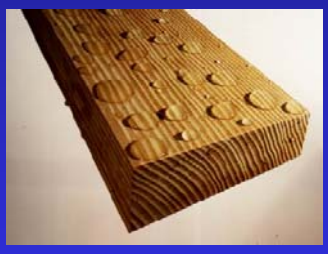
Preserving Structural Wood Components

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

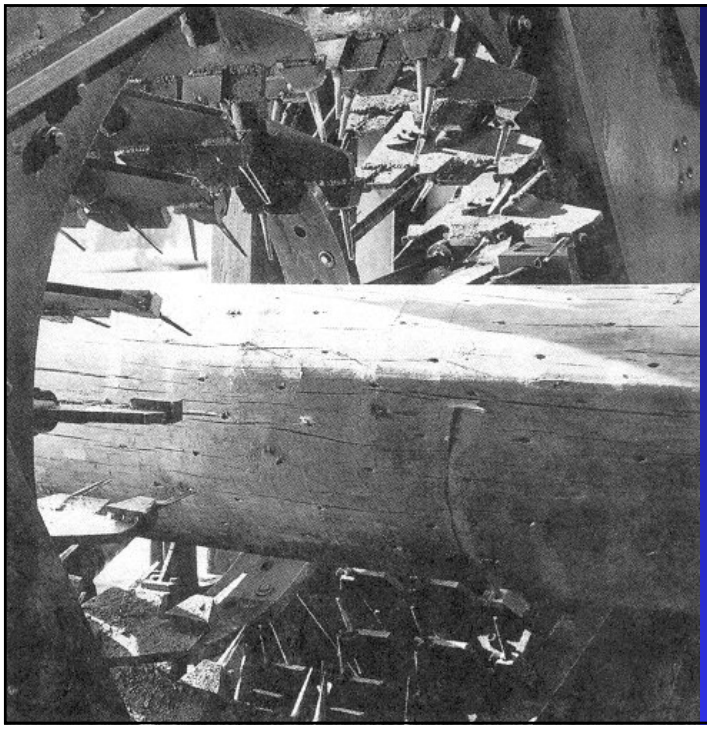
- Copper Naphthenate:
  - Considered to be an environmentally safe preservative
  - Not a restricted use pesticide - you can buy at local building supplier
  - Used frequently for field treatment of wood components and bridge timbers

