Preventing Moisture-Related Problems in Residential Wood Framing

Preservation treatments provide protection against the triple threat of mold, rot fungi and termites.

Provided by WoodSmart Solutions, Inc.

By Jeanette Fitzgerald

There is a popular phrase in the construction industry, "Don't worry about the problems you can see, worry about the problems you can't." This is especially true when discussing moisture-related problems such as mold, fungi rot, and termites. The seeds of potential moisture problems are present in rainfall and humidity during the construction process and then released daily into the air through cooking, showers, and air conditioning. Unfortunately, these problems can begin to develop deep within the structure of the home behind layers of plaster and drywall, underneath tile and linoleum, or growing unnoticed in attics and basements. The scale of the problem and, subsequently, the cost of the repair are exponentially larger by the time the greenish-black fuzz creeps into plain view or a homeowner's foot breaks through the floor in their kitchen nook.

Beyond the significant impact to the physical structure, moisture-related problems can dramatically affect the health of homeowners and their guests. Allergic reactions, flu-like symptoms, rashes, asthma, air illness, and even deaths have been caused by uncontrolled moisture that creates an environment ripe with molds and toxins that infect the indoor air quality day after day.

There is an estimated $9-10 billion spent to correct construction defects each year. 80 percent of those defects are moisture-related. 41 percent of the moisture-related problems developed in the envelope of the building. There are two reasons for the prevalence of moisture-related problems growing in the internal structure of homes and multi-family dwellings. First, moisture is everywhere. Second, there are weaknesses inherent in the wood materials most commonly used for the building frame that make them susceptible to these problems.

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Learning Objectives

After reading this article, you should be able to:

- Explain the moisture-related problems that plague wood frames in homes and multi-dwelling units.
- Describe three preventative treatments that protect wood frames from mold, fungi rot, and termites.
- Compare and contrast preventative treatments with regard to environmental impact, ease of installation, and influence to the wood components.

All photos courtesy of WoodSmart Solutions, Inc.

Moisture-related problems can begin deep in the envelope of a home, making them difficult to detect and expensive to correct.

Strengths and Weaknesses of Wood Framing

Today, untreated or white wood, in its many forms, is used throughout 95 percent of the residential and multi-family homes in the United States. Wood is a very popular building material for a wide variety of reasons. It is a readily available, replaceable, natural resource. It is also easy to work with, cost-efficient and available in different forms that offer varying degrees of flexibility, strength, and size.

The framing package of a house often includes dimension lumber, plywood, oriented-strand-board, and engineered wood products. Dimension lumber is a solid piece of wood often referred to simply by its dimensions, a 2x4, 2x8, etc. Plywood is thin layers of wood (plies) glued together and ordered by the number of plies, for example, 4-ply, 5-ply, etc. Oriented-strand-board (OSB) is created by compacting many 1-inch x 1-inch wood chips together. Engineered wood products (EWP) combine large wood chips and small wood chips to create the required board size. EWP supports more weight and structural load in floors and ceilings than the original dimension boards.

Despite all of the reasons that wood has become such a popular framing material, there are significant weaknesses in untreated wood that make this material susceptible to moisture-related problems. Wood is an organic natural resource and, as such, occupies a spot in the food chain. Wood and the cellulose inside wood are a food source for decay fungi, mold, termites and other wood ingesting insects. It is also susceptible to dimensional instability, racks, splits and bows.

The Wood and Moisture Relationship

Wood is an organic and porous material that absorbs moisture. The combination of wood and moisture creates a feeding ground for microbial agents like mold, rot fungi, and termites. The effects of these agents to the wood structure they attack can be devastating. By better understanding these threats, building professionals can make preparations to prevent against the invasion of the living spaces they design. Surprisingly, the best protection against each wood menace is to better control the wood's moisture absorption.

Mold is a fungus that eats wood. More specifically, mold secretes an enzyme that breaks down the cellulose in wood products into smaller pieces, so it can be absorbed. The process discolors and ultimately destroys the host material. In order for mold to grow and reproduce it requires an environment rich in oxygen, a food source, an acceptable temperature, and a sufficient amount of water. Typical indoor environments readily provide all of these factors—except one. Mold requires a higher quantity of moisture in the air than is comfortable to humans. The best defense against mold in buildings is moisture control.

