Preserving Structural Wood Components

• Biological degradation is caused by fungi, bacteria, insects, and marine borers

• Wood will last for centuries if kept in conditions unsuitable for biological agents

• Some protection from decay is afforded by heartwood of naturally durable species (e.g. southern pines)
Preserving Structural Wood Components

- In most cases, the natural durability of wood is not sufficient to protect it.
- Preservatives make the wood toxic to biological agents.
- Water repellants are not usually considered preservatives although they do protect the wood from water damage (i.e., checking) and the fact that the wood is drier will prevent some decay.

Preserving Structural Wood Components

- Wood used in exterior applications should be preservative treated (and wood used in wet applications).
- Do all cutting and drilling before treatment.
- Try not to field cut or drill if at all possible.
- Treatment recommendations and standards are provided by American Wood Preservers Association (AWPA), AASHTO, AITC.
Types of Wood Preservatives

- Water-borne
- Oil-type

Waterborne Preservatives

- Water-borne preservatives use inorganic arsenical compounds in a water solution
- Water-borne preservatives usually have light green color
- Water-borne preservatives form chemical bond with wood cells - will not leach or bleed
Waterborne Preservatives

- Water-borne preservative types include:
  - CCA - Chromated Copper Arsenate
  - ACA - Ammoniacal Copper Arsenate
  - ACZA - Ammoniacal Copper Zinc Arsenate
- CCA typically used for southern pine
- ACA, ACZA typically used for Douglas fir-Larch
- Water-borne preservatives are suitable for applications where human contact is frequent

** Really New ** Developments in Wood Preservatives

- Recent pressure from special interest groups has led to increased scrutiny of CCA treated lumber.
- EPA and the wood treating industry have voluntarily agreed to stop selling CCA treated lumber for residential uses by December 2003.
- CCA will still be used for industrial purposes (bridges, docks, piers).
**Really New** Developments in Wood Preservatives

- CCA replacements include:
  - Copper Azole
  - ACQ - Ammoniacal Copper Quat

- both have some disadvantages but these should be worked out soon

Oil-Type Preservatives

- Oil-type preservatives:
  - coal tar creosote (creosote)
  - pentachlorophenol (penta)
  - copper naphthanate

- Creosote and penta form a water resistant envelope on the surface of the wood.

- Oil-type preservatives are not recommended for applications with repeated human contact
Oil-Type Preservatives

- **Creosote:**
  - developed in 1830’s
  - formed from coal tar
  - recorded cases of 50+ years of protection of wood components
  - better at protecting the wood from checking and splitting associated with moisture changes

Oil-Type Preservatives

- **Pentachlorophenol:**
  - developed in 1930's
  - highly effective biocide
  - used on about 30% of treated wood
  - used mainly for poles, posts, and timbers
  - not recommended for marine use
Oil-Type Preservatives

• Pentachlorophenol:
  • Type A solvent (Heavy Oil) preferred for bridge applications
  • Type B solvent (butane) leaves a clean surface and can be used for handrails, etc.
  • Type C solvent (light oil) is used when treating glulam before gluing
  • Type D solvent similar to B

Oil-Type Preservatives

• Copper Naphthenate:
  • Considered to be an environmentally safe preservative
  • Not a restricted use pesticide - you can buy at local building supplier
  • Used frequently for field treatment of wood components and bridge timbers
Preservation Considerations

Factors affecting treatment:

- wood species - percentage of sapwood
  - southern pines have high proportion of sapwood and therefore treat very well
  - other species like Douglas fir have small percentages of heartwood and do not accept preservatives as readily

Material preparation before treatment:

- incising - cutting or boring holes or slits in the wood to increase fluid flow into the wood
  - Western species and hardwoods need incising
  - southern pines do not need incising
  - incising can reduce the strength of sawn lumber
Incising of pole

Incised guardrail post
Preservation Considerations

- Material preparation before treatment:
  - **pre-fabrication**
    - preservative treating forms a protective envelope around the wood
    - field fabrication (drilling and cutting) breaks the envelope and allows decay fungi to enter the wood
    - pre-fabrication can increase service life, reduce maintenance, and decrease construction costs

Field cutting exposes untreated wood
Prefabrication before treating

Preservative Application Methods

• Pressure:
  • Full-cell process - used for waterborne preservatives and oil-borne with high retention levels
  • Empty-cell process - recommended for most bridge timbers that use oil-type preservative

• Non-Pressure
  • brushing, soaking, dipping, thermal
Inside pressure treating cylinder

Excess creosote bleeding from glulam girder
New Developments in Wood Preservatives

- Recent research has been examining Borates for use as a wood preservative
- Borates have advantages in that they don’t use the heavy metals (such as arsenic, copper, chromium, etc.)
- Borates are waterborne preservatives
- Disadvantage to current borates is that they can leach out of the wood

