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1265 San Juan Dr. - Merritt Island, FL 32952
Phone: 321-501-5601

Naval Facilities Engineering Command
200 Stovall Street
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Inspection, Maintenance and Procurement Procedures for **Wood Poles**

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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.

E. R. HAMM
CAPTAIN, CEC, U.S. Navy
Assistant Commander for
Public Works Centers and Departments

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 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.

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INSPECTION, MAINTENANCE, AND PROCUREMENT PROCEDURES FOR WOOD POLES

1.0 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 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 poles is essential in preventing deterioration caused by wood-destroying organisms.

Antenna, distribution and transmission poles at Navy installations 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 wood poles.

This handbook provides information that will help Navy personnel to specify and receive preservative treated poles which best meet end use requirements. Specifically this handbook covers wood deterioration, preservative treatments for new poles, procurement specifications, inspection and quality control procedures, inspection of wood poles in service and maintenance of poles in service including remedial measures for co trolling deterioration caused by biological organisms.

2.0 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 EPA, DOD or State (contractors) certified pesticide applicators are permitted to apply wood preservatives 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 Material Safety Data Sheet (MSDS) supplied by most pesticide formulators. For additional information users should contact the cognizant EFD Applied Biologist [See Appendix (A)] or local Industrial Hygienist.

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.

3.0 WOOD POLE INSPECTION AND MAINTENANCE PROCEDURES.

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

Poles exposed to wetting can decay when water remains in contact with them or when rapid drying is restricted. Steel support sleeves [Figure (l)] lacking base drain hole is a good example. Periodic retreatment of such poles will significantly increase service life. Decay can typically be found where seasoning checks or bolt holes have exposed untreated wood found beneath the treated shell.

