplier.

2.2.2.6 Field Cuts and Pile Tops. Insofar as possible, all cuts that expose untreated wood should be avoided. Where field cuts are absolutely necessary, e.g., pile tops, the cuts and subsequent preservative treatments should be accomplished in accordance with AWPA M4. Use of sheet metal covers for fender piles, however, is discouraged because the covers are easily tom by impact and become a personnel hazard.

2.2.12 Sheet Piling - Timber. Timber sheet piling shall conform to the requirements in para 2.2.1.3 and 2.2.2.1 through 2.2.2.6 except as modified by para 2.2.12.1 through 2.2.12.5

2.2.12.1 Treatment. [DELETE]

2.2.12.6 Environmental Considerations. Sheet piling and bulkheads present greater localized environmental risk because of the greater number of piles and thus greater potential chemical loading in a given area. A site specific environmental risk assessment may be advisable.

3.1.2.2 Untreated Timber. All substructure wood components except for temporary structures and special design plastic-covered wood structures shall receive preservative treatment. Insofar as possible, all bolt holes and other cuts to timber should be done before wrapping or coating with plastic. If field cuts are unavoidable, no untreated wood can be left exposed.

3.1.2.3 Preservative Treatment. Except as stated in para 3.1.2.2 all substructure timbers shall receive preservative treatment. Treated timbers shall conform to current American Wood Preservers' Association (AWPA) Standards C1, C2 (salt water use), and CI8 that specify proper wood species, acceptable preservatives and minimum preservative retentions and penetrations. Treatment choices are (1) creosote or creosote-coal tar solution or (2) arsenical salts (ACA, ACZA, or CCA). In those areas where *Teredo* and *pholad* are present and *Limnoria tripunctata* is absent, creosote will provide adequate protection. In those areas where *Teredo* and *L. tripunctata* attack is expected and pholad attack is not, either dual treatment or an arsenical salt is recommended. In those areas where *Sphaeroma terebrcau is present* or where *L. tripunctata* and

pholad attack are expected, dual treatment is recommended. The attached map (from AWPA Standard C3) provides general guidance on the location of marine borers. Consult the nearest NAVFAC EFD Applied Biologist for specific requirements for specific locations. Creosote wood should not be used for walking surfaces or for structures such as handrails where it will be subject to human contact. Refer to para. 5.9 for properties of treated wood.

3.1.2.4 Records. Include in the construction records the wood species, preservative type, retention, and producer of installed treated timber.

3.1.2.5 Environmental Considerations. Consult with your environmental office for possible local regulations that restrict the use of treated wood in aquatic environments. Where a project involves the installation of a large volume of treated wood in an area of low water volume and limited flushing action or where there is any reason for environmental concern, a site specific environmental risk assessment may be advisable. Treated wood should be visually inspected before installation to assure no excessive residual materials or preservative deposits exist. Maximum chemical loading should not exceed 1.4 times the minimum retention specified for creosote treatments and 1.25 times the minimum for arsenical salt treatments. Plans for handling the treated wood upon dismantling of the structure should be considered in the design phase, especially in areas where the disposal of treated wood may become restricted.

3.1.2.6 Quality Assurance. Each treated timber lot must be branded in some form by the producer in accordance with AWPA M6. An inspection report by an independent inspection agency accredited by the American Lumber Standard Committee should accompany each timber shipment. All treated timber should be stored and handled in accordance with AWPA M4.

3.1.2.7 Safety Requirements. Specifiers and installers must follow the guidance in the 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 that must be provided by the treated wood supplier.

3.1.2.8 Field Cuts. Insofar as possible, all field cuts including bolt holes that expose untreated wood should be avoided. Where field cuts are absolutely necessary, the cuts and subsequent preservative treatments should be accomplished in accordance with AWPA M4. If feasible, order all cuts including bolt holes done prior to pressure treatment.

3.1.2.9 Minimum Dimension. [?]

3.2 Timber. Timber used in the deck structure shall conform to the requirements for substructure framing and bracing except as modified below.

