Selection and Use of Preservative Treated Wood

Tom Milton, Technical Director
WoodWorks, North-central

Selection/Use of Preservative Treated Wood

• The Many Benefits of Wood
• What Causes Wood to Deteriorate
• How to Protect Wood from Deterioration
• Preservative Treated Wood
• What Types of Preservatives are Available
• How is Wood Pressure Treated
• How is Treating Quality Measured & Verified
• Where is PT Wood Required by the IBC
• Specifying Treated Wood
• Use & Handling of Treated Wood

Trees: Our Most Valuable Natural Resource

• A renewable, sustainably managed, resource
• Reduce green house gases by: removing CO₂, producing O₂, and storing Carbon
• Compared to other building materials:
  • Requires less energy to process trees into finished products
  • Wood processing produces less air and water pollution
• 100’s of species with a variety of appearances & properties
• Readily available and locally sourced

The Many Benefits of Wood

- A familiar material easily cut, shaped & fastened
- Dimensionally stable to temperature changes
- Excellent physical and mechanical properties, e.g.- high strength-to-weight ratio
- High insulating properties to cold, sound, and electrical current
- Easily create aesthetically pleasing designs, nice “wood-grain” appearance
- Wood buildings are comfortable, energy efficient, reliable, easily remodeled, and cost effective.
- Recyclable and biodegradable
- Durable if protected or treated

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Wood Deterioration - 2 Categories

- Biotic (biological)
- Abiotic (nonbiological)

Nonbiological Deterioration

1) Weathering
   Cause: wetting/drying cycles (swelling and shrinkage), ultraviolet light, oxidation and leaching
   Solution: use coverings or water repellent and UV resistant finishes, eg- paints, stains, water repellents

2) Thermal Decomposition (Fire)
   Cause: exposure to flame or high heat
   Solution: use fire retardant chemicals, protected assemblies and/or fire sprinklers

3) Mechanical Damage
   Cause: abrasion to wood surfaces, eg-flooring, stairs
   Solution: use high-specific gravity, edge grain, or chemically hardened woods

4) Chemical Decomposition (Pulping)
   Cause: caustic chemicals, such as strong bleach solutions
   Solution: avoid caustic chemicals

Biological Deterioration

1) Insect Damage
   Cause: termites, borers, and carpenter ants
   Solution: use wood preservatives, barriers, termite baits, insecticides, keep wood dry

2) Marine Borer Damage
   Cause: shipworms and crustaceans
   Solution: wood preservatives and/or surface barriers
**Biological Deterioration**

3) Bacterial damage  
Cause: bacteria in high-moisture conditions  
Solution: keep wood dry or use wood preservatives

4) Fungal damage  
Cause: molds, stains, & decay fungi  
Solution: keep wood dry or use wood preservatives

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**Wood Fungi**

1) Sapstain Fungi  
Prevention: dry wood quickly or use anti-stain chemicals  
Sapstains affect appearance but not wood strength

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**Wood Fungi**

2) Mold Fungi  
Prevention: keep wood surfaces dry or use mold inhibiting chemicals  
Molds affect appearance but not wood strength

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**Wood Fungi**

3) Wood Decay Fungi  
(brown, white and soft rots)  
Prevention: keep wood dry or use wood preservatives

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**Wood Fungi Growth Requirements**

- Free water on cell walls
  - 40-80% MC optimum
  - < 19% MC prevents fungal growth
- Favorable temperature range
  - 50°F - 90°F optimum
- Oxygen
  - In situations without oxygen, wood lasts indefinitely, e.g. submerged logs,
- Digestible food source (i.e. wood)
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Wood products need protection from decay and insects when:

1. Exposed to high humidity or condensation
2. In direct contact with ground
3. In indirect contact with ground (concrete)
4. Exposed to water
5. Where termites are known to occur

Protecting Wood Products

To protect wood from biological deterioration:

- Dry wood to the MC it will eventually reach in service
- Keep wood dry during storage, transport, & construction
- Keep wood dry by using proper construction designs
  or
- Use naturally durable or preservative treated wood where conditions warrant