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

Preservation Considerations

- 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

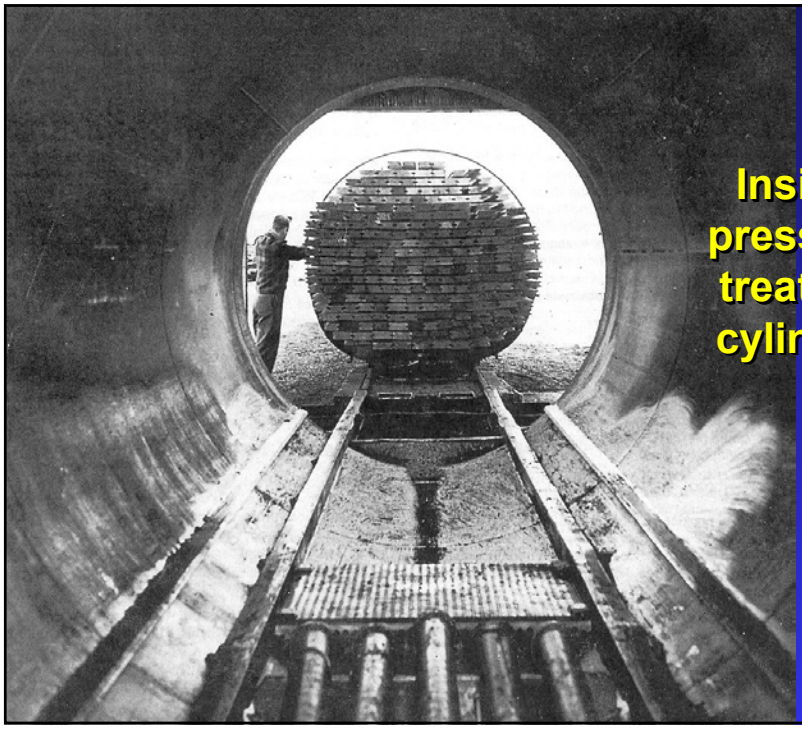
Preservation Considerations

- 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

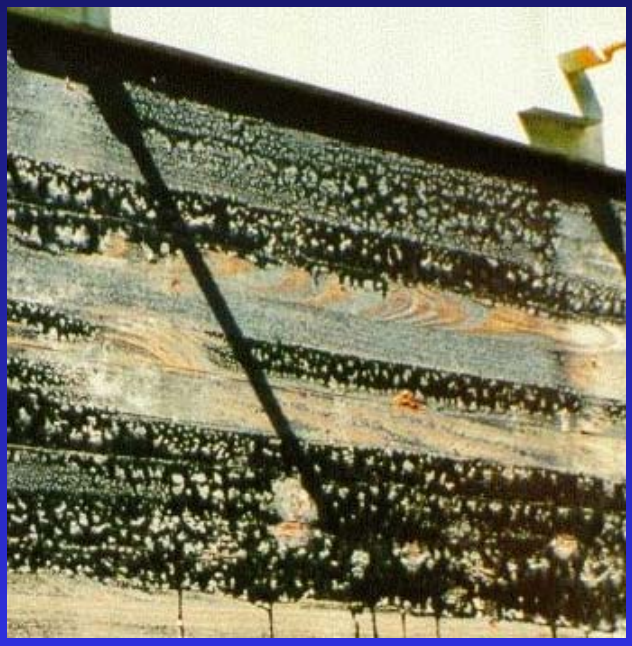
Field cutting exposes untreated wood

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 2: Southern Pine Preservative Retentions & Applicable AWPA Standards[1]

	Waterborne Preservatives[2]			AWPA Standard(s)		Creosote and Oilborne Preservatives[3]			
	Ammoniacal Copper Arsenate (ACA)	Ammoniacal Copper Zinc Arsenate (ACZA)	Chromated Copper Arsenate (CCA)	Commodity Standard	Use Category (UC)	Creosote	Creosote-Petroleum	Creosote Solutions	Pentachlorophenol (Penta)
	Retention Assay of Treated Wood – lbs./cu.ft.								
Lumber, Timbers & Plywood									
Above Ground	0.25	0.25	0.25	C2/C9	UC1-3	8[5]	8[5]	8[5]	0.40
Soil & Freshwater use	0.40	0.40	0.40	C2/C9	UC4A	10[5]	10[5]	10[5]	0.50
Permanent Wood Foundation (PWF)	0.60	0.60	0.60	C22	UC4B	**NR**	**NR**	**NR**	**NR**
Saltwater use	2.5	2.5	2.5	C2/C9	UC5	25	**NR**	25	**NR**
Piles									
Land or freshwater use & foundations	0.80	0.80	0.80	C3	UC4C	12	12	12	0.60
Marine									
Prevalent Marine Organism									
Teredo only	2.5[4] and 1.5	2.5[4] and 1.5	2.5[4] and 1.5	C18	UC5A	20	**NR**	20	**NR**
Pholads only	**NR**	**NR**	**NR**	C18	UC5A	20	**NR**	20	**NR**
Limnoria tripunctata only	2.5[4] and 1.5	2.5[4] and 1.5	2.5[4] and 1.5	C18	UC5B	**NR**	**NR**	**NR**	**NR**
Sphaeroma terebrans or for both pholads and limnoria tripunctata use a dual treatment									
First treatment	1.0	1.0	1.0	C18	UC5C	–	–	–	–
Second treatment	–	–	–	C18	UC5C	20	–	20	–

Table 2: Southern Pine Preservative Retentions & Applicable AWPA Standards[1]

	Waterborne Preservatives[2]			AWPA Standard(s)		Creosote and Oilborne Preservatives[3]			
	Ammoniacal Copper Arsenate (ACA)	Ammoniacal Copper Zinc Arsenate (ACZA)	Chromated Copper Arsenate (CCA)	Commodity Standard	Use Category (UC)	Creosote	Creosote-Petroleum	Creosote Solutions	Pentachlorophenol (Penta)
Poles									
Utility									
Normal	0.60	0.60	0.60	C4	UC4B	7.5	7.5	7.5	0.38
Severe service conditions (high incidence of decay and termite attack)	0.60	0.60	0.60	C4	UC4C	9.0	9.0	9.0	0.45
Building Construction – Round	0.60	0.60	0.60	C23	UC4B	9.0[5]	**NR**	**NR**	0.45
Posts									
Commercial-Residential									
Fence									
Round, half-round, and quarter-round	0.40	0.40	0.40	C5	UC4A	8[5]	8[5]	8[5]	0.40
Sawn four sides	0.40	0.40	0.40	C2	UC4A	10[5]	10[5]	10[5]	0.50
Highway Construction									
Fence, Guide, Sign, and Sight Posts									
Round, half-round, and quarter-round	0.40	0.40	0.40	C14	UC4A	8	8	8	0.40
Sawn four sides	0.40	0.40	0.40	C14	UC4A	10	10	10	0.50
Guardrail and Spacer Blocks									
Round	0.50	0.50	0.50	C14	UC4A	10	10	10	0.50
Sawn four sides	0.50	0.50	0.50	C14	UC4A	12	12	12	0.60

Specifying Wood Preservatives

- Examples of recommended preservative retention levels (lb/ft^3) for different bridge materials

Component Type	Creosote	Penta	CCA
Lumber above ground	8.0	0.40	0.25
Poles/Posts for buildings	9.0	0.45	0.60
Lumber for bridges	12.0	0.60	0.60
Glulam for bridges	12.0	0.60	0.60*
Lumber in saltwater	25.0	NR	2.50

Sample Quality Mark for Treated Lumber