Naval Facilities Engineering Command
200 Stovall Street
Alexandria, Virginia 22332-2300

INSPECTION, MAINTENANCE, AND PROCUREMENT PROCEDURES FOR CDAA WOOD COMPONENTS

HANDBOOK

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FOREWORD

The Navy has a multi-billion dollar investment in wooden structures and in utilities. Wood is a readily available, inexpensive natural resource that is both a versatile and useful construction material. The usefulness of wood is increased when it is protected against deteriorating agents by pressure treatment with preservatives. This handbook provides information which will help insure that Navy personnel are able to specify and receive preservative treated wood products most suitable for a particular end use. Specifically this handbook covers wood as a construction material, wood deterioration, preservation of new wood products, quality control or how to specify and inspect treated wood products, as well as inspection and maintenance of treated wood products and remedial control.

Additional information or suggestions that will improve this handbook are invited and should be submitted through appropriate channels to the Naval Facilities Engineering Command, (Attention: Code 1632), 200 Stovall Street, Alexandria, VA 22332-2300.

This publication has been reviewed in accordance with the Secretary of the Navy Instruction 5600.16A and is certified as an official publication of the Naval Facilities Engineering Command.

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ABSTRACT

This publication provides information which will help ensure that Navy personnel are able to specify and receive preservative treated wood products most suitable for a particular end use and ensure that the maximum service life is achieved. Specifically this chapter covers wood deterioration, preservative treatments for new wood products, procurement specifications, inspection and quality control for new treated wood products, inspection of wood products in service, maintenance of treated wood products and remedial control against wood destroying organisms.

CHANGE CONTROL SHEET

Document all changes, page replacements, and pen and ink alterations posted in this manual.

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CHAPTER 1. INSPECTION, MAINTENANCE, AND PROCUREMENT PROCEDURES FOR CDAA WOOD COMPONENTS

1.1 INTRODUCTION. Wood is one of our most valuable natural resources. Inexpensive, readily available and versatile, wood has become an important construction material. Wood's usefulness is greatly increased when it is protected against deteriorating agents by pressure treatment with preservatives and followed with supplemental in-place maintenance procedures which will further increase the service life of wood.

Despite what most people think, wood doesn't just naturally decay. It is deteriorated by wood-destroying organisms. The principal agents responsible for the biodeterioration of wood components within CDAA structures are Decay Fungi. These fungi require a certain combination of circumstances in order to flourish. One such circumstance is moisture. Wood containing a moisture level at or above the fiber saturation point, that is, above about 30% moisture, is subject to decay and subsequent serious loss in strength. Wood that remains dry, however, will not be colonized by decay fungi. Quality preservative treatment of wood used in construction and maintenance of wooden components in service are essential to prevent deterioration by wood-destroying organisms.

CDAA wood products constitute a significant monetary investment, especially when considering the expense of replacing structurally failed components. It is vitally important to recognize the potential for wood component failures, the need for a thorough inspection to determine planned replacement requirements versus replacement upon failure; and the possible need to employ state-of-the-art in-place wood protection systems to retard biodeterioration. Such planning and scrutiny will greatly enhance the service life of CDAA wood components.

This handbook provides information which will help ensure that Navy personnel are able to specify and receive preservative treated wood products most suitable for a particular end use and ensure that the maximum service life is achieved. Specifically this handbook covers wood deterioration, preservative treatments for new wood products, procurement specifications, inspection and quality control for new treated wood products, inspection of wood products in service, maintenance of treated wood products and remedial control against wood destroying organisms.

1.2 PESTICIDES (WOOD PRESERVATIVES). Wood preservatives are classified by the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) as pesticides. Only Environmental Protection Agency (EPA) registered materials are approved for use; all recommendations made are based on this requirement. OPNAVINST 6250.4A requires that all pesticide usage, contractor or in-house, be reported on NAVFACENGCOM Form 6250/2 (in-door applications) or 6250/3 (out-door applications).

NOTE: It is important to remember - only DoD or State (contractors) certified pesticide applicators are permitted to apply wood preservative chemicals, termiticides, herbicides, or conduct fumigation operations on Navy activities.

Safety is always an important consideration when handling preservative-treated wood. Users of preservative-treated wood should carefully follow the safety precautions outlined in the Consumer Information Sheet (CIS) and Safety Data Sheet (SDS) supplied by most pesticide formulators. For additional information users should contact the cognizant EFD Applied Biologist [See Appendix (A)] or local Industrial Hygenist.

Wood preservative chemicals bind tightly to the wood fibers and when handled properly pose little health risk. Individuals should wear long sleeve shirts, coveralls and chemical resistant work gloves when handling treated wood products to avoid prolonged or repeated skin contact. When cutting, drilling or machining treated wood products, a dust respirator should be worn to avoid inhalation of sawdust. The amount of dust and associated preservative chemical inhaled can be significant if an individual is not properly protected.

1.3 SPECIAL PROBLEMS.

13.1 High-band Steel Support Sleeves. Recent CDAA surveys have identified significant premature failures in high-band antennae poles at several sites throughout the world. The predominance of failures can be attributed to the metal support sleeves (Figure 1-1) and thereby creates an extremely favorable environment for decay fungi to grow, i.e., the accumulation and retention of water. In many instances failures are occurring in less than half the projected service life. Corrective actions include: 1) providing 3/4 inch diameter drain holes at the base of each support sleeve

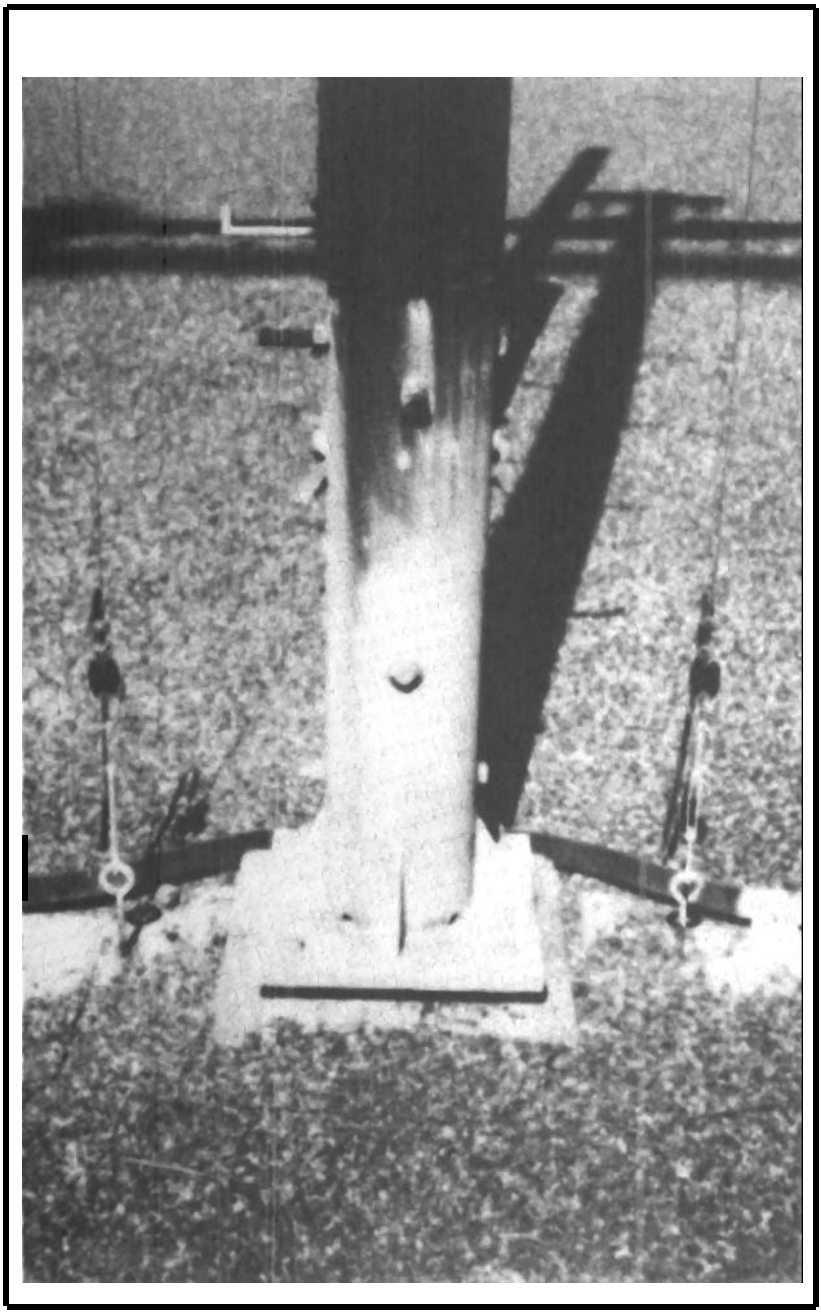

Figure 1-1
Metal Support Sleeve

to mitigate the accumulation of water and 2) eliminating the use of caulking materials around the collar which has proven to be ineffective in preventing the entrance of water into the sleeve. Additionally, caulking impedes air flow thus slowing the evaporation and drying process.

