Unit D: Forest Products

Lesson 4: Protecting and Preserving Wood

Student Learning Objectives: Instruction in this lesson should result in students achieving the following objectives:

1. Explain the principal causes of wood deterioration.
2. Identify commercial and noncommercial wood preservatives.
3. Identify naturally durable woods.
4. Describe preservatives used for wood.
5. Explain the non-pressure preservative treating processes.

Recommended Teaching Time: 3 hours

Recommended Resources: The following resources may be useful in teaching this lesson:

- A PowerPoint has also been developed with use of this lesson plan
- http://en.wikipedia.org/wiki/Wood_preservation
- http://www.naturalhandyman.com/iip/infxtra/infpre.html
- http://home.howstuffworks.com/home-improvement/remodeling/question278.htm

List of Equipment, Tools, Supplies, and Facilities

Writing surface
PowerPoint Projector
PowerPoint slides
Transparency Masters
Samples of wood (decayed & treated)

Terms: The following terms are presented in this lesson (shown in bold italics and on PowerPoint Slide #2):

- Coal-tar creosote
- Cold-soaking
- Double-diffusion
- Heartwood
- Hot-cold bath
- Sapwood
- Surface check

Interest Approach: Use an interest approach that will prepare the students for the lesson.

Teachers often develop approaches for their unique class and student situations. A possible approach is included here.

Show students samples of wood that has decayed and wood that has been treated with a preservative. Ask them to identify factors that led to the decay. Ask them why the preserved samples did not decay? Direct the class discussion to introduce the lesson.

Summary of Content and Teaching Strategies

Objective 1: Explain the principal causes of wood deterioration.

(PowerPoint Slide #3)

I. Like other materials, wood deteriorates as a result of interaction with the environment.

(PowerPoint Slide #4)

A. Wood exposed to fungi, damp or moist places, or certain insects will deteriorate.

1. Wood products placed near the surface of the ground are very susceptible to decay and to destruction by insects.
2. In general, all wood contacting the ground or exposed to weather should be treated with a preservative.

(PowerPoint Slide #5)

3. Using a preservative is even more important in regions where high rainfall and mild climate are factors.

(PowerPoint Slide #6)

B. When planning a project made of wood or that will utilize wood, following accepted precautions will reduce the chances that the wood will deteriorate prematurely.

1. Consider conditions that present potential decay or insect problems.

(PowerPoint Slide #7)

2. Design and treat new construction to protect wood from moisture, decay hazards, and insects.

(PowerPoint Slide #8)

3. Use treated wood in constructions where wood cannot be kept at least 45 centimeters above the surface of the ground and protected from excessive moisture. Treat exposed large load-bearing beams with preservative.

(PowerPoint Slide #9)

4. Recognize that preservative is essential where wood in permanent structures is in contact with the ground.
5. When wood decay is detected, immediately remove moisture from the wood so decay does not worsen. Decay causing fungi grow even when there is only a little moisture on the surface of wood cells.

****Take students to a wooded area if possible. Have them look for signs of wood decay. They then will need to tell you the reason behind the decay. Is it a fungus? Is it from insects? Have students figure out if there are certain areas more susceptible to wood decay? What do they think the reasoning behind this is?**

Objective 2: Identify commercial and noncommercial wood preservatives.

(PowerPoint Slide #10)

II. The purpose of treating wood is to protect it against insects and decay organisms.

A. Wood that is commercially pressure treated with a good preservative can be expected to give the most dependable service.

(PowerPoint Slide #11 shows a picture of pressure treated lumber.)

(PowerPoint Slide #12)

1. Pressure treatment requires expensive equipment and highly technical skills.
2. The wood to be treated is placed in a steel cylinder and sealed. A preservative is pumped into the cylinder, and pressure and/or vacuum is applied so that the wood takes up the desired amount of preservative.

(PowerPoint Slide #13)

B. Wood can be treated at home with good results by proper use of recognized toxic preservative. Good preservatives applied poorly or poor preservatives applied carefully are of little value.