Wood Structure and Natural Durability

Species that exhibit natural decay resistance in heartwood

- Cedar
- Redwood
- Cypress
- White oak
- Black locust

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Pressure Treated vs Preservative Treated

- Pressure-treated wood
  Describes treatment method
- Preservative treated wood
  Describes the benefit

Preservative Treated Wood

Preservative Treated Wood Applications

- Residential
  - Decks
  - Fences
  - Landscaping timbers
  - Ramps
  - Gazebos
  - Outdoor Furniture
  - Planter boxes
  - Doghouses
  - Trellises
  - Sill plates, furring strips, sleepers
  - Shakes & shingles
  - Permanent wood foundations

- Agricultural
  - Tomato & grape stakes
  - Post frame structures
  - Stables & corrals
  - Fence posts

- Commercial
  - Walkways & bridges
  - Structural columns
  - Exterior stairways
  - Utility poles
  - Building poles
  - Piling (foundation & marine)
  - Guardrail posts
  - Sign posts
  - Retaining walls
  - RR Crossties

Preservatives Extend Wood’s Service Life

- Untreated Wood: 5 years
- Treated Wood: 30-50+ years
- Service life is increased by 5 to 10 times
- Provides annual savings of $7.5 billion in U.S.
- Conserves 6.5 billion board feet of lumber products annually
- Saves 226 million trees-- equivalent to 435,000 new houses

Are Wood Preservatives Safe For People And The Environment?

- All Wood Preservatives Must be Registered.
  - The U.S. Environmental Protection Agency.
  - Regulated & Controlled Industry.
- Detailed Risk Reviews for Human Health and Environmental Impacts.
- Product Labels Designate in What Building Applications the Treated Wood May Be Used.
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What makes a good preservative?

Desirable Qualities Include:

- Broad spectrum toxicity to decay & insects
- Low mammalian toxicity
- Clean surfaces, pleasing color, odorless, paintable
- Resistant to leaching, strong fixation
- Low fire hazard and low corrosiveness
- Does not reduce wood strength
- Economical and accepted by consumers
- Provides good penetration & uniform distribution in wood
- Meets AWPA Standards & EPA registration requirements

How Are Preservatives Classified?

- By the type of carrier or solvent – creosote vs. oilborne vs. waterborne solutions
- By the preservative’s chemistry – organic (metallic) vs. inorganic (carbon) compounds
- By the application process – pressure vs. non-pressure
- By the type of EPA Registration – restricted use vs. general use

Waterborne Preservatives

- Clean to the touch, paintable surfaces
- No odors, suitable for interior applications
- After re-drying, low permanent weight increase (1-2%)
- Low solution cost
- Water repellents, colorants, & mold inhibitors can be incorporated into solutions

Waterborne Preservatives for Exterior Applications

- CCA – Chromated Copper Arsenate
- ACZA (Chemonite) – Ammoniacal Copper Zinc Arsenate
- ACQ – Ammonical Copper Quat
- ACQ – Alkaline Copper Quat
- CA-C – Copper Azole
- MCQ - Micronized Copper Quat
- MCA-Micronized Copper Azole
- Non Metal Preservatives – PTI & EL²

CCA

- Industry voluntarily modified EPA registered uses for CCA
- Effective Dec. 31, 2003 – CCA phased out for most consumer and residential applications
- CCA is still approved for industrial end use applications such as plywood, PWFs, highway construction, utility poles, piling and agricultural applications
- EPA does NOT recommend
  - the removal of existing
  - CCA structures
Waterborne Preservatives

Table 2: Identification of Preservatives Approved for the Pressure Treatment of Southern Pine Wood Products

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<tr>
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<td>165</td>
<td>166</td>
<td>Yes</td>
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<tr>
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<td>168</td>
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<td>170</td>
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<td>179</td>
<td>180</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Pressure Treated Southern Pine, 08-09 Edition, Southern Pine Council