1.3.2 Chamfering (High-Band Pole Butts). Improper or inappropriate chamfering of pole butts to sufficiently reduce the butt diameters so they will fit often exposes untreated wood beneath the treated zone to excessive moisture. Rarely are these butt sections retreated with preservative before being placed in the sleeves. Even when untreated wood is not exposed while chamfering, the accumulation of water in sleeves at the bases of poles should be avoided. The gradual necking down of the pole butt (Figure 1-2) increases the opportunity for water to flow into the support sleeve and creates a favorable environment for the growth of decay fungi. A much better approach is the abrupt necking down of the pole butt (Figure 1-3) which provides a lip that extends over the metal sleeve and prevents the majority of water from entering into the sleeve. This procedure should be mandatory.

Since chamfering of treated poles often results in reduced service life due to decay, necking down or chamfering requirements should be detailed in the procurement specifications to require the producer to make these alterations prior to pressure treatment!

1.4 WOOD COMPONENT INSPECTION AND MAINTENANCE PROCEDURES.

1.4.1 Introduction. Periodic and thorough inspections of wood component structures is vital to maximize their service life or to determine their requirements for repair modification or upgrading. Inspections provide knowledge of the structure and its components, the loadings to which it is subjected, the quality of the materials involved and their condition, and the effectiveness of fasteners and other hardware. All must be known in order to evaluate the ability of a structure to perform its intended function, and to determine the maintenance procedures necessary to restore it to its original function.

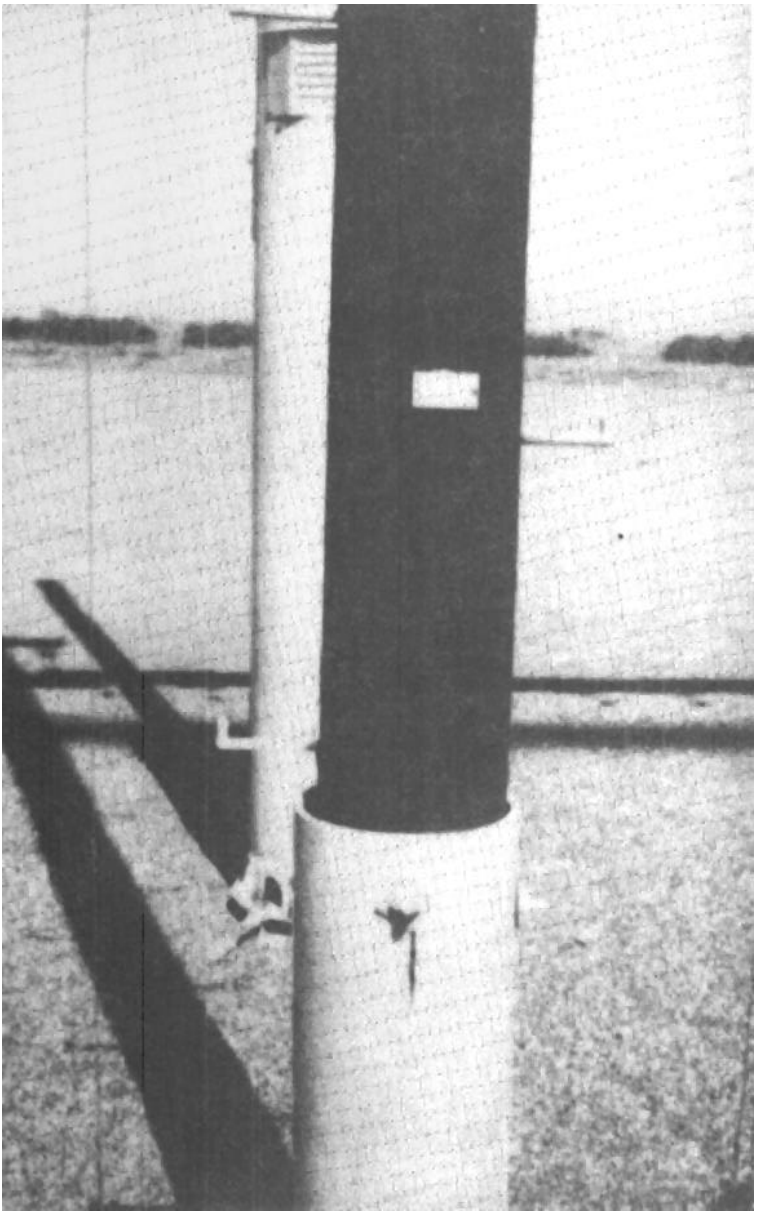

Figure 1-2
Gradual Necking Down of Pole butt

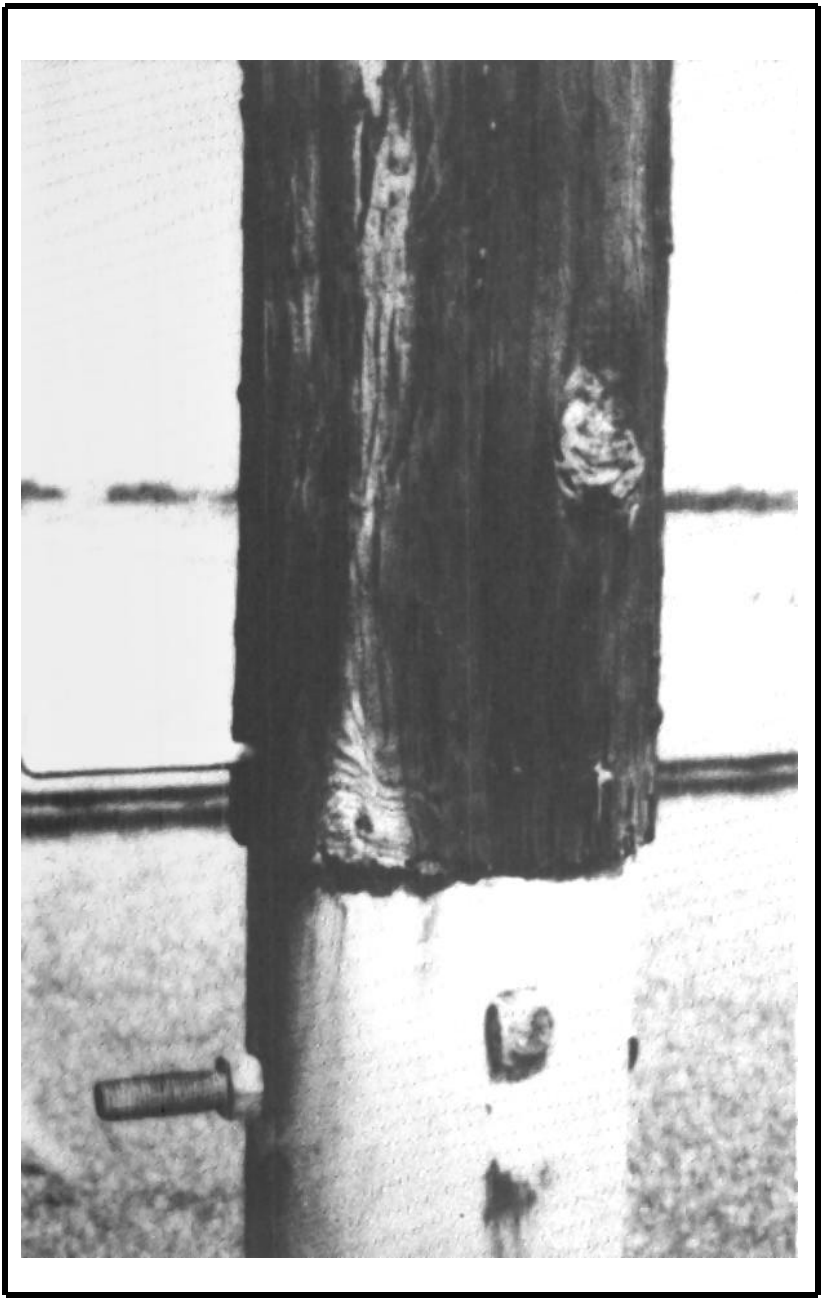

Figure 1-3
Abrupt Necking Down of Pole Butt

Timbers and poles exposed to wetting can decay when water remains in contact with them or whenever water which has entered the wood cannot escape, unless they are periodically retreated in the sections where a high decay hazard exists. Typically, decay can be found where untreated wood has been exposed at seasoning checks or bolt holes that permit water to enter the wood.

Preservative-treated timbers may decay when openings permit water to penetrate beyond the treated shell. Openings may result from deep seasoning checks, from gouging by pointed tools, from loosened fastenings such as bolts, or when cuts or holes made after treatment are left unprotected. That is why it is vitally important to treat with preservative any areas that are exposed to probing, cutting or drilling and to periodically retreat areas where water can enter wood or accumulate adjacent to it.

1.4.2 Visual Decay Detection. The color of wood may or may not indicate whether it has become decayed. As wood approaches the advanced stages of decay it looses its luster and may experience notable changes in color and become either much darker or much lighter than non-decayed wood. In the early stages, however, the wood may appear unchanged although it may have lost substantial percentages of its strength, particularly in shock resistance.