Decay fungi are living organisms that invade damp wood and use the cellulose inside as a food source. Gradually, this rot fungi decomposes the wood and destroys its strength. Rot fungi, also called wood rot, can cause the decayed area to look brown and crumbly or create a white or yellow discoloration with a spongy texture. Some rot fungi can grow for long periods of time without producing any external evidence of the internal destruction, while others produce visible fruiting bodies on the surface of the decaying wood. When previously dry wood is exposed to moisture, either by being laid on moist soil or being located in a moisture-rich area of a house, it is likely that wood decay problems will occur. Most wood rotting fungi must have a direct supply of water at the site of the decay. The key to preventing rot fungi is to control the presence of moisture inside the wood.

Some rot fungi can grow for long periods of time without producing any external evidence of internal destruction, while others produce visible fruiting bodies on the surface of decaying wood.

Termites, subterranean and Formosan, also threaten the structural integrity of wood framing components. These insects eat the cellulose in untreated wood. Although termites are often considered a pest problem, they are also a moisture-related problem. Termites, often referred to as white ants, lack the typical insect exoskeleton, and, instead, appear milky and white and almost larval. This soft body makes them vulnerable to drying out, so termites must keep their homes moist and are attracted to moist food supplies like damp or rotting wood. Most termites are actually blind and navigate using scent and moisture trails. Formosan termites, normally existing in the Southeast United States, are especially voracious and are capable of infesting homes by air and building nests in the wall systems of homes. Termites can create their nests inside their food source and when they do so, they share their homes with fungi and bacteria that help them to destroy the wood.

Preventative measures that can be taken during home construction to help protect a home against termite infestation include: making sure that lumber and other wood components do not come into contact with the soil, placing a moisture barrier under basements to keep the area dry, treating wood components with a pesticide that make them unappealing to the termite palate, and ensuring that the wood in the home envelope is kept as dry as possible. To make an already constructed home less attractive to termites, start by eliminating moisture problems and remove excess food sources like firewood, lumber, paper, and tree stumps from the immediate surrounding area.

Some indications that a home may be infested with termites include: a temporary swarm of winged insects in the home or in the soil around the home, cracked or bubbling paint, frass (termite droppings), mud tubes on exterior walls, and wood that sounds hollow when tapped.

The Prevalence of Moisture-Related Issues Today

Despite the potential destruction that these moisture-related problems can create, building codes require minimum protection. Today's minimum standard building code requirements specify that only a small amount of lumber used in home construction must be treated against rot fungi, termites, and other wood-ingesting insects. The piece of wood that requires protection is the sill plate in slab construction, which separates the cement slab from the wooden structure built upon it.

New construction techniques are changing the interior environments of many residential homes. Over the past few years homes have become more energy-efficient and air-tight. Less natural air infiltration has caused more moisture to build up inside the houses. This moisture-rich air circulates throughout the house day after day, creating a home-sweet-home environment for mold, rot fungi, and termite infestations.

Today, that lack of required wood framing protection costs the construction industry and homeowners a significant amount of money, time, and headaches to remedy. Current estimates show that replacement materials needed to repair damage caused by rot alone account for nearly 10 percent of the annual wood production in the United States. Homeowners pay $2 billion/year to replace wood damaged by fungal decay and wood ingesting insects. To address a mold problem, the average residential remediation ranges between $50-$100K. Currently, there are over 10,000 mold-related law suits weaving their way through the legal system. "Mold, rot, wood ingesting insects and moisture are some of Florida's biggest building issues that I'm confronted with as a builder," said John Dukovac, President of La Maison Homes in Sarasota, Florida.

The average mold remediation in a residence costs homeowners between $50-100K.

It is also important to note that at the present time there are no accepted federal, state, or local health-based standards for permissible exposure to mold and mildew, but mold has been credited with affecting the health of human beings. Runny noses, itchy eyes, wheezing, and skin rashes resulting from mold allergies have been well documented over the last few years. Recently, too, mold has been attributed with causing infections in people undergoing chemotherapy treatments and in people with severely disabled immune systems. Stachybotrys is the mold usually associated with sick building syndrome and it is being investigated as the cause of hemorrhage in the lungs of infants. While the potential threat of mold on human health and well-being is still being evaluated, it is universally accepted that houses should be kept free of mold.