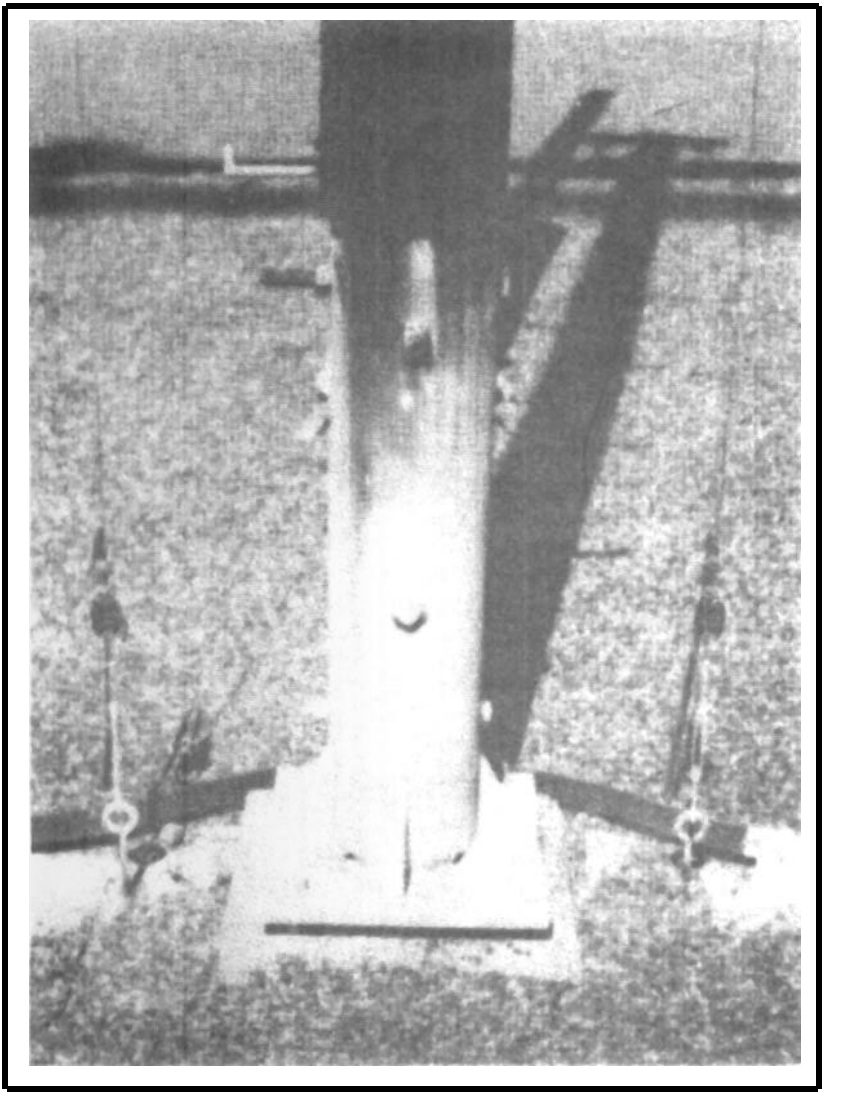

Figure 1
Metal Support Sleeve

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 preservatives, all areas that are exposed to probing, cutting or drilling. Periodic retreatment of areas prone to moisture contact and accumulation must also be done on a scheduled basis.

3.2 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 loses 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 strength, particularly in shock resistance.

The presence of fruiting bodies [Figure (2)] 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 signs of infestation by these insects may be evidence of decay.

A number of signs provide visual evidence of existing conditions that may be conducive to decay. 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, such as a shigometer or pilodyn [Figure (3)]. 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. Noticeable 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 rain, wetting, or other sources of moisture. Wood primarily absorbs water through end grain, so decay often begins at joints.