The presence of fruiting bodies indicates that a decay fungus is present in the member where the bodies occur. Some fungi produce fruiting bodies at the wood surface after little or moderate decay while others do not produce fruiting bodies until after extensive decay has occurred.

Another visible clue to the presence of decay is the localized depression or sunken faces over decay pockets which extend close to the surface of the member. Termites, carpenter ants, and beetles often are associated with decayed wood and evidence of infestations by these insects may be evidence of decay.

A number of signs provide visual evidence of conditions conducive to decay and areas exhibiting these signs should be inspected carefully. Evidence of water, such as watermarks may indicate areas of decay. Such areas should be checked with a moisture meter. If their moisture content is above 20%, the wood is wet enough to support fungal growth. If their moisture content is near 30%, decay likely is in progress. Rusted nail heads, screws or bolts

also indicate that wood is being wetted. Noticable growth of moss or other vegetation on wood surfaces or in checks or cracks is evidence of potentially hazardous wetting. Special attention should be paid to wood adjacent to water-trapping areas such as joints where end-grain is exposed to rainwetting or other sources of moisture. Wood primarily absorbs water through end grain, so decay often begins at joints.

1.4.3 Inspection & Maintenance Procedures (Antennae Poles).

1.4.3.1 Internal Decay. When performing inspections and maintenance on antennae poles it is important to know that internal decay occurs as a result of fungal infestations that (1) start in poles before treatment or (2) where wood destroying organisms are able to penetrate the outer protective shell of preservative treated wood which surrounds the non-treated wood in the center. Deep checks which develop after treatment, mechanical damage from improper handling, woodpecker holes or other actions which break the protective shell, provide avenues for entry of decay fungi. Internal decay will also develop in pole tops cut or bored in the field when the cut surface is not coated with a topical preservative.

WARNING
Do not cut the butt ends off poles as this exposes the central untreated core of wood at the bottom of the poles and provides easy access to termites and decay fungi.

Checks and mechanical damage in the shell of treated wood can also expose the center of the pole to decay fungi.

1.4.3.2 External Surface Decay. External decay is most common at or below the ground line. As poles age, external decay may develop as the effectiveness of the treatment begins to decline.

1.4.3.3 Insects. Attacks of the untreated interior portions of poles by subterranean termites or carpet ants are difficult to detect. However, if insects can gain entry, so can decay fungi. Therefore, the two will often occur together,

1.4.3.4 Inspection Procedures. The purpose of a pole inspection is to: (1) identify poles that are dangerous and should be replaced and (2) identify poles which are in the early stages of deterioration so that corrective actions can be taken.

Visual. A visual examination of the poles, using binoculars to inspect tops, can provide valuable information regarding the pole's condition.

Decay. Machine-damaged areas and checks should be critically examined during visual inspection. The size and location of seasoning checks should be noted. In general, the wider the check, the deeper it penetrates and the more likely untreated heartwood is exposed. Remember, only decay in the advanced stages is readily apparent. The presence of fungi in wood where decay has not progressed appreciably can be detected only by culturing or microscopic examination of the wood. Early decay can extend four feet or more above internal, visibly rotten areas in Douglas-fir poles. Surface decay usually occurs within the first 12 to 18 inches below the ground line, so digging is generally necessary to detect it. Periodic application of groundline preservative treatments will prevent and/or control this type of decay.

Termites and Carpenter Ants. These insects infest the internal untreated portion of poles. Therefore, little external visual evidence of their presence is apparent. Some termite galleries may be present if the insects are trying to bridge over treated wood. In addition, if a carpenter ant infestation has occurred, scattered bits of very fibrous and sawdust-like frass may be present in the area. Since a break in the protective shell must occur before these insects can reach and infest the untreated wood, decay is also likely to be present.

Vertebrate Organisms. Damage from vertebrate organisms, such as woodpeckers, is usually apparent. Binoculars should be used when inspecting large poles. If the damage is fresh, broken pieces of wood from the excavated hole should be present on the ground. Decay will be associated with older damage.

Vertebrate control may require permits from the Federal government or state. Recommendations and assistance for control should be obtained from the cognizant EFD [Appendix (A)].

Mechanical. Mechanical damage is generally obvious and found in the ground line area to a few feet above the ground.

Physical Tests. In addition to visual inspection, several physical tests are available to aid antennae pole inspectors in determining the presence of biological damage. Some of these methods are very basic while others involve sophisticated electronic equipment. In all cases, considerable experience is required to interpret the results, especially with the newest non-destructive testing devices for wood poles.

Sounding. Sounding is a common method of inspecting poles for internal voids. The pole is firmly hit with a hammer from ground level to as high as one can reach. A crisp sound usually indicates the pole is solid, A dull sound thus indicates wet and possibly rotten wood and a "drum" sound indicates a void.

WARNING
Sounding Usually Detects Only The Worst Poles.

To develop experience, poles that are sounded should then be bored to confirm which defects are actually present.

Boring. Where decay or insect attack is suspected, the pole is generally bored for confirmation. Increment borers (Figure 1-4) are most commonly used. The core can be closely examined at the site and also saved for later culturing or microscopic examination. An effective, but simple way to save increment cores is to insert them into soda "straws", seal the ends and label for identification. Protected in this manner, increment cores can be shipped to a laboratory for biological studies,

Poles that sound suspicious should be bored near deep checks and at the pole base or at ground line. If rot is detected, the poles should be bored at three or four points around the circumference. The shell thickness, depth of preservative treatment, and pole circumference are determined. Requirements for replacement, reinforcement, field treatments or schedules for reinspection can then be determined.

When boring holes above ground, the tool should be oriented slightly upward. This prevents water from accumulating in the hole. All openings made during inspection should be treated with a registered preservative and plugged with preservative-treated dowels. Protective goggles and other safety equipment, as appropriate, should be worn.

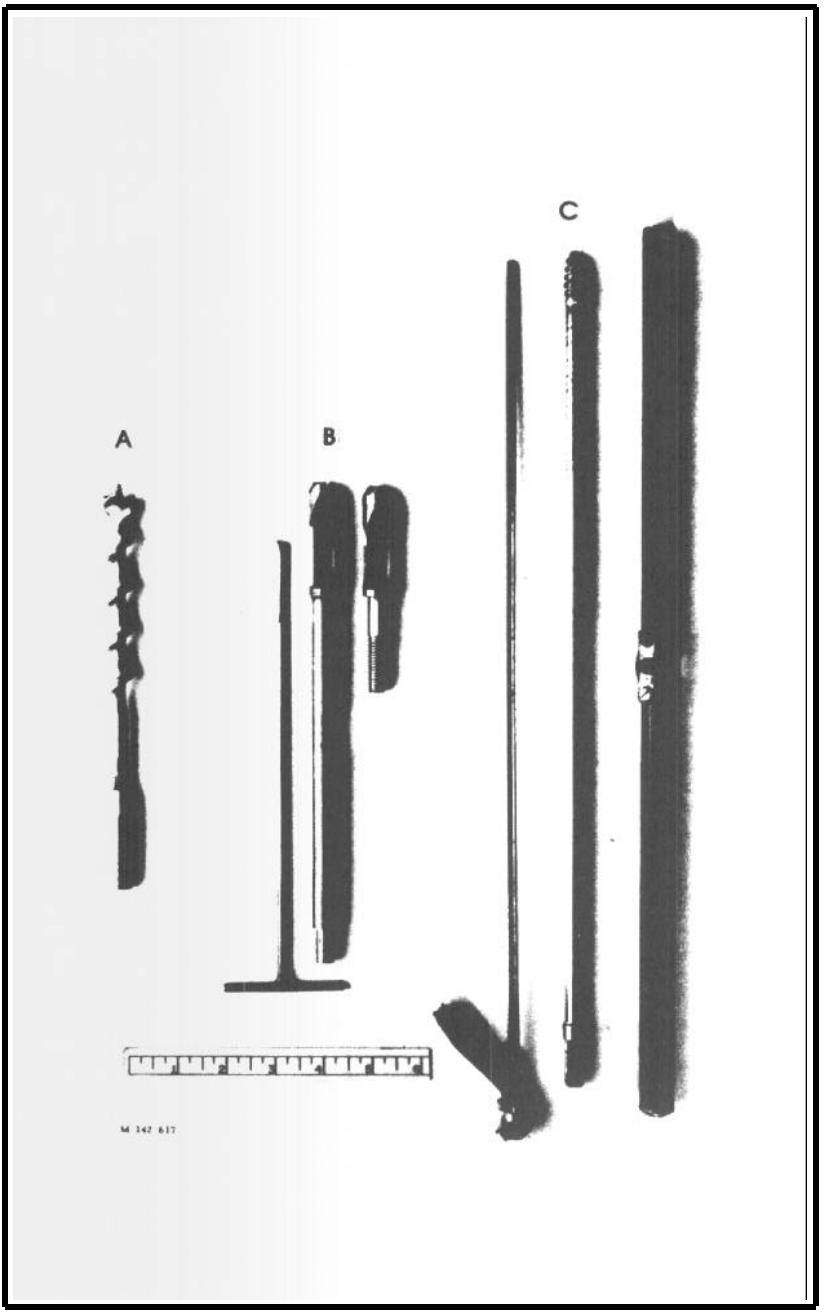

Figure 1-4
Increment Borers

Shell Thickness Indicator. A shell thickness indicator (Figure 1-5) can be used to determine the thickness of the non-decayed wood when poles are drilled rather than using an increment borer.. The rod is inserted into the hole and then pulled back with pressure against the side of the hole. The hook at the end will catch on the remaining sound wood.