Moisture and the Construction Process

Moisture-related problems stem from wood that has absorbed too much moisture. Unfortunately, it is impossible to keep wood from being exposed to water during the construction process. Typically, the untreated lumber is manufactured at the mill, shipped to the lumber yard, and then sent directly to the construction site where it can sit for weeks or months as the house is being built. From morning dew and fog to Gulf Coast humidity and May showers, exposure to moisture occurs before, during, and after construction.

Wood arriving to job sites today often already contains more water than wood used years ago. As the demand for wood has continued to grow, the supply of wood from the United States has become much younger, or greener. Greener lumber has a higher moisture content than its slightly more mature sibling. As greener supplies make their way onto job sites and into homes, this wood is even more susceptible to moisture-related problems in the future.

In addition, much more wood on United States construction sites today actually came from Canada, Australia, or Europe. The lumber from these new locations experiences the outdoor elements on the open road or a transoceanic voyage before becoming part of an American home. This wood gets plenty of opportunities to absorb rain, mist, and salty water en route.

Moisture is an undeniable presence in the construction process. The average new 2000 square foot home contains about five tons of moisture that must evaporate from the structure.

The Responsibility of Moisture Management

Who is responsible for moisture management during a residential project? Lumber, plywood panel, and OSB manufacturers do not warrant for mold growth. Per building codes, builders are not required to treat the majority of the wood components on projects to provide any sort of preventative protection against moisture-related problems. Contractors cannot control the levels of moisture to which wood is exposed on the job site. Builders' Risk policies and Homeowners' insurance have fungus exclusions placing the detection and remediation of mold, a moisture-related problem, clearly outside the bailiwick of coverage.

Until recently the industry attempted to address moisture exposure by modifying the construction process. Wraps, for instance, were applied to houses, but with only moderate success. Victims of poor installation technique, some of the wraps actually ended up trapping moisture against the wood, instead of providing an effective barrier.

In the last six years, the building industry has begun to address moisture issues by introducing new product treatments onto the market that are designed to protect the vulnerable building envelope. With the availability of new products, architects are in a better place than ever to make an impact. Architects can help clients by specifying products that prevent and protect the wood components against mold, rot fungi, and termites. "We continually evaluate products that not only meet our project demands, but also address our client's needs for cost efficiency, safety, and durability. New technologies for protecting wood framing components present added value opportunities for all types of construction," said Joel Carter from Carter Architecture, Myrtle Beach, SC.

Preventative Treatments for Wood Framing

One very common area for mold growth and other moisture–related problems to begin is any place in which two or more pieces of wood are fitted together with the potential threat of water getting in between them.

Today, there are three ways to protect wood components in the building envelope from moisture-related problems. They are a job site spray that prevents mold and microbial growth, a two-step coating process that protects wood from mold, rot fungi, and termites, and a pressure treatment that prevents termite damage and wood rot.

Job Site Spray

Open up any Yellow Pages and flip to the Contractor section. In cities all over the United States there are contractors dedicated to protecting and eliminating mold and microbial growth on the surface of wood products in a home. These specialized contractors will visit the job site and apply a chemical spray to the completed superstructure of the project, protecting the treated surfaces from mold growth. After the spray is completed, construction can resume usually after only a delay of a couple of days.

It has been suggested that some job site spray treatments can deliver protective benefits for up to 25 years. These spray-on treatments do not provide protection against termites or rot fungi.

There are many different types of chemical spray and even patented application methods, so the services of each contractor should be reviewed thoroughly before a selection is made. Beyond the limited protection provided, common complaints about the job site spray include possible scheduling conflicts, inconsistent application, and incomplete coverage associated with on-site application. Since the spray is applied after the superstructure is erected, many potential problem areas do not receive treatment, because they simply are not accessible. This treatment also does not begin protecting the wood on the project until the house is almost complete and it does not assist wood components in regulating moisture absorption, it just makes mold unable to grow on the treated surfaces.

Two-step Coating Process

The most recent development in wood protection is a two-step coating process that protects wood framing components from mold, rot fungi, termites, and other wood ingesting insects.