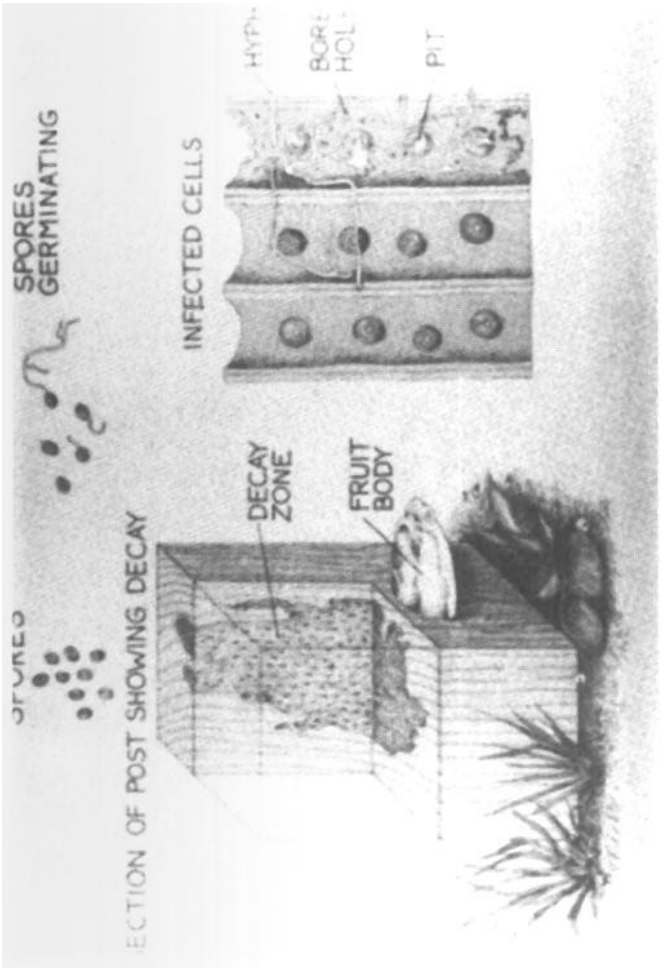

Figure 2
Decay Fungus Fruiting Body

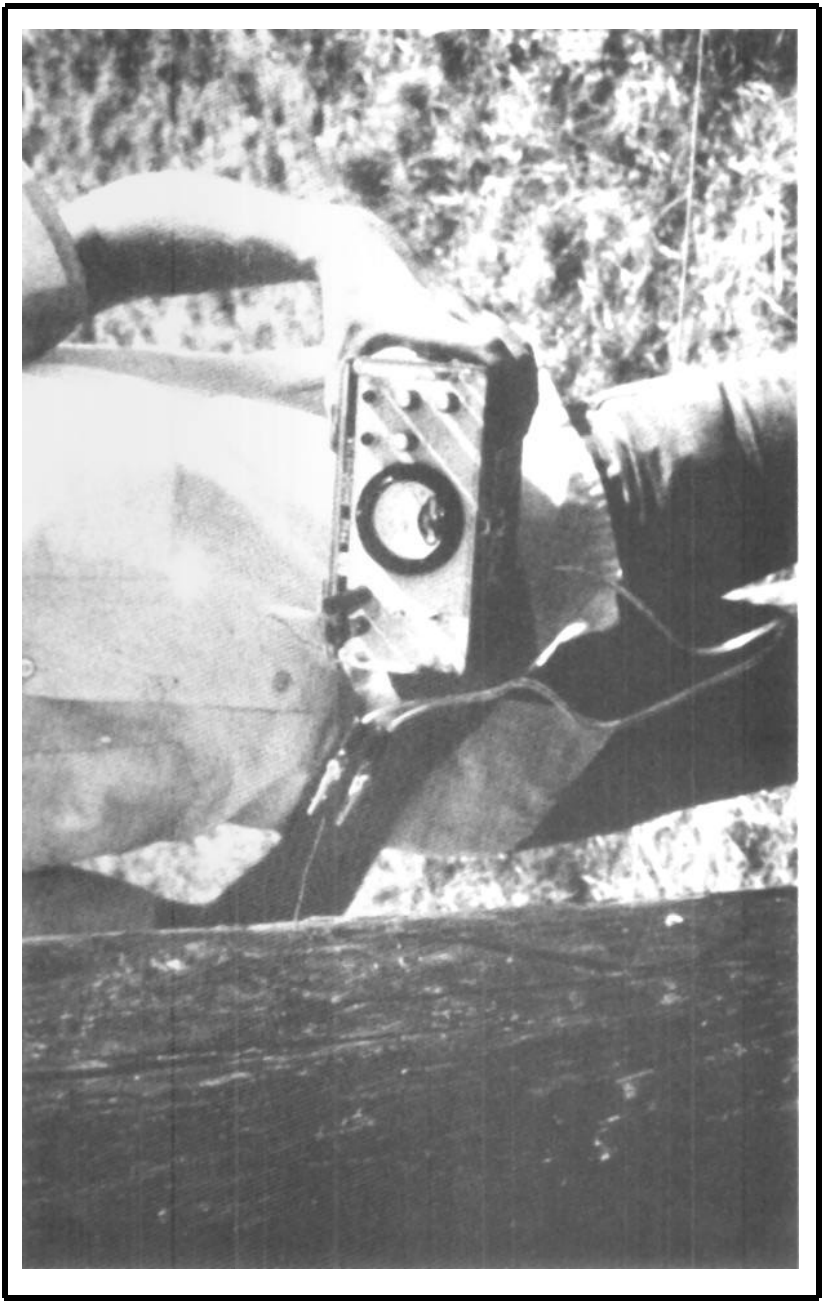

Figure 3
Moisture Meter Suitable for Inspection Work

3.3 Inspection & Maintenance Procedures for Wood Poles.

3.3.1 Internal Decay. When performing inspections and maintenance on antenna 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 holes 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 for 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.

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

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

3.3.4 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 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 nondestructive 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 (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.

Shell Thickness Indicator. A shell thickness indicator [Figure (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