When pushing a tight fitting shell-thickness indicator into a hole, you can feel the tip of the hook pass from one growth ring to another in solid wood, but not in rotten wood.

Biological Tests. It is important to detect and treat decay fungi as early as possible if the strength properties of the wood are to be maintained. Biological tests are still the most reliable means for detecting early stages of decay.

Culturing. The early or "invisible" stages of decay can be detected by culturing in the laboratory the core samples you have collected in the field using increment borers. Each core is placed in a plastic straw, labeled and the ends of the straw stapled shut.

The cores are brought to the laboratory and culturing begins within 24 hours.

Insect Identification. It is usually beneficial to identify insects if an infestation has occurred. If field identification is not possible collect the insect, their boring dust (frass), and a portion of the wood with typical damage, and consult the cognizant Pest Management Consultant (See Appendix A) for assistance with identification

Determination of Serviceability. The results of your visual and physical inspections and lab reports help you determine the serviceability of the wood member. As the integrity of a wood member is destroyed by biological agents, its ability to withstand the load it was designed for is diminished. As more and more wood is destroyed, the structure becomes weaker. With poles, the location of the wood that is destroyed is more important then the amount of wood destroyed. The outer 44% of the pole radius contributes most (about 80%) of the bending strength. Therefore, decay in the center of the pole will reduce strength substantially less than if the outer shell is deteriorated. Decay in the above ground portions of the outer shell of a well-treated pole is an indication that the pole was decayed before treat-

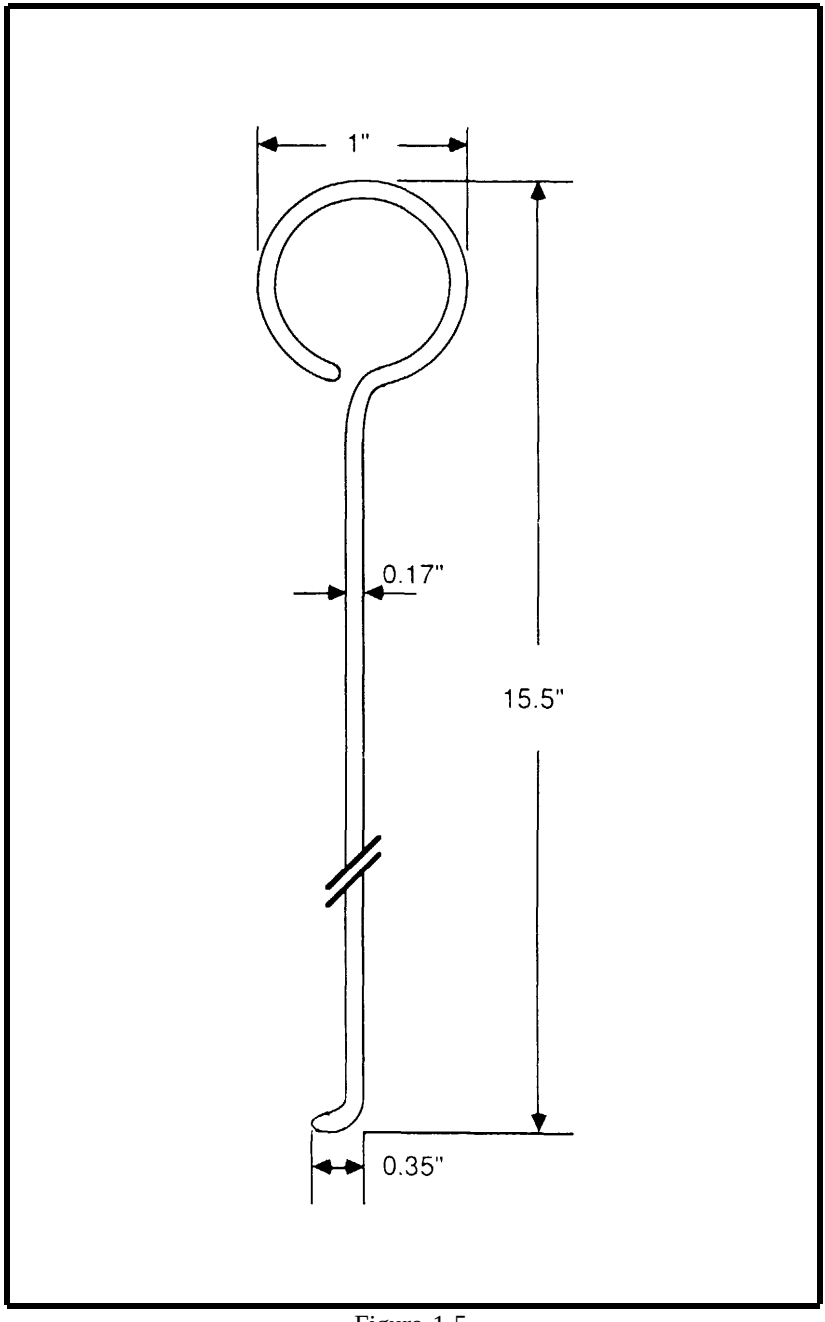

Figure 1-5
Shell Thickness Indicator

ment. This is why it is important to specify "white wood" inspection of treated products to be purchased.

1.4.3.5 Remedial Treatment.

WARNING
Preservatives are classified as pesticides and are therefore included within the provisions of PL 92-516, Federal Insecticide, Fungicide, and Rodenticide Act, as amended. As such, records on the use of wood preservatives must be maintained.

Groundline or Bandage Treatment. Groundline brush or bandage treatments are very effective in controlling surface decay in the outer shell of poles at and below groundline. With these treatments, the soil is excavated from the bases of poles to a depth of approximately two feet. The exposed surface of poles then are checked for decay and, if present, the decayed wood is removed using a sharpened shovel. Next a bandage wrap is fastened around the below-grade portions of the poles or preservative is applied directly to the pole surface and covered with a water-impervious wrap such as polyethylene that is fastened tightly to the poles. The wrap should not be damaged as the backfill is being replaced.

Before treatment, the surface to be treated should be cleaned of any decayed or loose wood, No more sound wood than necessary should be removed. All debris should be removed from the excavated area around the pole.

NAVFAC Specification TS-20312 (Maintenance of Wooden Utility Poles) is a specification for groundline treatment and should be used as a guide for developing a contract specification.

Internal Void Treatment. Liquid preservatives or fumigants may be used to control decay and insect attack within the central core of poles. These treatments require drilling holes into the decayed areas and placing the preservatives or fumigants in the holes, The holes are capped following treatment.

Internal void treatment with liquids is most successful on cedar and other woods that develop well defined rot pockets and where the transition from

rotten to sound wood is abrupt; they are least effective in Douglas-fir with poorly defined rot pockets. For Douglas-fir, use a fumigant alone or in combination with a water-soluble preservative solution. To arrest internal decay, water-soluble chemicals, e.g. arsenicals, fluorides or borates are forced into the voids and diffused through the wet wood. Ants in pole voids can be controlled by injection with volatile liquids combined with preservatives such as creosote or pentachlorophenol.

Serviceable poles with voids, hollows or insect galleries can be internally treated with a liquid pesticide registered by the EPA for such use. Poles shall be bored with a 3/8 inch drill bit, a sufficient number of times to assure uniform internal coverage. Preservatives are pumped into the bottom hole until it runs out the next higher hole. The hole is then plugged with a preservative-treated plug, and preservative is then pumped into the next higher hole until it runs out the hole above. This procedure is repeated until the entire cavity is flooded or a maximum of one gallon of preservative is used. Preservative pastes also can be injected into holes to treat internal voids.

Fumigant Treatment.

WARNING
Because of the hazards associated with fumigants, they shall only be applied by individuals who hold a valid DoD or State Pesticide Applicator certification In the Category applicable to fumigation.

Consult the cognizant PMC for local regulations concerning fumigants. Fumigants can control internal decay for at least nine years. As a result, the use of fumigants is now common technology.

Sodium N-methyl dithiocarbamate (Vapam), methylisothiocyanate (MITC-Fume) (Vorlex), and tricholoronitromethane (chloropicrin) are currently registered with the U.S. Environmental Protection Agency (EPA) for application to wood.

Label directions for applications of individual fumigants must be followed. In general, starting at the ground line, 5/8 to 7/8 inch diameter holes are drilled directly towards the center of the pole at a steep downward angle.

The hole should not be through the pole or intersect seasoning checks which would allow the fumigant to escape. To assure good distribution of the fumigant, holes are spaced evenly (and drilled in a downward direction) around the pole in an upward spiral pattern with a vertical spacing of 6 to 12 inches. If more than two treating holes intersect an internalvoid or decay pocket, re-drill the holes further up the pole into relatively solid wood where the fumigant will gradually volatilize and move through the wood.