ACQ “Preserve Wood” & “Nature’s Wood”

- Douglas fir / Hem fir / Southern Yellow Pine
- AWPA Book of Standards
- ICC Evaluation Service Report
- Ground & Fresh Water Contact

CA-C Wolmanized® Outdoor®

- Hem fir / Southern Yellow Pine
- AWPA Book of Standards
- ICC Evaluation Service Report
- Ground & Fresh Water Contact

PTI Wolmanized® L³ Outdoor® Wood

- Douglas fir, Hem fir, SYP
- AWPA Book of Standards
- ICC Evaluation Service Report
- Above-ground Use Only
- PTI = AWPA Designation (propiconazole, tebuconazole, imidacloprid)
- Very Little Color Unless Colorant is Added for ID Purposes
- Low Impact on Hardware & Coatings

MCQ & MCA MicroPro™

- Micronized Copper Products
- MCQ = “SmartSense”
  - Hem Fir / SYP
- MCA = “LifeWood”
  - Southern Yellow Pine
- ICC Evaluation Service Report
- Light, fresh appearance, slightly darker than untreated wood
- Above Ground, Ground & Fresh Water Contact
**EL² Ecolife™**
- Douglas fir, Hem fir, SYP
- AWPA Book of Standards
- ICC Evaluation Service Report
- Above-ground Use Only
- EL² = AWPA Designation (DCOI, Imidacloprid)
- Very Little Color Unless Colorant is Added for ID Purposes
- Low Impact on Hardware & Coatings

**Creosote Solutions**
- Unique - acts as both carrier and preservative
- Patented in 1836
- Excellent protection - fungi, insects, most marine borers
- Insoluble in water and leach resistant
- Excellent thermal stability
- Water repellent - enhances dimensional stability
- Used for industrial products including: RR Crossties, Marine piling, Bridge timbers

**Oilborne Preservatives**
- No dimensional change to treated products
- Enhanced water repellency
- Soluble in light to heavy petroleum oils with varying viscosities and properties
- Treating solutions can be heated, enhancing penetration and allowing in-cylinder drying processes
- Low to high permanent weight increase

Oilborne Preservatives Include:
- Pentachlorophenol (Penta or PCP)
- Copper Naphthenate (CuN)
- Copper 8 Quinolinolate (Cu8)

**New Mold Protection Products**
- Mold-Resistant Framing
  - FrameGuard®
  - BluWood®
  - QuanTIM™
- Factory-Applied Surface Coating (green, blue, purple) for Lumber, Plywood, Trusses, OSB
- Offers Added Resistance to Termites and Fungal Decay in Interior Applications.
- **NOT** a Substitute for Treated Wood!

**Selection/Use of Preservative Treated Wood**
- The Many Benefits of Wood
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- **How is Wood Pressure Treated**
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Source: Pressure Treated Southern Pine, 08-09 Edition, Southern Pine Council
**Treating Methods**

**Non-Pressure Treating Methods:**
- **Brush:** e.g. field application of CuN to field cuts; delivery of preservatives incorporated in stains & water repellents
- **Spray:** e.g. application of antistain products to fresh-sawn lumber, application of mold inhibitors
- **Dip:** e.g. application of specific preservatives to window and door parts prior to assembly; application of antistain products; dip treatment of pallets, crating, posts
- **Diffusion and Fumigation:** e.g. remedial, internal re-treatment of utility poles, log homes, bridge timbers & millwork with special diffusible preservatives.