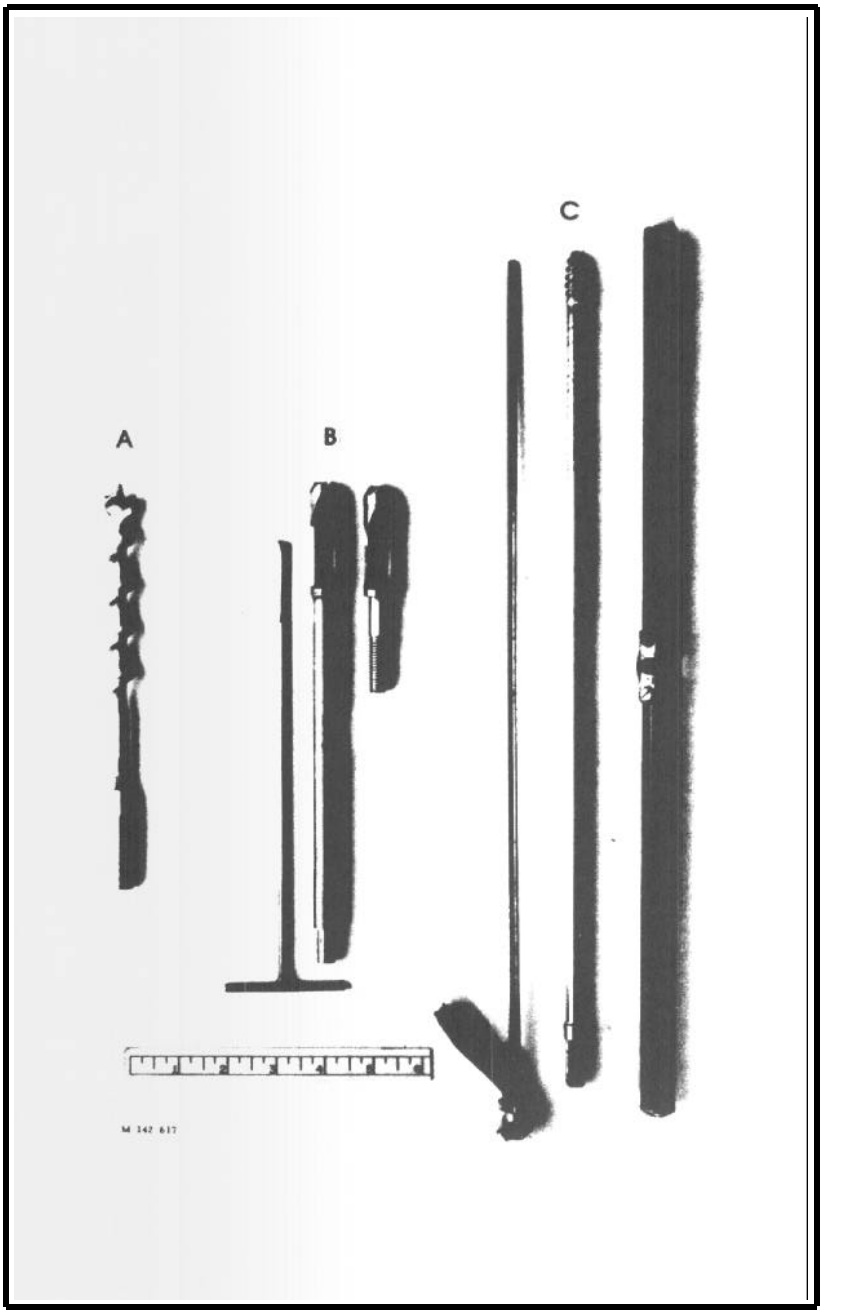

Figure 4
Increment Borers

Figure 5
Shell Thickness Indicator

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

4.0 REMEDIAL TREATMENTS.

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.

NOTE: CONTRACTOR QUALIFICATIONS: Contractors hired to formulate and apply preservatives (pesticides) to wood products, including poles, shall be licensed in accordance with the laws of the State/Country within which the work is being done. If EPA restricted use pesticides are used in the accomplishment of this specification, the pesticide must be applied by a certified pesticide applicator, or under the direct supervision of a certified applicator who is present on the installation at the time of application. The individual's certification must be valid in the state in which the application is to be made and in the category of work to be performed. The successful bidder shall be required to provide to the Contracting Officer proof of these qualifications. The contractor's supervisor(s) shall be Pole Treating Specialist(s), with a minimum of two years field experience in the art of pole inspection. The Contractor shall furnish proof, as demonstrated by at least three references, of qualifications and ability to perform the work specified.

4.1 Superficial Preservative Treatments. Preservative applications by brush, spray or pinstream (oil squirt can) do not penetrate deeply into the wood. These treatments are therefore not intended to protect the wood from sustained exposure to degrading organisms but more so as an adjunct to a good initial pressure preservative treatment.

Brush treatments should be flooded onto the surface and not brushed out thin, like paint. Checks and other openings should be saturated to the point of refusal. A pinstream application using a squirt type oil can applicator can be used effectively in this type of application. Wood should be well dried before treatment or it will not accept preservatives applied in this manner. If spraying, a course spray should be used to min-

imize health hazards. Special precautions should be taken to avoid drift.

Topical treatments recommendations for the major preservative classes are as follows:

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.

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.

The label on the preservative container is a legal document. All methods of application, precautions, cleanup, safety, and dispersal must be carefully followed.

4.2 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 containing a preservative 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.

4.3 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 plugged 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.

4.4 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.