The fumigant placed in decay pockets will be lost if the seasoning checks connect the pocket to the outside of the pole. If the decay pocket is above the ground line, holes should be bored above and below the pocket. A three inch long treated plug is inserted into each hole after treatment.

Fumigant applicators must wear protective clothing and stand upwind from the point of application. The proper amount of the chemical is applied to the lowest hole first, leaving enough space for the plug. A tight fitting preservative treated plug is driven into the hole. **Care must be exercised to avoid squirting the fumigant from the hole while driving the plugs.** The applicator should continue to work up the pole one hole at a time.

Decay fungi recolonize vapam-treated poles in about five years, but the fungal population remains low for at least nine years. These poles should be retreated every nine years by placing additional fumigant in the same hole.

The effectiveness of wood fumigants for long term insect control is uncertain. Vapam may control subterranean termites, however, carpenter ants are known to reinfest wood shortly after fumigant application, perhaps because of the decreased fumigant concentration.

NAVFAC Specification TS-20312 provides additional guidance on pole fumigation requirements. Application of wood preservatives requires DOD or State certification (See Section 1.2).

1.4.4 Inspection & Maintenance Procedures (Boom-Boards).

1.4.4.1 Problems to Be Found.

Nature of Timbers. Timbers are different than poles in that they are sawed products. With the exception of Southern pine, they usually do not contain a continuous sapwood band which is easily treated. Therefore incising of

most large timbers will improve the preservative treatment. In addition many timbers will contain a pith center which results in deep radial seasoning checks from the surface to the center. These checks often penetrate past the treated zone.

1.4.4.2 Inspection Procedures.

Visual. The visual inspection of heavy timbers is similar to that for other wood products. External evidence of decay includes features such as fruiting bodies, abnormal surface shrinkage, such as localized depressions or sunken faces on wood surfaces, loose joints, abnormal deflections, crushing, cracking, etc., and insect activity. Remember, carpenter ants and termites prefer damp wood.

Other visual evidence such as water marks from periodic wetting, rust stains, especially if from wood-penetrating fasteners or hardward, and plant growth such as moss or other vegetation, especially in cracks or crevices, indicates that existing conditions are, or have been, conducive to decay.

Detecting Decay. Decay in heavy timbers is detected in much the same way as previously described for wood poles. The "pick test" or probing can be used to detect surface decay. Sounding by an experienced inspector may provide some estimate of the potential for internal decay. Boring or coring is used to estimate the extent of internal decay.

1.4.4.3 Remedial Treatments. Remedial treatments may be either external or internal. External treatments include the elimination of sources of moisture wetting the wood, and flooding the surface of critical areas with an acceptable preservative. Pentachlorophenol has traditionally been used for treating wood surfaces. New preservative emulsions have some use because they can concentrate larger quantities of toxic preservatives within a localized area.

For interior treatment of timbers, pressure injection of one of the water borne preservative pastes, or borate or flouride rods in holes bored in the timbers is effective. Application of liquid preservatives without pressure can also be effective, but penetration is primarily along the grain of the wood. The fumigants, vapam and chloropicrin, have been shown to be effective in controlling decay in horizontal members. Boron and Fluoride rods have also been shown to effectively control decay in large dimension products such as poles and timbers.

In controlling decay in horizontal members not exposed in enclosed spaces, fumigants such as vapam and chloropicrin are effective.

1.5 PRESSURE PRESERVATIVE TREATMENTS.

1.5.1 Introduction. Due to the limited availability of durable woods such as green heart, cypress, redwood or cedar, the Navy must use relatively non-durable wood that is treated with preservatives to-protect from attack by decay fungi and insects, Preservatives applied to wood by nonpressure processes usually provide only superficial protection. For maximum protection, all wood components at CDAA sites world-wide should be initially preservative treated by pressure processes.

1.5.2 Incising.

1.5.2.1 Background. Preservative penetration in hard-to-treat woods such as Douglas-fir, Western-fir, Western-hemlock, redwood and pines that contain a large amount of heartwood, is significantly increased by incising wood before treatment. The incisions made in sawn materials arc commonly 1/4 to 1/2 inch long and deep and about 1/8 inch wide. For such woods, incising should be specified, non-incised material should not be accepted as an alternate in bids. Only Southern, Red or Ponderosa pines arc exempt from this requirement. Whenever possible, specifications should state that components should be cut to lengths needed in construction and bored to accept fasteners prior to preservative treatment.

1.5.2.2 Requirements. All wood products, larger than 2 inches, from species other than Southern, Red or Ponderosa Pine, must be incised prior to treatment, provided the incisions will not make the material unfit for the use intended.

1.5.3 High-Band Poles. CDAA surveys have identified significant premature failures in high-band poles at several sites throughout the world. The predominance of failures can be attributed to factors which enhance decay fungi activity such as metal support sleeves, pole butt chamfering techniques, and the generally hostile environment in which these products arc subjected. These problem areas are discussed in detail in sections (1.3.1) and (1.3.2) respectively.

Additional fortification (preservative loading) of the original pressure preservative treatment is one of several techniques used to improve service life performance when environmental conditions are considered harsh and contribute significantly to the early failure of wood components or when treated members must be cut or bored on site. This procedure will increase both preservative penetration and retention which will, in turn, effectively protect poles against the sometimes hostile environments to which they are subjected.

Preservative treatments for new wood products are specified in accordance with the American Wood Preservers Association (AWPA) treatment standards. AWPA standard C-4 (POLES) specifies preservative retention levels in accord with geographical location and associated decay hazards. As conditions worsen, higher retention levels are specified. At CDAA sites where poles are subject to extremely hostile environments, due to the reasons discussed above, even the highest retention level is considered unacceptably low. Increasing preservative loading to an effective1 level therefore requires that CDAA poles be specified under the AWPA C-3 (PILE) standard which accommodates the desired loading level. Thus, CDAA high-band poles to be ordered under this standard are in essence piles and should be designated (for preservative treatment purposes in accordance with AWPA Standards) as MARINE PILING.

NOTE:
A CDAA high-band pole treatment specification which has been tailored with the above guidelines in mind is attached as Appendix B.

1.5.4 Low-Band Poles. Wood inspection surveys conducted at several CDAA sites throughout the world determined that low-band poles are performing extremely well, even in the most hostile environments such as Galeta Island, Panama. Preservative assays were conducted at these sites. Surprisingly, retention assays for these poles (all creosote preservative treated) indicated exceptionally high retention levels. Keeping in mind also that these poles have been in service in excess of 25 years during which time some preservative leaching has occurred. The exceptional performance being experienced can be primarily attributed to the superior preservative treatment of these components. Furthermore, these poles are

all installed on a concrete bed (Figure 1-6) elevated above groundline. This is a much less hazardous exposure than if the pole butts were placed in soil where preservative depletion would be more severe.

In order to continue this exceptional performance record, preservative treatments found in these poles should be duplicated when ordering new replacement poles. As discussed above in 1.3.3, this requirement can only be accomplished by specifying in accordance with AWPA standard C-3 (PILES). Appendix B, treatment specification for High-Baud Poles, can also be utilized for specifying Low-Band Poles by citing AWPA Standard (C-3) for Marine Exposure.

1.5.5 Boom-boards. CDAA site service records indicate that many boom-boards are failing in less than 20 years. With state-of-the-art glue laminations and ability to improve preservative loading via "dual treatment" consisting of treating laminants prior to gluing and again after fabrication, a superior treatment can be achieved that significantly adds to the service life of these components.

NOTE:
The specification attached as Appendix C has been tailored with state-of-the art methodologies in mind.

1.6 QUALITY ASSURANCE FOR NEW PRODUCTS.

1.6.1 Certificates of Compliance. This document, offered by the treater, signifies that treatment standards have been complied with. This is the least desirable method of insuring quality. Unless the activity has the capability of inspecting wood products to verify quality, the certificate of conformance should never be accepted in lieu of physical inspections or Quality Marks.