1. A preservative protects wood from dangerous fungi and insects.

(PowerPoint Slide #14)

2. A good preservative must do a number things.
   a. It must penetrate the wood to sufficient depth to form an exterior shell of poisonous wood that will prevent attacks by fungi and insects, even in surface checks that may later develop.
   1. A ***surface check*** is a crack, usually formed in the drying-out process.

(PowerPoint Slide #15)

   b. It must retain its toxic effect under field conditions for a number of years.
   c. It should not easily leach out of the wood while in service.
   d. It must not be flammable or injurious to the wood, or corrode metal.

(PowerPoint Slide #16)

   e. It should not be dangerous to animals and humans when used in normal concentrations.
   1. Protective clothing and accessories, and eyeware should be worn to guard against injury from spills and spatters. It must be handled safely and applied according to the manufacturer's label.

(PowerPoint Slide #17)

3. Lumber treated with preservatives should be handled cautiously. Always wear skin and eye protection when handling treated lumber. Protection from breathing the sawdust when cutting treated lumber is necessary.

(PowerPoint Slide #18)

4. Treated lumber should not be used for interior applications.
5. Treated lumber should be sealed with paint or polyurethane after construction. To prevent the preservative from being leached out.

(PowerPoint Slide #19)

6. Lumber treated with arsenic-based wood preservatives such as chromated copper arsenate (CCA) has been banned for residential use as a wood preservative by the EPA because arsenic is known to cause cancer in humans and was phased out of production in January 2004.

(PowerPoint Slide #20)

a. Because of the wide spread use of CCA-treated lumber, certain precautions should be followed to reduce exposure to arsenic.

1. Seal wood annually with standard wood treatments.

(PowerPoint Slide #21)

2. Wash your skin when and where any contact has been made and especially before eating.
3. Do not store toys or tools in treated lumber. Arsenic leached from the lumber will accumulate on anything around it, including the soil.

(PowerPoint Slide #22)

4. Do not allow children or pets to have access to this type of treated lumber.
5. Cover a CCA-treated outside table with a tablecloth before using.

(PowerPoint Slide #23)

7. Preservatives such as coal-tar creosote, solutions of creosote mixed with other toxic chemicals, pentachlorophenol (penta) solutions, and water-borne materials containing one or more compounds of copper, zinc, fluorine, and chromium bring good results.

(PowerPoint Slide #24)

However, coal-tar creosote and pentachlorophenol are only available for purchase and use by properly licensed users.

****If materials are available bring in the types of preservers talked about in this objective. Students can get into groups, read the directions on how to properly handle each one of these preservatives, and then share their findings with the class.**

Objective 3: Identify naturally durable woods.

(PowerPoint Slide #25)

III. There are several naturally durable woods.

(PowerPoint Slide #26)

A. The natural durability of a given wood is determined by what part of the tree it is taken from.

1. The sapwood of trees is not durable when it is in contact with the soil. ***Sapwood*** is the light-colored wood near the outer portion of the tree.

(PowerPoint Slide #27)

a. Sapwood is composed of living cells and conducts water and minerals to the tree crown.

(PowerPoint Slide #28)

2. ***Heartwood***, the dark inner core of the tree, is composed on non-living cells and naturally resists decay better than the sapwood.

a. The heartwood is more resistant in some species than in others.

(PowerPoint Slide #29)

b. The heartwood of several species is considered naturally durable and, though untreated, can be used in areas where wood comes in contact with the ground.

(PowerPoint Slide #30)

1. Black locust, black walnut, osage-orange, catalpa, cedar, chestnut, chinkapin, juniper, lighter or pitchy pine, pacific yew, red mulberry, sassafras and white oak species are considered naturally durable.

a. Black locust, lighter pine, red mulberry, pacific yew and osage-orange are considered the most durable.

****Have students go back out to the wooded area. Have them check the trees again that have insect damage or that are decaying. What type of trees are these? Is there a pattern between the trees that do and do not have damage***?*

Objective 4: Describe preservatives used for wood.

(PowerPoint Slide #31)

IV. Wood preservatives are used to preserve or extend the life of wood and wood products.

A. Wood preservatives can be divided into two groups: preservative oils and water-borne salts.

(PowerPoint Slide #32)

1. Preservative oils have higher resistance to leaching than do salts and are more suitable for outdoor exposure.

(PowerPoint Slide #33)

a. The following are examples of preservative oils.