At overseas installations, insure, through the cognizant Pest Management Professional (Appendix A), that this material is legally acceptable.

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. These are restricted use pesticides and can only be applied by a certified applicator.

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 internal void 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 2.0).

5.0 POLE TOP PROTECTION. Pole top deterioration is caused by decay fungus and weathering action. Depressions, splits, and checks create water holding pockets which cause wood to expand and contract, freeze and thaw and subsequently split and check. These conditions present an ideal condition for decay fungi. When left unchecked, the pole top continues to deteriorate until pole topping or removal is necessitated.

Pole top products are now available which effectively protect pole tops from weathering. decay fungi and ultimately degradation.

Pole tops (caps) are designed to keep the roof portion of poles free of moisture thus preventing attack by decay fungi. Preservative fluids are also available which should be applied to the pole tops prior to capping or topping.

6.0 POLE STRENGTH RESTORATION. Woodpeckers, carpenter ants, decay fungi and termites can cause extensive damage to wood poles. Left unheeded they can cause serious damage and result in early pole failure.

When poles are found to be structurally damaged and accompanied by significant strength loss, repair alternatives versus replacement must always be considered. New state-of-the-art techniques, using epoxy resins, fibers, and fillers can restore poles to their original strength [Figure (6)]. When cured, these epoxies are stronger than wood and can also be drilled, sanded, painted or sawn and be applied to wet surfaces. When applied in conjunction with preservative supplements for preventing further deterioration, poles can be restored to original condition. When site conditions make pole replacement prohibitively costly, pole restoration can become a viable solution via cost reduction and prevention of down time. Therefore this should become an available procedure in any pole maintenance program.

Steel reinforcement splints are also available for restoring pole integrity. Splints can also be utilized as a temporary repair procedure for emergency use when poles are mechanically damaged. Replacement or permanent repair can then be done during normal working hours rather than via costly overtime work.

Screening is also available for use on poles that are continuously attacked by woodpeckers, usually caused by territorialism. Territorial poles may require screening to prevent continuing attack.

7.0 PRESSURE PRESERVATIVE TREATMENTS.

7.1 Introduction. Due to the limited availability and variation in decay resistance of durable woods such as green heart, cypress, redwood or cedar, the Navy is required to 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 poles world-wide should be initially preservative treated by pressure processes.

7.2 Incising.

7.2.1 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 [Figure (7)]. The incisions are 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