**U.S. Wood Treating Industry**

**Commercial Pressure Treating**
- 452 Commercial Pressure Treating Plants, US, 2004
- 2004 Industry Gross Sales, estimated $4.9 billion
- Industry Employees 13,600
- Average sales per plant $10.9 million


**Preparing Wood for Treatment**
- **Debarking**
- **Seasoning to 20% MC or less by air drying, kiln drying, or in-cylinder steaming/drying processes**
- **Incising**
- **Cutting wood to size, pre-drilling & pre-machining**

**Pressure Treatment Process**

**Typical treating plant**
- Preservative, Mix and Water Storage Tanks
- Treating Cylinder
- Vacuum and Pressure Pumps
**Pressure Treatment Process**

- **Dry wood is loaded into cylinder**
- **Initial vacuum pulls out air**
- **Liquid preservative chemicals fill cylinder**
- **Pressure forces preservative chemicals into wood, typically 150-200 psi**
- **Remaining liquid emptied for later use**
- **Final vacuum removes excess liquid**

**Kiln drying after treatment (KDAT)**

Specify KDAT: When pressure treated dimension lumber will be used in framing applications, where it will be covered or enclosed, (and therefore difficult to re-dry), building codes require a moisture content of 19% or less. e.g. permanent wood foundation lumber and plywood.

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**Quality Assurance**

Treating Plant follows AWPA Standards and ICC-ES Reports

Accredited 3rd party inspection agency routinely and randomly inspects and tests each plant and recently treated stock for conformance to AWPA Standards and any appropriate ICC-ES Reports. Accredited agencies include:

- Bode Inspection-Beaverton, OR
- Southern Pine Inspection Bureau, Pensacola, FL
- Timber Products Inspection, Conyers, GA

American Lumber Standards Committee, (ALSC) provides oversight and accreditation to 3rd party inspection agencies
**Quality Assurance**

Verification of the treatment starts at the treating plant and involves drawing a representative sample (20) of increment cores from each charge for later analysis and recording.

**Quality Assurance**

Analysis of increment core samples determines:

- **Retention**—the amount of preservative, retained in the wood, measured in pounds (of preservative) per cubic foot (of wood)
- **Penetration**—the depth of treatment, measured in inches or percent of sapwood

**IBC Section 2303.1.8.1**

**Quality Mark – Required Information**

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**Codes and Standards**

- Building codes—dictate the conditions under which treated wood must be used. e.g. IBC, IRC
- Standards—detail how wood should be treated with preservatives. e.g. AWPA Standards, ICC Evaluation Reports, utility pole, RR tie industries.
- Both codes and standards are necessary and work in tandem to ensure treated wood consumers, select and use the appropriate material for the given application and conditions.

**American Wood Protection Association**

- Founded in 1904
- International, nonprofit technical society
- Standards writing organization for the wood preserving industry in U.S.
- Provides a technical forum for industry, research and users.
- Protects consumers by ensuring uniform product performance.
- Referenced in all building codes.
- Updated Annually – Currently 2009 Edition
- Determines if a preservative is effective and can be listed in the standards
- Establishes how much preservative is needed (retention) depending upon the exposure and use.
Building Code Requirements for PT Wood

IBC Section 2303.1.8 – Lumber, timber, plywood, piles and poles supporting permanent structures shall be treated according to the requirements of the American Wood-Protection Association (AWPA) for species, product, preservative and end use.

IBC Section 2304.11.2.1
Where wood joists or the bottom of a wood structural floor are closer than 18" or wood girders when closer than 12" to exposed ground in crawl spaces...

Building Code Requirements for PT Wood

Section 2304.11.2.2
Where wood framing members rest on concrete or masonry exterior foundation walls and are less than 8" from exposed ground.

Section 2304.11.2.6
Where wood siding, sheathing & wall framing on the exterior of a building are less than 6" to the ground.

IBC Section 2304.11.2.3-Furring Strips
Where wood furring strips or other wood framing members attach to the interior of exterior masonry or concrete walls below grade.

IBC Section 2304.11.2.4-Sleepers & Sills
Where sills and sleepers are on concrete or masonry, which is in direct contact with earth.

IBC Section 2304.11.2.5 –Girder Ends
Where the ends of wood girders entering exterior masonry or concrete walls have clearances of less than 0.5" on tops, sides and ends.

IBC Section 2304.11.2.7 – Posts or Columns
Where posts or columns supporting permanent structures are [themselves] supported by a concrete or masonry slab or footing that is in direct contact with the earth.
Building Code Requirements for PT Wood

IBC Section 2304.11.3-Laminated Timbers
Where the portions of glued laminated timbers that form the structural supports of a building are exposed to weather and not protected from moisture.