1. ***Coal-tar creosote***, the most widely used industrial preservative, is a brownish or black oil made by distilling coal tar. It is practically insoluble in water and has proven to be the best preservative for wood that will come in contact with water.

(PowerPoint Slide #34)

2. Coal-tar creosotes for non-pressure treatments are creosotes known as crystal- free coal-tar creosotes.

(PowerPoint Slide #35)

In the process of manufacture, the crystal forming chemicals have been removed. Since the oil flows freely at ordinary temperatures, creosotes of this type are used when brush or spray applications are desired.

(PowerPoint Slide #36)

3. Creosote mixtures are made from coal tar and are usually so toxic to fungi that they can be diluted up to 50 percent or more with other oils to lower the cost of using the preservatives.

(PowerPoint Slide #37)

4. Other creosotes include wood-tar, water-gas-tar, and oil-tar. They have wood-preserving properties when of good quality and properly used.
5. Coal tar alone is not a good preserver. It is not very poisonous to fungi and it does not penetrate wood very well.

(PowerPoint Slide #38)

6. Of the chlorinated phenols, pentachlorophenol or penta, has gained wide acceptance as an effective wood preservative in cold soaking and in the hot-cold bath process. It is available in the dry flake form or ready to use solution.

(PowerPoint Slide #39)

7. Concentrated and ready to use solutions of copper naphthenate are available for mixing with petroleum oils to make a treating solution that is effective against termites and decay.

(PowerPoint Slide #40)

2. Water-borne salts generally do not perform as well as preservative oils under conditions favorable to leaching.

a. Water-borne salts are principally used where wood will not be in contact with the ground.

(PowerPoint Slide #41)

However, some water-borne salts, such as those used in the double diffusion process, have been developed to the point where good performance can be expected even when the treated wood is in contact with the ground.

(PowerPoint Slide #42)

b. Wood treated with water-borne preservatives is relatively clean, paintable, and free of objectionable odor.

(PowerPoint Slide #43)

c. The following are examples of water-borne salts.

1. Zinc chloride preservative is relatively inexpensive, has no color, is uniform in quality and is not a fire hazard. It will leach out of wood that is in contact with the soil and does not perform as well as other preservatives.

(PowerPoint Slide #44)

2. Chromated zinc chloride and copperized chromated zinc chloride were developed as improvements over zinc chloride. They are more resistant to leaching.

(PowerPoint Slide #45)

3. There are a number of commercially available patented preservatives sold under the trade names of the companies that make them. They are principally used for the treatment of wood where there is not ground contact and where the treated wood will be painted.

(PowerPoint Slide #46)

3. Odor, paintability, color, and combustibility are other factors to consider when choosing a preservative.

****Use TM: D4-1 or PowerPoint Slide #47 as material for lecture and discussion. Bring back the preservatives that the students used in Objective 2. Have them now look at the label and figure out which is the best to use, and in what situation it should be used.**

Objective 5: Explain the non-pressure preservative treating processes.

(PowerPoint Slide #48)

V. An alternative to pressure treating lumber is to use non-pressure treating processes.

A. There are several non-pressure preservative treating processes.

(PowerPoint Slide #49)

1. Superficial application of oil preservatives to wood by brushing, spraying, dipping or soaking will increase the service life of the wood by two or three times.

a. Superficial applications are recommended only when more effective treatments cannot be used.

(PowerPoint Slide #50)

2. ***Cold-soaking*** involves submerging the wood in a preservative solution for about 48 hours in summer to 72 hours in winter.

a. Wood to be treated with an oil preservative should first be dried to a moisture content of 20 to 30 percent.

(PowerPoint Slide #51)

3. ***Double-diffusion*** is a treatment process in which unseasoned wood is soaked in two separate chemical solutions. The two chemicals react to produce a preservative that is insoluble in water and is toxic to insects and fungi.

(PowerPoint Slide #52)

a. Two of the most reasonably priced chemicals for use in this treatment are technical-grade copper sulfate and technical-grade sodium fluoride in water.