Figure 6
Pole Restoration Using Epoxy Resins, Fibers and Fillers

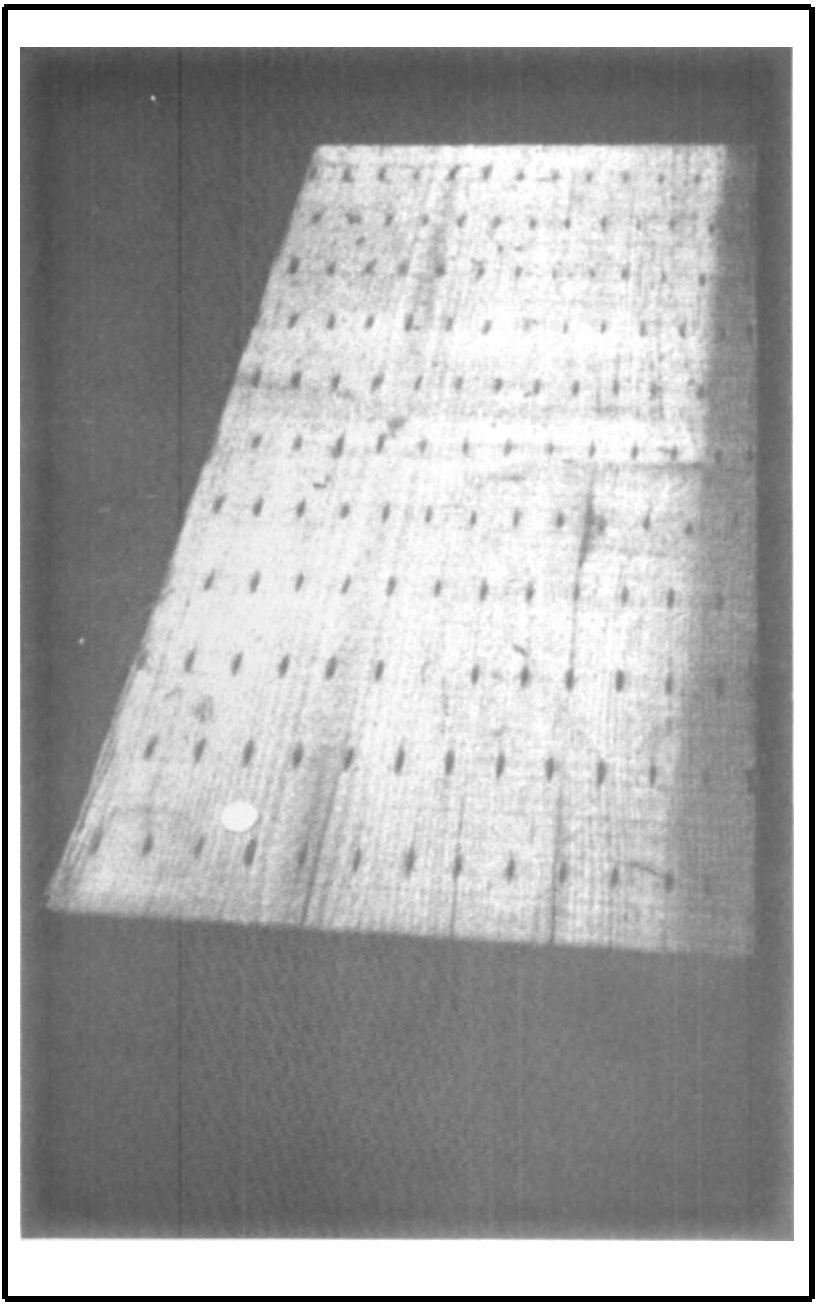

Figure 7
Incising to Enhance Preservative Treatment

material should not be accepted as an alternate in bids. Whenever possible, specifications should state that poles should be pre-cut, predrilled, or otherwise mechanically altered, prior to preservative treatment.

7.3 Enhanced Preservative Treatments.

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 poles. This procedure will increase both preservative penetration and retention which in turn will effectively protect poles against extremely hostile environments to which they are sometimes 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 many sites world-wide, poles are subjected to extremely hostile environments and even the highest retention level prescribed by AWPA treatment standard C-4 may not be sufficient to attain satisfactory performance. Increasing preservative loading to an acceptable level therefore requires that pole treatments be specified in accordance with AWPA treatment standard C-3 (PILES), a treatment standard which accommodates higher loading level requirements. High preservative retention poles to be ordered under this standard are, by AWPA treatment standards definition, piles and should be described (for specifying treatment in accordance with AWPA Standards) as piles.

NOTE:
Appendix (B) is a pole treatment specification which has been tailored in concert with the above guidelines.

8.0 POLE PERFORMANCE EVALUATION (IN-SERVICE). Wood inspection surveys conducted at several sites around the world determined that many poles are performing extremely well, even in the most hostile environments. 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 many of these poles have been in service for over 25 years during which time some preservative leaching has occurred. The exceptional performance being experienced can be primarily attributed to superior original preservative treatment. In order to continue this exceptional performance, preservative treatments found in these poles should be duplicated when ordering new replacement poles. As discussed above in 7.3, this requirement can only be accomplished by specifying in accordance with AWPA standard C-3 (PILES).

9.0 QUALITY ASSURANCE FOR NEW PRODUCTS.

9.1 Introduction. U.S. Navy policy is to obtain independent inspection for verification to avoid even the appearance of conflicts of interests and appearances of such. Therefore, wood products purchased by the Navy shall be inspected by the government or by an inspection agency independent of the producer company. The Navy requires that either (1) an independent inspection agency verify that the treated wood products comply with the appropriate AWPA standards or (2) that the treated wood products are stamped by a Quality Assurance agency which verifies compliance with the appropriate AWPA standards.

9.2 Certificate if Compliance. This document, offered by the treater, signifies that treatment standards have been complied with. This document is not reliable and 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), Southern Pine Inspection Bureau (SPIB) Quality, or the WQC Quality Mark of the Rural Electrification Administration on each product will be accepted in lieu of inspection reports as evidence of compliance with applicable AWPA treatments Standards.