IBC Section 2304.11.5
Supporting Members for Permanent Appurtenances
In geographical areas where needed, wood members which support buildings, balconies, decks or porches if exposed to weather and without adequate cover protection.

IBC Section 2304.11.6
Termite Protection
In geographical areas where hazard of termite damage is known to be very heavy, wood floor framing.

Building Code Requirements for PT Wood

2304.11.4.1-Posts or Columns
Posts and columns supporting permanent structures that are embedded in concrete that is in direct contact with the earth, embedded in concrete that is exposed to the weather, or in direct contact with the earth.

2304.11.4.2-Wood Structural Members Wood structural members supporting moisture-permeable floors or roofs that are exposed to weather such as concrete or masonry slabs.

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AWPA USE CATEGORY SYSTEM

- New format for treatment standards
- Simplifies specification for specifiers and users
- Based on end use biodeterioration hazard to which the treated product will be exposed
- 5 Use Categories based on exposures & expected product performance.
- Categories range from weather protected (UC1 mild exposure/lowest risk) to salt water marine (UC5 severe exposure/highest risk).
- Separate Use Category for fire retardants.

AWPA Use Category System

Degree of protection needed depends upon:
- Geographic location
- Desired service life
- Structural vs. Nonstructural components
- Replacement difficulty
- Exposure severity (ie.- interior, exterior, above ground, ground contact, freshwater, or saltwater
### Specifying With the AWPA Use Category System

#### Use Category 1 (UC 1)
- Interior Construction
  - Not in contact with ground or foundations
  - Protected from weather
  - Protected from interior sources of water
  - Insect Hazard Only e.g., interior construction and furnishings

#### Use Category 2 (UC 2)
- Interior Construction
  - Not in contact with ground
  - Protected from weather
  - Subject to dampness and occasional sources of water
  - Decay Fungi & Insect Hazard
    - e.g., interior construction

#### Use Category 3 (UC 3)
- Exterior construction,
- Above Ground
- Decay Fungi & Insect Hazard
  - UC3A: Coated & rapid water runoff; e.g., coated millwork, siding, and trim
  - UC3B: Uncoated or poor water runoff; e.g., decking, deck joists, railings, fence pickets, uncoated millwork

#### Use Category 4 (UC 4)
- Ground or Fresh Water Contact; Exposed to all weather cycles
- Subject to Fungal and Insect Hazards
  - UC4A: Non-critical components, low decay areas; e.g., fence, deck & guardrail posts, crossties and utility poles
  - UC4B: Critical components or difficult replacement, high decay areas; e.g., permanent wood foundations, building poles, horticultural posts, crossties & utility poles
  - UC4C: Critical structural components, extreme decay potential; e.g., land & fresh water piling, foundation piling, crossties & utility poles
Specifying With the AWPA Use Category System

**Use Category 5 (UC 5)**

- Wood Used in Salt or Brackish Water
- Exposed to marine borer attack
- Applications such as marine piles, docks, bridges, bulkheads, bracing
  - UC5A-Northern waters, north of New Jersey, San Francisco
  - UC5B-Waters between NJ and GA, South of San Francisco
  - UC5C- Waters south of GA, Gulf Coast, Hawaii, & Puerto Rico

**Specifying With the AWPA Use Category System**

**Use Category F - UC F**

- Fire Retardant Treated Wood
- Above Ground Use Only
- Two Risk Groups – Determined by Weather Exposure
  - UCFA: Interior - Continuously protected from weather e.g.—roof sheathing, roof trusses, studs, joists, paneling
  - UCFB: Exterior - Exposed to weather or wetting e.g.—vertical exterior walls, inclined roof surfaces or other construction which allows water to quickly drain