The first step applies a semi-vapor permeable film that encapsulates all six sides of each piece of lumber on the project. The film makes the wood water-repellent and controls its natural moisture absorption capabilities, while allowing moisture vapor to escape from within. The wood continues to breathe, which helps to contain normal moisture levels from within. By limiting the absorption of uncontrollable moisture, both topically and subsurface, wood components coated with this film are more stable and able to withstand extreme weather conditions. Beyond protecting wood by managing the presence of moisture within, the film itself is also specially formulated to resist mold fungus growth on the cured surface of the film.

The second step treats the wood framing components with Disodium Octaborate Tetrahydrate (DOT). DOT is an EPA-registered fungicide and pesticide that protects against wood ingesting insects, including subterranean and Formosan termites.

Wood products are coated at the factory and arrive on the job site protected from the elements and ready for installation, which helps builders avoid costly construction interruptions and inspection delays. These coated wood components can be stored outside and unprotected for six months.

This two-step coating process protects each inch of the wooden superstructure of a house from moisture and moisture-related problems, because each piece of wood or lumber is individually treated at the factory, before arriving on the job site. It can be applied to all of the wood framing components used in a covered structure, which includes: structural lumber, plywood, OSB, sub-floor panel products, EWP, truss products, moldings, and trim boards. Roof systems, wall systems, and floor systems can all be protected.

These factory-applied two-step solutions bond with the wood at a molecular level, offering lifetime protection.

Pressure-treated Wood

Pressure-treated wood was invented over 70 years ago to protect wood components from termites, wood-ingesting insects, and rot. Pressure treating is a process that forces chemical preservatives deep into the wood. The wood is placed into a large holding tank, and then the tank is depressurized to remove all air. After all air has been removed, the tank is filled with the preservative under high pressure, which forces the preservatives deep into the wood. Pressure treatments make wood unappetizing to termites and other wood-ingesting insects. Pressure-treated wood will not rot.

This pressure treatment is written into the building codes to protect a specific piece of the wood frame package, the sill plate. Sill plates are the lowest framing boards in a wood home. They are bolted to the top of the foundation and the house is then erected on top of them.

In the Gulf States, where termites are a large concern, some builders use pressure-treated wood for more of the framing package than the sill plate. Unfortunately, this preventative treatment essentially water logs the wood pieces, making them heavy and hard to work with.

Pressure-treated wood has a lifespan of 20 years under the harshest conditions.

How The Two-Step Coating Process Works

Factory Applied Application
The two parts that comprise the coating system are applied precisely to all sides of the approved substrates using a specifically engineered process.

Water Permeable Film
The infusion film allows trapped moisture vapor within wood to escape, and keeps external moisture from seeping in, creating optimal moisture balance.

Continued Penetration
The infusion film ingredients continue to migrate below the topical surfaces after initial treatment application for sub-surface protection.

Cellular Bonding
As it penetrates, the infusion film bonds with wood fibers at the cellular level.

The two-step coating process protects wood components against mold, rot fungi, and termites before, during, and after construction.

A Comparison of Treatments

Although the job site spray, two-step coating process, and pressure treatment are each geared toward protecting the life of construction lumber, they differ dramatically in important ways. Their impact on both indoor and outdoor environments is different—swinging from non-toxic and LEED® supportive to requiring special disposal procedures. The ease of installation, potential corrosion issues, and the impact that the treatment will have on the structural integrity of the wood are each unique to the wood preservation treatment selected.

EPA Regulations

The Environmental Protection Agency (EPA) is a governmental agency formed to protect human health and the environment. As the watchdog of both people and organisms, it is not surprising that if a product makes claims about its ability to prevent mold or rot fungi, or to deter termites, the product must be registered with the EPA. It is an

absolute requirement. The EPA evaluates every registered product to determine if it has enough of any type of chemical in it to be labeled hazardous, polluting, or carcinogenic. If it does, then that product becomes regulated by the EPA Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA).