3.2.1 Preservative Treatment. The use of untreated timber should be avoided wherever possible and, except for temporary structures, can be used only above mean high water level. Untreated timbers should be kept as dry as possible by designing for efficient water drainage that eliminates any water accumulation on wood and by protecting the cut off ends of timber (decay often starts in wood joints). Treated timbers shall conform to current American Wood Preservers'

Association (AWPA) Standards C1 and C2 (above ground use) that specify proper wood species, acceptable preservatives and minimum preservative retentions and penetrations.

REFERENCES

[Delete AWPB References]. [Add] AWPA Standards. American Wood-Preservers' Association. PO Box 849, Stevensville, MD 21666

NFGS-0249IJ PIER TIMBERWORK
[Unlike 1025/6, I see little need for changes to this spec.]

1.1 [Delete AWPA P2 and AWPA P5 (note: these are referenced routinely by AWPA C2)]

1.2.2.1 Timber Preservative Inspection [OK as is except use "comply" vice "complying"

1.2.3.1 Delivery Inspection List [Add] All preservative-treated wood, but especially creosote products shall be inspected visually to ensure that there are no excessive residual materials or preservative deposits. If the material is not clean and dry it must be rejected because of environmental concerns.

1.3 Delivery and Storage [OK as is]

2.1.1.1 Solid Sawn [OK as is but I don't know why we are restricting it to southern pine, Douglas-fir or Western? Larch]

2.1.1.2 Preservative Treatment

NOTE: [Move paragraph 3 "usage" to paragraph 1.]

[delete reference to AWPA P2 and PS since these are referenced by AWPA C2]

[I don't know why certain treatments are eliminated; e.g., chromated zinc chloride and pentachlorophenol; unless there is a compelling reason this sentence should be deleted]

3.1 CONSTRUCTION. [Add] Specifiers and installers must follow the guidance in the 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 that must be provided by the treated wood supplier.

3.2.1 Timberwork [Add to first sentence] ...,preservative MSDS, and Consumer Information Sheet provided by the supplier. Wood preservatives are restricted use pesticides and must be applied in compliance with applicable standards.

NFGS-02483J WOOD MARINE PILING
1.3 QUALITY ASSURANCE

1.3.1 Untreated Timber Piles. Untreated piling will not be used except for fender piles where an analysis of pile maintenance and replacement records clearly justifies its use or where plastic covered piling are used as described in NCEL TN-1811, Plastic Coatings and Wraps for New Timber Piling. [Note: special care in handling and frequent inspections of installed plastic-covered piles are required to assure that no exposure of the untreated wood occurs]

1.3.2 Treated Timber Piles. [same as 1.3.1 Timber Piles Preservative Treatment] [Add] All preservative-treated wood, but especially creosote products shall be inspected visually to ensure that there are no excessive residual materials or preservative deposits. If the material is not clean and dry it must be rejected because of environmental concerns.

[add] Note: Consult with your environmental office for possible local regulations or policies that restrict either the use of treated wood in aquatic environments or the eventual disposal of treated piles.

[add] Note: Insofar as possible, all cuts that expose untreated wood should be avoided. Where field cuts are absolutely necessary, e.g., pile tops, the cuts and subsequent preservative treatments should be accomplished in accordance with AWPA M4. Use of sheet metal covers for fender piles, however, is discouraged because the covers are easily tom by impact and become a personnel hazard.

1.4 [Add] Specifiers and installers must follow the guidance in the 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 that must be provided by the treated wood supplier. Treated wood should be rejected if there

2.2 PRESERVATIVE TREATMENT
Note: Select pile treatment as follows (consult the nearest NAVFAC EFD Applied Biologist for specific requirements for specific locations):

1. In those areas where *Teredo* and pholad are present *and Limnoria tripunctata* is absent, creosote will provide adequate protection.

2. In those areas where *Teredo* and *L. tripunctata* attack is expected and pholad attack is not, either dual treatment or an arsenical salt is recommended.

3. In those areas where *Sphaeroma terebrans* is present or where *L. tripunctata* and *pholad* attack are expected, dual treatment is recommended.

4. [OK as is]

3.1.1.6 [Add to end of paragraph] Include in the construction records the wood species, preservative type, retention and producer of installed treated timber.

Appendix B

BEST MANAGEMENT PRACTICES (BMP) FOR THE USE AND PROTECTION OF WOOD IN THE MARINE ENVIRONMENT

1. Specify treated wood in all circumstances unless it is clearly evident that plastic-covered or untreated wood can provide the required performance.