9.3 Quality Assurance Guidance. All personnel involved in the receipt of treated wood products should familiarize themselves with the quality assurance procedures detailed in NAVFAC MO-312.2, Field Guide for the Receipt and Inspection of Treated Wood Products By Installation Personnel. This document provides users with a step by step process for quality assuring wood products.

9.4 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.

9.5 Branding or Marking.

9.5.1 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.

9.5.2 Requirements.

General: Treated material shall be either hammer or heat branded, or metal tagged in accordance with AWPA Standards M1 and M6.

Piles: **If** poles are specified for ultra treatment under AWPA standard

C-3 (PILES), each (pole) 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.

9.5.3 General Inspection Procedures: To check for evidence of inspection prior to treatment, look on the tip (top) end of the poles for a brand that identifies the inspection agency and the inspector [Figure (8)]. Upon inspection "in the white", poles which meet material standards are hammer stamped on the tip end. This is the only stamp that is ever put on the tip end.

To determine the type of treatment and preservative retention level, check the brand applied by the supplier. Following preservative treatment, poles are branded on the face side of the pole 10 feet from the butt for poles 50 feet or shorter and 14 feet from the extreme butt for poles over 50 feet long. These brands contain the following information:

(1) Supplier's Name
(2) Plant Designation
(3) Year of Treatment
(4) Species of Timber and Preservative Treatment
(5) Preservative Retention
(6) Class and Length

Poles are treated in accordance with the appropriate federal standard or AWPA Standard C4 and are inspected under Power Pole Standard REA-DT5C. To determine that poles have been inspected, check for a hammer mark of an approved inspector/agency on the butt end of each pole [Figure (9)]. The brand must contain the letters WQC or equivalent quality mark.

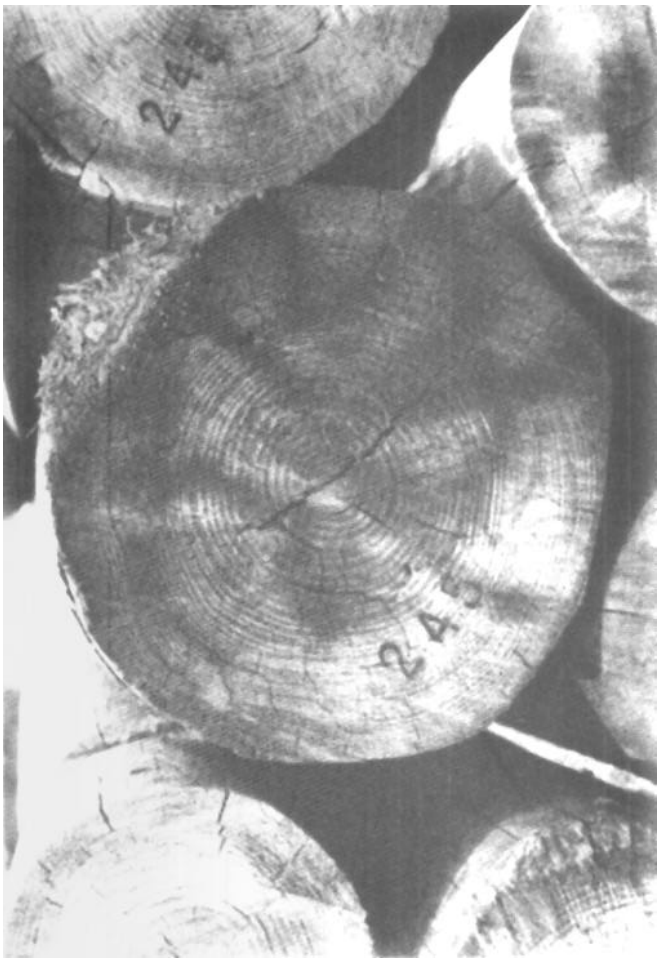

Figure 8
Typical Inspection Agency "In-The-White"
Hammer Stamp Mark Placed on Pole Tip