The EPA also has very strict requirements about how companies can promote their product capabilities with regard to mold, rot fungi, and termites. In order to remain compliant with the EPA, mold claims by topical application can only be made about the surface of the product. For instance, the job site spray designed to prevent mold growth can only be marketed as preventing mold growth on the wood, cement, and steel surfaces that have been treated. Also, the two-step coating process can only make mold prevention claims about the surface of the product that has been coated at the factory.

Architects should be wary of companies that are either not registered on the EPA website or attempt to bend around EPA regulations in their promotional materials.

With regard to the wood treatments described earlier, the two-step coating process has been reviewed by the EPA and is not regulated by FIFRA. The wood components treated in the two-step process, coated with a semi-vapor permeable film and DOT, are considered non-hazardous, non-polluting, and non-carcinogenic per the limits of FIFRA.

Wood components treated in the two-step process are considered non-hazardous, non-polluting, and non-carcinogenic per the limits of FIFRA, making them safe to use throughout a home.

The EPA also regulates all wood preservatives, such as the ones employed during the pressure treatment process. Until 2003, the preservative most commonly used in the residential pressure-treated lumber was chromate copper arsenate (CCA). CCA is extremely toxic and contains arsenic, the same chemical used in rat poison. Leading up to 2003, nearly 40 million pounds of arsenic were used to create pressure-treated wood in the United States every year. Finally, the construction industry voluntarily eliminated the presence of CCA treated wood in residential projects, limiting the use of CCA to marine and industrial applications.

The less toxic preservatives amine copper quat (ACQ) and copper azole (CA) provide pressure treatment protection for wood components used for decks, mailboxes, swing sets, and oceanside boardwalks, and are considered safer for human contact. The use of copper as a main element in these preservatives has made pressure-treated wood more expensive that its toxic brother. In an attempt to manage the escalating costs, pressure-treated wood manufacturers have started offering wood options with different levels of pressure treatment protection. The most lightly treated product is meant to be used for decking, then there is wood meant for above-ground construction, ground contact, and permanent wood foundations (PWF). It is important for the construction team to make sure, when using pressure-treated wood, that the level of protection specified, purchased, and delivered matches the intended use of the lumber.

Impact on Structural Integrity

The two-step coating process can be applied to all wood components without compromising their structural integrity.

Pressure treatments can only be used on solid, dimensional lumber. Any attempts to pressure treat plywood, OSB, or EWP will void the structural properties of these wood-framing components.

Installation Restrictions

Wood that has been treated in the two-step process does not require any special handling. These components can be sawed, mechanically anchored, adhered, and painted just the same as untreated wood components. The factory coating does not apply significant extra weight to the components either.

Pressure-treated wood is impregnated with chemicals and requires special consideration when being installed into a residential project. Sawdust from pressure-treated wood can be an irritant to the nose, eyes, and skin. Direct skin contact should be prevented and the use of both dust masks and eye protection is highly recommended when working with pressure-treated wood.

Pressure-treated wood tends to cup as it dries and it becomes prone to splitting. To prevent splits, contractors should pre-drill any nail or screw holes within an inch of the end of the board. This lessens the chance that the board will split, while the installation team is fastening it.

Wood that has been treated in the two-step process does not require any special handling. These components can be sawed, mechanically anchored, adhered, and painted just the same as untreated wood components.

When wood is pressure-treated, it essentially becomes a piece of wood soaked in chemically treated water. This water-soaked wood is much heavier than dry lumber, often weighing in at 38 pounds per cubic foot of wood, and can cause installation headaches and backaches for the contracting team. This weight dissipates as the water evaporates.

Moisture is an undeniable presence in the construction process. The average new 2000 square foot home contains about five tons of moisture that must evaporate from the structure.

Weathering and Warping

The predisposition to twisting, cupping, splitting, and bowing is one of the weaknesses of using wood. The porous nature of wood naturally allows for the rapid absorption of moisture and rapid moisture loss as the wood dries in the sun and air. This rapid, un-controlled absorption and loss of moisture causes the warping, wracking, and checking in wood components.

The semi-vapor permeable film applied to each side of the wood as the first step of the two-step process adds a control mechanism to the absorption and loss of moisture within wood, slowing the vapor transfer. This added control conditions wood components to resist twisting, cupping, and splitting and provides builders with more usable wood on the job site, especially when the framing package has been delivered to the job site and exposed to rainfall or high moisture. Specifically, this conditioning process has been credited with reducing lumber waste factors by as much as 50% on extended projects where wood framing is exposed to the weather for longer periods of time.