**Use Category System, Specifying Treated Wood**

**Table 8B: Wood Composites, Commodity Specification F**

<table>
<thead>
<tr>
<th>End-Use Commodity</th>
<th>Use Category (U)</th>
<th>Use Category (C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parawood Lumber</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
</tr>
<tr>
<td>Lumber/Frame Lumber</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
</tr>
<tr>
<td>Interior, Floor &amp; Decking</td>
<td>3B, 4B, 5B</td>
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<td>Highway, Structural, General</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
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<tr>
<td>Above Ground, Structural</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
</tr>
<tr>
<td>Highway, Structural, Low Decay</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
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<tr>
<td>Glazed Pile, see Table 8</td>
<td>3B, 4B, 5B</td>
<td>3B, 4B, 5B</td>
</tr>
</tbody>
</table>

Source: Pressure Treated Southern Pine, 08-09 Edition, Southern Pine Council

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Design Values for Treated Wood

Reference design values for structural lumber can be found in the Design Values for Wood Construction Supplement of the National Design Specification® (NDS). Reference design values and adjustment factors apply to both untreated and pressure treated lumber, equally.

Exceptions and Adjustments for Pressure Treated Wood

Load duration factor, $C_D$
Cannot exceed 1.6 for structural members pressure treated with waterborne preservatives.

Wet Service Factor, $C_W$
Where moisture content of the wood will exceed 19% for an extended time, reference design values must be adjusted by the appropriate wet service factor, $C_W$, found in the NDS®.

Incising Factor, $C_I$
A reduction imposed on wood species that must be incised. $C$ reduces MOE by 5%, and bending, tension and compression allowable design stresses by 20%.

Retreatment of Field Cuts with Copper Naphthenate (2% Cu)

AWPA Standard M4
- CUPRINOL-Green #10
- WOLMANIZED-End Cut Solution
- JASCO- Termin-8, Copper-Green, Copper-Brown

Fasteners & Connectors for Pressure Treated Wood

- Hot dipped galvanized generally acceptable for above grade applications.
- Type 304 or 316 stainless steel is recommended for more severe exterior applications. SS required for PWF’s.
- HDG fasteners must meet ASTM A153 with 2 ounces zinc/sq ft.
- HDG connectors must meet ASTM A653, Class G185 with 1.85 ounces zinc/sq ft.
- Fasteners & connectors must be the same type of metal.
- Standard carbon steel or aluminum must not be in direct contact with PT wood.
- Electroplated galvanized hardware typically not acceptable by building codes.
- Hardware coated with proprietary anti-corrosion technologies may be acceptable.
- Carbon based preservatives and borates are less corrosive than copper based preservatives. Standard fasteners may be used, but exposure conditions may dictate coated fasteners.
- Always follow manufacturer’s recommendations.

Finishing Treated Wood

- Stain and paint can be applied to treated wood after wood is dry, follow coating manufacturers recommendations
- Water repellent coating recommended every 2 years
- No surface preservative needed to retain decay resistance
- See website or literature for building and maintenance tips

Consumer Handling Precautions

- About the same for treated and untreated wood
- Wear gloves, dust mask, and safety goggles
- Launder work clothing after use
- Dispose of by normal trash collection
- Never burn treated wood
Information Sources

- Wood Preservative Science Council: [www.woodpreservativescience.org](http://www.woodpreservativescience.org)
- US Environmental Protection Agency: [www.epa.gov](http://www.epa.gov)
- American Wood Protection Association: [www.awpa.com](http://www.awpa.com)
- US Forest Products Lab: [www.fs.fed.us](http://www.fs.fed.us)
- Forest Products Society: [www.forestprod.org](http://www.forestprod.org)
- Southern Pine Council: [www.southernpine.com](http://www.southernpine.com)
- Western Wood Preservers Institute: [www.wwpinstitute.org](http://www.wwpinstitute.org)

Selection/Use of Preservative Treated Wood

Questions?

“Use Wood Products and Feel Good About It”

Tom Milton
tom@woodworks.org
WoodWorks

http://www.wwpinstitute.org/

http://www.southernpine.com/