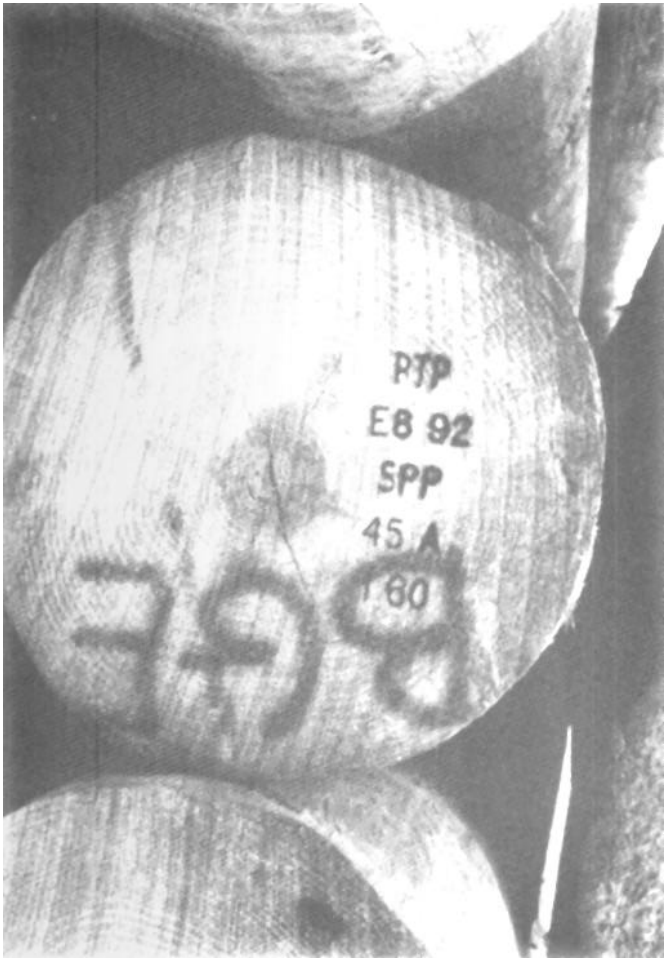

Figure 9
Typical Inspector/Agency Preservative Treatment
Inspection Mark Placed on Pole Butt

10.0 TECHNICAL PROCUREMENT REVIEW.

NAVFACINST 6250.4C 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 arc 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.

11.0 CARE AND HANDLING OF TREATED WOOD PRODUCTS.

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

11.1 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.

11.2 Machining and Cutting, All cutting, boring and other machining of wood should be done prior to preservative treatment as much as possible. Cutting treated wood at the construction site exposes untreated heartwood to wood destroying organisms.

Untreated wood, exposed by cutting, etc., at the job site should be field treated. The same wood preservatives used to pressure treat commodities can often be used for treatment of field cuts or else a copper naphthenate solution containing a minimum of two percent copper metal can be used. For detailed information on preservatives and field application methodology, refer to AWPA Standard M4 which includes all treated wood products.

12.0 HANDLING AND STORAGE.

Poles treated with oil borne preservatives should be installed soon after treating to minimize lateral movement of preservative to the extent that subsequent durability of the treated product will be reduced. This is a particularly important consideration in procurement programs for poles that might normally be expected to be in storage for a minimum of one year.

Poles treated with creosote or oil base preservatives stored in a horizontal position for over 18 months can lose preservative due to bleeding and volatilization or the preservative can migrate in the wood. To minimize this loss, poles should be rotated periodically while in storage.

Migration or loss of preservative during storage is not a problem with water-borne preservatives.

13.0 TECHNICAL ASSISTANCE.

13.1 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 pesticides (wood preservatives) legal requirements (State and Federal Laws) for pesticide applications, pesticide use, 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.

14.0 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 6250.3H. **Applied Biology Program Services and Training.** Lists the pest management services, to include vegetation control and wood protection. Describes in detail the training and certifica-

tion requirements necessary to apply pesticides on Navy activities.

3. NAVFACINST 6250.4B. **Selection, Use and Maintenance of Pressure-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.

7. NAVFAC MO-312.2 of April 1991. **A Field Guide for the Receipt and Inspection of Treated Wood Products by Installation Personnel.** All Navy personnel should have this book in hand when inspecting treated wood products for acceptance.

15.0 RECORD KEEPING REQUIREMENTS.

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

15.2 Discussion. Historical records maintained on poles 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 inspection teams thereby enabling inspection efforts to be more selective during the overall structural evaluation. Specific information needed;

Component Replacement.

- Specific component replaced and location within SYSTEM.
- 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 B
TREATMENT SPECIFICATION
(Ultra-High Preservative Loaded Wood Poles- For Use in Hostile Environments)

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.