The contractor is responsible for the quality of treated wood products. Each treated product must be branded by the producer in accordance with AWPA M6. The Contractor must provide the Contracting Officer's Representative (COR) with the inspection report of an independent inspection agency, approved by the Contracting Officer, that verifies that products comply with applicable AWPA Standards. The American Wood Preservers Bureau (AWPB) or Southern Pine Inspection Bureau (SPIB) Quality

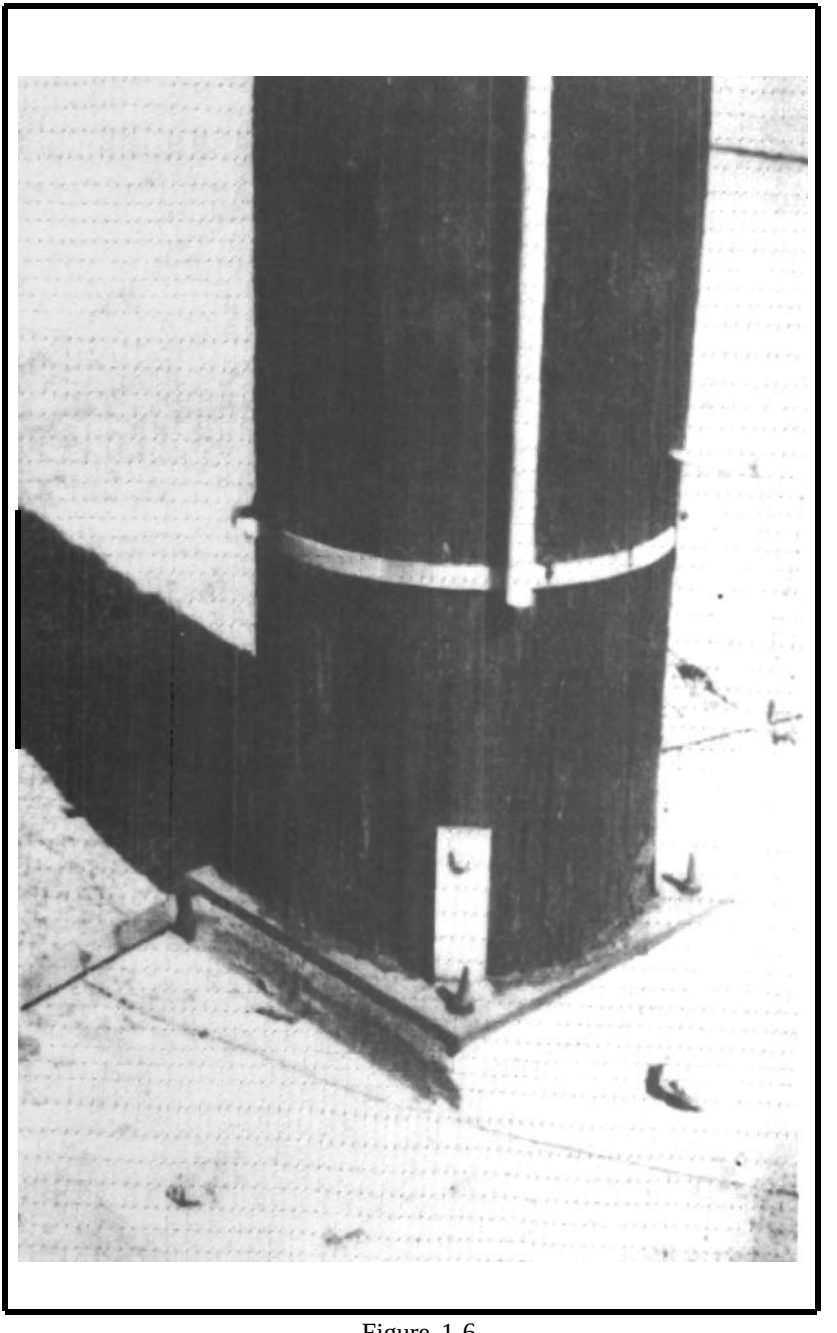

Figure 1-6
Low-Band Poles Concrete Bed

Mark on each product will be accepted in lieu of inspection reports, as evidence of compliance with applicable AWPA treatments Standards.

1.6.2 Plant Inspection. The Contracting Officer reserves the right to perform plant inspections of the products being treated. The Contracting Officer is allowed unlimited access to the plant with inspection privileges for all facets of the treating process.

1.6.3 Branding or Marking.

1.6.3.1 Background. This requirement is frequently overlooked by activities during the procurement and receipt of treated wood products. Omission of this requirement on specifications, or failure of activity personnel to reject unmarked materials upon delivery can be costly to the activity. Materials found to be non-conforming to specifications after delivery may not be returnable to the contractor, because unmarked products cannot be identified as belonging to a specific contract or contractor. The activity is then left with the option of either installing inferior materials, which will predictably fail prematurely, or utilize these materials for less critical projects where premature failures are less costly to repair.

Marking or branding of wood products also serves another important function; that of providing activities with a means of evaluating product performance. All branding requirements must minimally require the type of treatment, the name of the treater and the treatment year. This information provides activity inspectors with the means to evaluate product performance which will subsequently identify shortcomings in the Quality Assurance Program. Branding also allows activities to evaluate product performance by given treaters. Thus, branding requirements are critical to the success of any Quality Assurance Program.

1.6.3.2 Requirements.

General: Treated material shall be either hammer or heat branded, dye stamped, or tagged with metal, plastic, or water and tear proof paper, in accordance with AWPA Standards M1 and M6.

Timbers: Sawn material more than 2 inches (nominal) in thickness and treated with an oil-type preservative shall be individually branded or tagged on one end except that plywood and lumber less than two inches (nominal) in thickness may be bundled with weatherproof tags attached to the bundle to identify species, preservative, retention, supplier, and year of treatment.

When treated with a waterborne preservative, each piece of lumber four inches and larger in nominal width shall be permanently dye stamped on the surface.

Piles: Each pile shall be branded or tagged in two places approximately 5 and 10 feet from the butt. The brand shall identify species, length, preservative, retention, supplier, and the year of treatment.

Poles: Each pole 50 feet or less in length shall be branded or tagged 10 feet from the butt. Poles 55 feet or more in length shall be branded or tagged 14 feet from the butt. All poles shall have the required branding or tagging included on the butt face. The brand shall identify species, class and length, preservative, retention (may be indicated with "S" for standard or "H" for heavy retention), supplier, plant designation, and year of treatment.

1.7 TECHNICAL PROCUREMENT REVIEW

NAVFACINST 6250.4B requires that Requisitions and Invitations for Bid for treated wood products which deviate from the instruction be reviewed and approved by the cognizant NAVFAC EFD Applied Biologist prior to submission. This requirement will insure that the most appropriate product is ordered, that current treatment specifications are cited, and that Applied Biologists are alerted to pending procurements which may require actions to insure product quality.

Review requirements may be waived or reduced by the cognizant EFD when an activity has been shown to be consistently receiving products of acceptable quality. Review guidance may then be provided on an as necessary basis to maintain acceptable product quality levels.

1.8 CARE AND HANDLING OF TREATED WOOD PRODUCTS.

WARNING
Whenever possible, alterations should be made prior to the original pressure preservative treatment!

1.8.1 Introduction. AWPA Standard M4 outlines recommended practices for the care of preservative-treated wood products. The publication deals primarily with practices at the treating plant, however, the following field recommendations are made.

1.8.2 Machining And Cutting. When treated wood products are cut or altered prior to installation, the user should treat the effected surfaces with the same preservative, if available, or as follows:

1.8.3 Oilborne Preservatives. At least two brush applications of either creosote or a solution of at least 5 percent pentachlorophenol in a suitable solvent or one heavy application of a grease/paste containing at least 10 percent pentachlorophenol. Cleanliness requirements should dictate the type of treatment.

1.8.4 Waterborne Preservatives. At least one application of a 5 percent solution of the same preservative used in the original treatment.

For either of the above preservatives, appropriate copper napthenate solutions can be utilized as this preservative is compatible with either of the above preservative formulations.

1.9 TECHNICAL ASSISTANCE.

1.9.1 General. EFD Applied Biologists are available to provide technical assistance to all Naval activities on wood related matters. On-site assistance can be obtained via Engineering Service Requests or during scheduled on-site reviews which are normally conducted at least biennially. Applied Biologists maintain particular expertise in the area of pesticide (wood preservatives) legal requirements (State and Federal) for pesticide applications, pesticide use in general, State and Federal pesticide applicator certification requirements, and pesticide applicator training. Appendix A provides names, addresses and phone numbers and geographical areas under their cognizance. Activity assistance or technical information should be obtained from the EFD which maintains responsibility for activities within your geographical area.

1.10 REFERENCE GUIDES.

1. OPNAVINST 6250.4A. **Pest Management Programs.** This instruction designates responsibilities, states the legal requirements for the safe handling and use of pesticides and provides guidance for a careful environmental stewardship of Navy property and natural resources.

2. NAVFACINST 6250.3G. Applied Biology Program Services and Training. Lists the pest management services, to include vegetation con-

trol and wood protection. Describes in detail the training and certification requirements necessary to apply pesticides on Navy activities.

3. NAVFACINST 6250.4B. **Selection, Procurement and Use of Preservative-Treated Wood Products.** Based on intended end use, provides guidance for the specification of treated wood products to extend the service life of wood products.

4. NAVFAC MO-312. **Wood Protection.** Provides information on the different tree species, and the physical and chemical characteristics of wood. Discusses the different chemical preservatives along with the purpose, advantages and disadvantages of each type. Finally discusses the importance of a quality management program for assuring the receipt of quality treated wood products.

5. **American Wood Preservers Association Book of Standards.** This publication provides the technical requirements for chemical preservatives, chemical retention levels for specific end products, testing procedures, and product marking requirements. These are the non-government standards to be cited in Navy procurement specifications.

6. NAVFAC Specification TS-20312. **Maintenance of Wooden Utility Poles.** Provides guidance for the inspection and preventive maintenance of a utility pole plant. Properly treated utility poles can last 40-50 years, a periodic inspection and maintenance program can add many additional years.

1.11 RECORD KEEPING REQUIREMENTS (WOOD COMPONENTS).

1.11.1 Background. Complete records on the replacement and preservative in-place treatment of wood components are often either not kept or are incomplete.