Plastic-covered wood can be specified and used in accordanice with NCEL Tech Note TN-1811. Questions concerning this TN should be addressed to the Waterfront Materials Division of the Naval Facilities Engineering Service Center (NFESC) at (805)982-1070. Untreated wood should be expected to last from 6 months to two years.

2. For treated wood, specify the appropriate material in terms of performance as defined in the American Wood-Preservers' Association (AWPA) Standards.

You may obtain current standards by contacting AWPA at PO Box 286, Woodstock, MD 21163-0286 or (410) 465-3169. Questions concerning these standards can be addressed directly to AWPA or contact your local EFD Applied Biologist or NFESC.

3. If a project involves the installation of a large volume of treated wood in an area of low water volume and limited flushing action or there is any cause for environmental concern, a site-specific risk assessment is highly recommended.

Consult with your environmental office early in the design phase; consider the inclusion of a risk assessment in the NEPA documentation. At present there is no NAVFAC developed standard procedure or recommendation for accomplishing such a risk assessment. A computer spreadsheet program for evaluating the risk of treated wood usage in aquatic environments has been developed by the Western Wood Preserver's Institute (WWPI) and may be applicable. Consult with NFESC Waterfront Materials Division on its usage.

4. Specify that treated wood be produced in compliance with current industry BMP

Industry BMP describe proper procedures to be used by wood treaters and include criteria for treatment, post treating, maximum chemical loading, and visual inspections. Current BMP for creosote, arsenical salt-treated, and dual-treated wood can be obtained from the WWPI at (800) 279-WOOD or by contacting NFESC.

5. Specify that treated wood be inspected by an independent agency and again on site before installation.

Carefully follow the appropriate NFGS for specifying treated wood.

6. Specify that handling, field treatment, and installation of treated wood products shall be in conformance with AWPA Standard M4 and all applicable safety requirements.

See BMP number 2. Field cuts that expose untreated wood must be avoided, if at all possible. On site inspections may be required to ensure compliance with AWPA M4. Specifiers and installers must follow the guidance in the 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 that must be provided by the treated wood supplier.

Appendix C

SPECIFIC ACTIVITY PRACTICES/PROBLEMS

Problem: Use of material not in compliance with AWPA standards; premature failure results.

Solution: Insist on full compliance with the quality assurance BMP listed in Appendix B by all contractors and activity responsible individuals. Each project plan should state these BMP and name those responsible for assuring compliance.

Problem: Potential project delays or cost increases are incurred due to unforeseen environmental considerations.

Solution: The prospect of environmental risk that accompanies treated wood usage in aquatic environments should be considered early in the design stage. Consult with your environmental department and consider a proactive risk assessment at that time.

Problem: It is difficult if not impossible to determine the most cost effective material for waterfront construction; no local data is available.

Solution: Keep careful records of the installation and maintenance of all waterfront. construction materials. Assign a specific department that task and maintain the records for at least 20 years. For treated wood include the type of treatment, retention level, treating company, and installation date.

Problem: Treated wood removed from service cannot be readily disposed of in a landfill.

Solution: Consult with your environmental department; every region will have different programs and different applicable local regulations. Consider reuse options such as (1) reuse as landscape timber, fence posts, etc., (2) resawing to recover untreated wood portions, (3) recycling as fuel, (4) decontamination procedures such as chemical extraction or biological breakdown, and (5) reconstitution of chipped treated wood.

Problem: Activity personnel do not have the required knowledge to properly accomplish the required solutions listed above.

Solution: Consider the implementation of a training program designed specifically for responsible individuals. [Such a training program was developed by NAVFAC and may be available if there is a demand]

Problem: Treated wood is not acceptable because of environmental concerns but alternative materials are also not acceptable because of cost or other considerations.

Solution: Consider the use of plastic-coated wood. Use NCEL TN-1811 for guidance in specifying its usage.

Problem: Difficulty in finding answers to technical questions related to the use of treated wood in aquatic environments.

Solution: Consider consultation with NFESC Waterfront Materials Division personnel at (805) 982-4234 or (805) 982-1070