Specifying Wood Preservatives

- Specifications for preservative-treated wood components include:
  - species of wood
  - intended use
  - applicable material standards and American Wood Preservers Association (AWPA) standards
  - type of preservative treatment (e.g. CCA)
  - preservative retention level (lbs/cu.ft.)
  - any fabrication required and any inspection requirements
Specifying Wood Preservatives

- AWPA Standards:
  - www.awpa.com
  - specify:
    - preservative (AWPA P-standard)
    - treatment type (AWPA C-standard)
      - preservative retention
      - preservative penetration
      - mechanical preparation and treating conditions

Specifying Wood Preservatives

- AWPA Standards:
  - Standard C14 - preservative treatment for wood used in highway construction
  - Standard C28 - preservative treatment for glued-laminated timbers
  - most AWPA standards present retention levels depending on conditions of use
    - above ground
    - ground contact
    - marine
<table>
<thead>
<tr>
<th>Waterborne Preservatives</th>
<th>AWPA Standard(s)</th>
<th>Cremenate and Gilborne Preservatives</th>
<th>Poles</th>
<th>Poles</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Retention Assay of Treated Wood – lbs./cu.ft.</td>
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<tr>
<td>Lumber, Timbers &amp; Plywood</td>
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<tr>
<td>Above Ground</td>
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<td>0.25</td>
<td>C2/09</td>
<td>UC1-3</td>
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<tr>
<td>Soil &amp; Freshwater use</td>
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<td>C2/09</td>
<td>UC5</td>
<td>25</td>
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<td>Piles</td>
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<td>UC1C</td>
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<td>Marine</td>
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<tr>
<td>Prevent Marine Organism</td>
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<tr>
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<td>2C18</td>
<td>UC5B</td>
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<td>Limonia triticeps</td>
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<tr>
<td>Sphaeroma terebrans or both</td>
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<td>UC5B</td>
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<tr>
<td>Second treatment</td>
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<td>C18</td>
<td>UC5C</td>
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</table>

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<tr>
<td>Piles</td>
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<td>Posts</td>
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<td>Commercial-Residential Fence</td>
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<td>0.40</td>
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<td>UC4A</td>
<td>8⁰</td>
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<tr>
<td>Round, half-round, and quarter-round</td>
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<td>0.40</td>
<td>C5</td>
<td>UC4A</td>
<td>8⁰</td>
</tr>
<tr>
<td>Sawed four sides</td>
<td>0.40</td>
<td>0.40</td>
<td>C2</td>
<td>UC4A</td>
<td>10⁰</td>
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<tr>
<td>Highway Construction Fence, Guide, Sign, and Sight Posts</td>
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<td>0.40</td>
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<tr>
<td>Round, half-round, and quarter-round</td>
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<td>0.40</td>
<td>C14</td>
<td>UC4A</td>
<td>8⁰</td>
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<tr>
<td>Sawed four sides</td>
<td>0.40</td>
<td>0.40</td>
<td>C14</td>
<td>UC4A</td>
<td>10⁰</td>
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<td>Guardrail and Spacer Blocks</td>
<td>0.50</td>
<td>0.50</td>
<td>C14</td>
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<td>Round</td>
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<td>0.50</td>
<td>C14</td>
<td>UC4A</td>
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<tr>
<td>Sawed four sides</td>
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<td>0.50</td>
<td>C14</td>
<td>UC4A</td>
<td>12</td>
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</tbody>
</table>
Specifying Wood Preservatives

• Examples of recommended preservative retention levels (lb/ft³) for different bridge materials

<table>
<thead>
<tr>
<th>Component Type</th>
<th>Creosote</th>
<th>Penta</th>
<th>CCA</th>
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<tbody>
<tr>
<td>Lumber above ground</td>
<td>8.0</td>
<td>0.40</td>
<td>0.25</td>
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<tr>
<td>Poles/Posts for buildings</td>
<td>9.0</td>
<td>0.45</td>
<td>0.60</td>
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<tr>
<td>Lumber for bridges</td>
<td>12.0</td>
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<td>0.60</td>
</tr>
<tr>
<td>Glulam for bridges</td>
<td>12.0</td>
<td>0.60</td>
<td>0.60*</td>
</tr>
<tr>
<td>Lumber in saltwater</td>
<td>25.0</td>
<td>NR</td>
<td>2.50</td>
</tr>
</tbody>
</table>

Sample Quality Mark for Treated Lumber

- 1998
- Ground Contact
- Inspection Agency: KDAT
- Preservative Type: CCA-C
- Retention Level (lbs/cu.ft.): 0.40
- Treating company: Joe's Treating Co.
- Auburn, AL
- Proper Exposure Conditions
- Applicable AWPA Standards
- C2, C9 STDS