1.11.2 Discussion. Historical records maintained on wood components within the CDAA arrays are invaluable in determining structural performance, identifying potential biological problem areas (decay), and for evaluating effectiveness of in-place maintenance procedures.

Records on in-house inspections can also provide significant and useful information to CDAA inspection teams thereby enabling inspection efforts to be more selective during the overall structural evaluation. Specific information needed by the CDAA survey team includes:

Component Replacement.

- Specific component replaced and location within array.
- Date of replacement.
- Cause for replacement.
- Photographs of damage causing replacement.

In-House Inspections.

- Date of inspection.
- Type of inspection; sounding, drilling, visual, etc.
- List of components inspected and findings.

In-Place Maintenance Efforts.

- Date of treatment.
- Type of treatment.
- Material used.
- Identification list of components treated.

Appendix A

NAVAL FACILITIES ENGINEERING COMMAND APPLIED BIOLOGISTS

Office	Personnel	Area of Responsibility
Applied Biology Program (1634) Naval Facilities Engineering Command, 200 Stovall Street Alexandria, VA 22332-2300 703/325-0045, DSN 221-4045, FAX 703/325-6904	Mr. William A. Gebhart (1634) Dr. Peter J. Egan (1634A) (Wood Protection)	Navy-wide
Atlantic Division (161) Naval Facilities Engineering Command Norfolk, VA 23511-6287	Dr. Daniel G. Maiello (161A) 804/444-9581, 9546 DSN 564-9581, 9546	Virginia, North Carolina, Kentucky, West Virginia, Argentina, Newfoundland Iceland, United Kingdom, West Germany, Greece, Italy, Morocco, Spain, Azores, Antigua, Barbados, Trinidad, Turks Caicos, Bermuda, Puerto Rico, Panama
Pacific Division (114A) Naval Facilities Engineering Command Pearl Harbor, HI 96860-7300 808/471-3948	Mr. Lawrence Pinter (808/474-5961) Dr. Stanley Y. Higa (808/474-5956) (wood protection)	Hawaii, Midway, Guam, Phillippines, Okinawa, Japan, Australia, Bahrain Diego Garcia
Northern Division (164) Naval Facilities Engineering Command Philadelphia, PA 19112-5094 215/897-6057, DSN 443-6417 (143) (Northern Division also supports Chesapeake Division installations)	Mr. Peter L. Fish (Navy-Wide Wood Protection) 215/897-6688, DSN 443 Mr. Thomas C. Walker Mr. Stephen Kincaid Mr. Jeff Davis Mr. Simeon Hahn 215/897-6057, DSN 443	Maine, New Hampshire, Vermont, Massachusetts, New York, Illinois, Indiana, New Jersey, Pennsylvania, Delaware, Ohio, Maryland, Virginia, Connecticut, Michigan, Wisconsin, Minnesota, Iowa, Missouri, Kansas, Nebraska, North Dakota, South Dakota, Colorado, District of Columbia, Rhode Island

Office	Personnel	Area of Responsibility
Southern Division (16A) Naval Facilities Engineering Command, P.O. Box 10068 Charleston, SC 29411-0068 803/743-0508, 10, 11 DSN 563-0508, 10, 11	Mr. C. W. Bennett (16A) (wood protection) Mr. Melvin P. Marks (16A1) Mrs. Sharon E. Bartku (16A2)	North Carolina, South Carolina, Georgia, Florida, Alabama, Louisiana, Mississippi, Tennessee, Texas, Arkansas, Oklahoma, New Mexico, & Andros Island (Bahamas)
Western Division (162A) Naval Facilities Engineering Command, P.O. Box 727 San Bruno, CA 94066-0720 415/244-3572,3 DSN 494-3572,3	Mr. A. Reese Christopherson Mr. Scott Dombrosky (wood protection)	Alaska, Arizona, California Idaho, Montana, Nevada, Oregon, Washington, Wyoming, Utah
(Western Division also supports Southwest Division installations)		
Commanding Officer (410E) U.S. Navy Public Works Center Subic Bay FPO San Francisco, CA 96651-2900 DSN 384-6292	Mr. Napolean P. Camba	All U. S. Navy installations in the Phillippines
Commanding Officer (420E) U.S. Navy Public Works Center Box 13 FPO Seattle 98762 DSN 234-7414	Mr. Akira Masui	U. S. Navy installations in Japan (less Okinawa)

APPENDIX B
TREATMENT SPECIFICATION
(CDAA High-Band poles- "Marine piles")

1) Product: Southern Pine (preferred due to treatability and performance.)

2) Preservative Treatment: Creosote and Creosote solutions in accordance with American Wood Preserver's Association [current (standard P2-)].

3) Materials and Requirements:

(a) Piles: Provide Southern Pine clean-peeled piles conforming to ASTM D25. Minimum (butt circumference measured at 3 feet from the butt end)(tip-circumference) shall be (___ inches) (as indicated). Piles shall be in one piece. Splices will not be permitted.

(b) Preservative Treatment: Treat piles by the full-cell pressure process in accordance with AWPA C1 and C3 for Marine piling using Creosote and Creosote solutions [current (AWPA P2-)].

4) Certificates of Compliance:

The contractor shall be responsible for the quality of treated wood products. Each treated pile shall be branded, by the producer, in accordance with AWPA M6. The contractor shall provide the Contracting Officer's Representative (COR) with the inspection report of an independent inspection agency, approved by the Contracting Officer, that offered products comply with applicable AWPA Standards. The AWPB Quality Mark "MP-2" on each pile will be accepted, in lieu of inspection reports, as evidence of compliance with applicable AWPA treatment standards,

5) Plant Inspection:

The Contracting Officer reserves the right to perform plant inspections of the treating process. Provide the Contracting Officer with a minimum 3-week advance notice, indicating location of the initial preservative treatment. Allow the Contracting Officer unlimited access to the plant and inspection privileges for all facets of the treating process.

6) Branding or .Marking:

Each treated pile shall be permanently marked or branded, by the producer, in accordance with AWPA M6.

7) Note: When Government inspections result in product rejection, the Contractor shall promptly segregate and remove rejected material from the premises. The Government may also charge the Contractor any additional cost of inspection or test when prior rejection makes reinspection or retest necessary.

APPENDIX C
RECOMMENDED TREATMENT SPECIFICATION
For
CDAA Structural Glued Laminated Members (Boom-Boards)

1. QUALITY ASSURANCE

A. Standards: Complywith ANSI/AITC A190.1-83. “Structural Glued Laminated Timber”.

B. Factory Markings: Factory mark each piece of glued structural units with the AITC “Quality Inspected” mark.

C. Quality Assurance: Require that all orders are inspected by an independent inspection agency to assure conformance to treatment standard.

2. PRODUCTS

A.. Lumber: Comply with ANSI/AITC A190.1-83, AITC 117 and applicable SPIB standards cited therein for grades required to achieve glulam requirements for design values, appearance, fabrication limitations and species.

B. Laminating Combination: 26F-VS

C. Lumber Species: Southern Yellow Pine

D. Adhesive: ANSI/AITC A190.1 “Wet-Use” Type

E. Treatment:

1. Lumber is to be treated with pentachlorophenol prior to laminating according to [current (AWPA specification C28-)]. The net retention is to be 0.5 pounds per cubic foot, as determined by laboratory analysis.

2. Glulam members are to be retreated after fabrication according to AWPA specification [current (C28-)] creosote. The net retention of creosote is to be 10 pounds per cubic foot, as determined by laboratory analysis.

3. FABRICATION

A. General:

1. Comply with ANSI/AITC A190.1-83 in providing units indicated, provide manufacturer’s standard sizes and shapes required to fulfill indicated performances.

2. Shop - fabricate for connections and connecting hardware to greatest extent feasible, including drilling of bolt holes.

B. Appearance Grade:

1. Visible decayed knots and sound knots larger than 3/8" in diameter will not be allowed in the width or depth of glulam members. Small decayed knots or sound knots exposed by sawing ends or drilling will be allowed.