(PowerPoint Slide #53)

4. ***Hot-cold bath*** consists of heating seasoned wood in a preservative for several hours and then quickly submerging the wood in a cold preservative for several hours more.
   a. Hot-cold bath process uses coal-tar creosote and other oil preservatives. It is the most effective of all non-pressure processes.

**** Give the definition of each one of these treating processes and have the students tell you which process you are talking about.**

Review/Summary: Use the student learning objectives to summarize the lesson. Have students explain the content associated with each objective. Student responses can be used in determining which objectives need to be reviewed or taught from a different angle. Questions on PowerPoint Slide #51 can also be used as review.

Application: Students will be able to scope out wood damage in Afghanistan and know how to protect it.

Evaluation: Use the following sample test to evaluate the students' comprehension of the material covered in this lesson.

Answers to Sample Test:

Part One: Matching

1. h
2. f
3. e
4. g
5. d
6. b
7. a
8. c

Part Two: Completion

1. part
2. preservative
3. preservative oils, water-borne salts
4. preservative oils
5. insects
6. water-borne salts

Part Three: Short Answer

1. wood deteriorates as a result of interaction with the environment.
2. a. It must penetrate the wood to sufficient depth to form an exterior shell of poisonous wood that will prevent attacks by fungi and insects, even in surface checks that may later develop.
b. It must retain its toxic effect under field conditions for a number of years.
c. It should not easily leach out of the wood while in service.
d. It must not be flammable or injurious to the wood, or corrode metal.
e. It should not be dangerous to animals and humans when used in normal concentrations.

Sample Test Name_____

Test

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Part One: Matching
Instructions. Match the term with the correct response. Write the letter of the term by the definition.

a. coal-tar creosote
b. cold-soaking
c. double-diffusion
d. heartwood
e. hot-cold bath
f. sapwood
g. surface check
h. wood preservatives

_____ 1. Used to preserve or extend the life of wood and wood products.
_____ 2. Light-colored wood near the outer portion of the tree, not durable when in contact with the soil.
_____ 3. Heating seasoned wood in a preservative for several hours and then quickly submerging the wood in a cold preservative for several hours more.
_____ 4. A crack, usually formed in the drying-out process.
_____ 5. Dark inner core of the tree, is composed on non-living cells and naturally resists decay.
_____ 6. Submerging the wood in a preservative solution for about 48 hours in summer to 72 hours in winter.
_____ 7. Most widely used industrial preservative, is a brownish or black oil made by distilling.
_____ 8. Treatment process in which unseasoned wood is soaked in two separate chemical solutions.

Part Two: Completion
Instructions. Provide the word or words to complete the following statements.

1. The natural durability of a given wood is determined by what _____ of the tree it is taken.
2. In general, all wood contacting the ground or exposed to weather should be treated with a _____.

3. Wood preservatives can be divided into two groups: _____ and _____.

4. _____ have higher resistance to leaching than do salts and are more suitable for outdoor exposure.

5. The purpose of treating wood is to protect it against _____ and decay organisms.

6. _____ are principally used where wood will not be in contact with the ground.

Part Three: Short Answer
Instructions. Provide information to answer the following questions.

1. Why does wood deteriorate?

2. A good preservative must do a number things. What are those things?

Characteristics of Commonly Used Wood Preservatives[1]

Characteristics	Preservative				
	Penta		Creosote	Water-Borne Treatments (CCA)[2]	Cooper-Napthenate
	In Light Oil	In Heavy Oil			
Paintability	V	NR	NR	E	F
Color	tan	brown	brown to black	green	green
Odor	V	P	P	E	P
Intimate contact with plants	NR	NR	NR	G	V
Intimate contact with animals	NR	NR	NR	NR	V
Handling	V	P	P	P	G
Indoor Use	NR	NR	NR	NR	F
Effectiveness	E	E	E	E	F

Legend

E–Excellent P–Poor G–Good V–Variable F–Fair NR–Not recommended

[1]These characteristics are for treated wood following three months of storage or service.

[2]When oil-based paints are used, water-borne preservative-treated wood must be dried before painting.

Source: General Report SA–GR2, Southeastern Area, State and Private Forestry, USDA Forest Service.