2. Provide Industrial Grade, complying with AITC 110, with the exception noted in 3.B.1

APPENDIX D
LIST OF SUPPLIERS

Poles and Piles

Baldwin Pole & Piling Co., Box 768, Bay Minette, AL 36507
Poles and Piles

Brown Wood Preserving Co., Rt 3, Box 309, Northport, AL
Poles and Piles

Cahaba Pressure Treated, Rt 1, Brierfield, AL 35035
Poles and Piles

Great Southern Wood Preserving Inc., 201 Park Blvd., Irvington, AL 36544
Piles

Huxford Pole & Timber Co., Inc., PO Box 579, Hwy #21, North Huxford, AL 36543
Poles and Piles

Koppers Ind, PO Box 510, Montgomery, AL 36101
Poles & Piles

T. R Miller Mill Co., Box 708 Brewton, AL 36427
Poles

Olon Belcher Lbr Co., Box 160, Brent, AL 35034
Poles

Seaman Timber Co., Inc., Box 372, Hwy 25S., Montevallo, AL 35115
Poles and Piles

Stallworth Timber Co., Inc., PO Box 38, Beatrice, AL 36425
Poles

Swift Lumber Inc., PO Drawer 1298, Atmore, AL 36504
Poles and Piles

Arizona Pacific Wood Preserving, 805 W. Chambers St., Eloy, AZ 85231
Poles

J. H. Baxter Co., 422 Mill St., Weed, CA 96094
Poles and Piles

J. H. Baxter Co., Box 477, Long Beach, CA 97440
Poles and Piles

Cal Coast Wholesale Lumber, PO Box 6873, Ukiah, CA 95482
Poles and Piles

Fontana Wood Preserving Inc., 15500 Valencia Ave., Fontana, CA 92335
Poles

Koppers Industries Inc., PO Box 351, Oroville, CA 95965
Poles and Piles

McCormick & Baxter Creosoting, PO Box 1728, Stockton, CA 95201
Poles and Piles

Pacific Wood Preserving, 560 District Blvd., Bakersfield, CA 93313
Poles and Piles

San Diego Wood Preserving, 2010 Haffley Ave., National City, CA 92050
Poles and Piles

Koppers Industries, 465 W. 56th Ave., Denver, CO 80216
Poles and Piles

Ponderosa Timber Co., PO Box 239, Dolores, CO 81323
Piles

Wigand Corp., 850 Eklton Dr., Colorado Springs, CO 80907
Piles

Apalachee Pole Co., PO Box 688, Bristol, FL 32321
Poles and Piles

Florida Wood Treaters Inc., 4500 E. 11th Ave., Hialeah, FL 33013
Piles

Koppers Industries Inc., Box 1067, Gainesville, FL 32602
Poles and Piles

Post & Lumber Preserving Co., PO Box 940, Quincy, FL 32357
Piles

Robbins Mfg Co., PO Box 17939, Tampa, FL 33682
Poles and Piles

Wood Treaters Inc., PO Box 41604, Jacksonville, FL 32203
Poles and Piles

Ace Pole Co., PO Box 1323, Waycross, GA 31502
Piles

Atlantic Wood Industries, Box 1608, Savannah, GA 31498
Poles and Piles

Baxley Creosoting Co., E. Parker Street, Baxley, GA 31513
Poles

Brunswick Wood Preserving Co., RR #5, Box 2K, Brunswick, GA 31520
Poles and Piles

Camilla Wood Preserving co., Box 13087, Pensacola, FL 35291
Poles

Cook County Wood Pres, Box 6437, Adel, GA 31620
Piles

Glennville Wood Preserving Co., Inc., Rt 4, Box 28, Glennville, GA 30427
Poles and Piles

Keadle Treating Co., Inc., 889 RR St 6, Thomaston, GA 30286
Poles and Piles

Langdale Forest Products Co., Box 1088, Valdosta, GA 31603
Poles and Piles

Manor Timber Co., Inc., Rt 1, Box 60, Manor, GA 31550
Poles

W. C. Meridith Co., Inc., Box 90456, East Point, GA 30364
Poles and Piles

Savannah Wood Pres Co., Inc., 501 Stiles Ave, Savannah, GA 31412
Piles

Union Timber Corp, Box 238, Homerville, GA 31634
Poles and Piles

B. J. Carney Industries, Inc., Box 408, Spokane, WA 99210
Poles

Pressure Treated Timber Co., 3200 Gowen Rd., Boise, ID 83705
Poles and Piles

Hagar Wood Preserving Inc., County Rd 700 North, Forrest, IL 61741
Piles

Illinois Wood Pres, Inc., Box 491, Hillsboro, IL 62049
Piles

Southern Indiana Wood Pres Co., Rt 1, Box 147, Winslow, IN 47598
Piles

Western Tar Products Corp., BOX 270, Terre Haute, IN 47808
Piles

Brown Wood Preserving co.. PO Box 14234, Louisville, KY 40214
Poles

Esterday Tie & Timber Co., PO Box 421, Mayfield, KY 42066
Poles and Piles

Kentucky Wood Preserving of Winchester, PO Box 15, Winchester, KY 40391
Poles

Benton Wood Preserving Co., Box 54, Shreveport, LA 71161
Poles and Piles

Madisonville Wood Preserving Co., Box T, Madisonville, LA 70447
Piles

Atlantic Wood Industries, PO Box L, Fruitland, MD 21626
Poles and Piles

Eastern Maryland Wood Treating, PO Box 155, Federalsburg, MD 21632
Poles and Piles

Hatheway & Patterson Co., 15 County St., Mansfield, MA 02048
Poles and Piles

Continental Wood Preservers, 7500 E. Davidson Ave., Detroit, MI 48212
Poles and Piles

Hagar Wood Preserving, 1211 Judd St., S.W., Grand Rapids, MI 49509
Piles

Lake States Wood Preserving, PO Box 8, Munising, MI 49862
Poles and Piles

Bell Lumber & Pole Co., Box 2786, New Brighton, MN 55112
Poles

Page & Hill Forest Products, Box 7, Big Falls, MN 56627
Poles and Piles

Brookhaven Wood Preserving Co., Box 974, Brookhaven, MS 39601
Poles

International Paper Co., PO Box 340, Wiggins, MS 39577
Poles

Koppers Industries, PO Box 160, Tieplant, MS 38960
Poles and Piles

Phillips Bldg Supply, Box 3059, Gulfport, MS 39505
Poles and Piles

Southern Wood Pres of Hattiesburg, PO Box 630, Hattiesburg, MS 39403
Poles and Piles

Timco Inc., Box 190, Wiggins, MS 39577
Piles

International Paper Co., PO Box 2671, Joplin, MO 64803
Piles

Kalispell Pole & Timber co., Box 1030, Kalispell, MT 59903
Poles

McFarland Cascade, Box 1496, Tacoma, WA 98421
Poles

Atlantic Wood Industries, Box 487, Hainesport, NJ 08036
Poles and Piles

Koppers Industries, Maritime & Tyler Sts., Port Newark, NJ 09114
Poles and Piles

General Wood Pres, Box 370, Leland, NC 28451
Poles

Great Northern Wood Preserving Box 249, Akron, OH 44309
Poles and Piles

J. H. Baxter Co., PO Box 10797, Eugene, OR 97440
Poles and Piles

Conrad Wood Preserving, 3998 Wildwood Dr., North Bend, OR 97459
Poles and Piles

Kerr-McGee Chemical Corp. FPD, Box 25861, Oklahoma City, OK 73125
Poles and Piles

McCormick & Baxter Creosoting, Box 3048, Portland, OR 97208
Poles and Piles

National Wood Preservers, PO Drawer F, Havertown, PA 19083
Poles

Puerto Rico Wood Treat, Box 29228, Rio Piedras, PR 00929
Piles

Koppers Industries, Box 1725, Florence, SC 29503
Poles and Piles

Wheeler Consolidated, Box 8, Whitewood, SD 57793
Poles and Piles

Landale Forest Products, PO Box 328, Sweetwater, TN 37874
Poles

Conroe Creosoting, Box 9, Conroe, TX 77305
Poles and Piles

Garland Creosoting Co., PO Box 589, Longview, TX 75606
Poles and Piles

Hart Creosoting Co., Box 300, Jasper, TX 75951
Poles and Piles

W. J. Smith Wood Preserving, Box 703, Denison, TX 75020
Poles and Piles

Walker Wood Preserving, Box 1217, Livingston, TX 77351
Piles

Utah Wood Preserving, 1959 S. 1100 W., Wood Cross, UT 84084
Poles

Atlantic Wood Industries, Box 340, Portsmouth. VA 23704
Poles and Piles

Koppers Industries, 4020 Koppers Rd., Salem, VA 24153
Poles

Wood Preservers, Box 1018, Warsaw, VA 22572
Poles and Piles

Oeser Co., PO Box 156, Bellingham, WA 98227
Poles and Piles

Pacific Wood Treating, 111 W. Division, Ridgefield, WA 98642
Poles and Piles

Wyckoff Company, 520 Pike St., #1220, Seattle, WA 98101
Poles and Piles

Koppers Industries, PO Box 397, Superior, WI 54880
Piles

Penta Wood Products, 8682 State Rd 70, Siren, WI 54872
Poles

Richardson Wood Preserving, Box 904, Sheboygan Falls, WI 53085
Piles

Webster Wood Preserving, Box 297, Bangor, WI 54614
Poles and Piles

Chesapeake Corp., Box 155, Route 453, Eutawville, SC 29048
Piles

Taylor Treating, PO Box 248, Sheridan, OR 97378
Poles and Piles

San Diego Wood Preserving, 2010 Haffley Ave., National City, CA 92050
Piles

Laminated Timbers

Structural Wood Systems - Greenville, AL

Unit Structures - Magnolia, AR

Sentinel Structures - Peshtigo, WI

Unadilla Laminators - Unadilla, N.Y.

Wood Inspection Equipment

Forestry Suppliers, Inc., P.O. Box 8397, Jackson, MS 39204

Osmose Wood Preserving, Inc., 980 Ellicot St., Buffalo, N.Y. 14209

Timber Products Inspection, Inc., P.O. Box 919, 884 Blacklawn Rd, Conyers, GA 30207

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