The pressure treatment process is designed around the porous nature of wood. This process accelerates the natural absorption rate of wood by soaking wood in a highly pressurized environment designed to drive water and chemicals deeply and quickly into wood pieces. Then, pressure-treated lumber is shipped to the lumber yard in stacks that are tightly bundled and often damp. By the time these bundles arrive on the job site, they are often a combination of straight and warped wood pieces. The warped pieces were invariably on the outside of the bundle, exposed to direct sunlight and air. This exposure caused one side of the wood to dry faster than the other, and, subsequently, warping occurred.

The rapid absorption and loss of moisture inherent in the pressure treatment process may explain why pressure-treated wood tends to cup as it dries. Cupping occurs when wood bends along its width away from the bark side. This wood is also sensitive to splitting and cracking as contractors work to fasten this protected wood onto the project.

Disposal

The wood that has been coated in the semi-permeable vapor film and the DOT can be disposed of in the same ways that untreated and white wood are disposed. This coated wood can be disposed of in local landfills, used in mulch, and burned in compliance with Federal, State, and local regulations.Wood that has undergone the two-step coating process can even be recycled.

In most communities, before chemically treated wood can be publically disposed, it must be proven that no metals are in the wood and that the level of pesticide in the wood falls below a level pre-determined by the government.

Pressure-treated wood is not easily allowed back into the environment. The arsenic or copper metals used in the wood preservative require special disposal. Pressure-treated wood should not be burned residentially under any circumstances. Federal and State regulations mandate that treated wood be burned in an approved commercial or industrial incinerator facility. The ash is toxic because the arsenic in the preservative does not burn off. Do not add pressure-treated wood to residential soil or compost heaps.

Threat of Corrosion

The two-step coating process does not add any threat of corrosion to the internal envelope of the house. The coatings applied are not corrosive to any type of metal fastener or plate. No special nails or screws must be used throughout the project.

With the addition of copper compounds to the preservative used in pressure treatment, pressure-treated materials are now more corrosive to common steel. Protect the integrity of the building envelope by using corrosion-resistant nails, screws, and connectors. The copper present in the wood also creates the possibility of a galvanic reaction with dissimilar metals. Fasteners and flashings should be stainless steel or copper whenever possible to reduce this risk.

The threat of corrosion to homeowner safety depends upon where the pressure-treated wood is being used. If the mailbox falls down due to corrosion, no harm, no foul. If the corrosion occurs on the sill plate, where the wood frame of the house attaches to the cement foundation, the risks of structural damage and personal harm become serious.

Specification Example

Architects can ensure that the wood components used in the envelope of a home are protected from mold fungus growth, rot fungi, and wood-ingesting insects in their project specification. An example of a project spec designed to incorporate this desired level of protection is below.

Materials: A pre-construction, factory applied two-part DOT wood preservative and infusion film wood component coating. The DOT is a fungicide and insecticide that prevents damage by rot fungi and wood ingesting insects, including subterranean and Formosan termites. The infusion film is a water repellant, semi-vapor permeable film that limits moisture absorption. The infusion film is specially formulated to resist mold fungus growth on the cured surface of the film.

Coating Applications: DOT wood preservative and infusion film wood coating technology is factory applied by authorized, licensed wood coating application companies. Wood components are delivered to the job-site by the builders' current source of supply for structural components, wood framing materials and building materials. Precise process control assures proper application of the two-part system to all sides, edges, and ends of each wood component.

Quality Assurance: Factory application of the two-part DOT wood preservative and infusion film process to be precisely monitored by

qualified personnel. Scientific testing analysis, mandatory quality control procedures and policies by licensed wood coating companies and manufacturers, field and laboratory technicians/chemists to be verified by third party inspection.

Worrying about the problems that are not readily visible in a home, such as the problems growing behind the walls and in the ceiling, can drive any sane person crazy. The damaging relationship between water and wood can be a significant contributor to the worry burden. Every drop of rain, cloud of mist, steaming teapot, or humming air conditioner could release the water droplet that would wiggle down in between two boards in the envelope of the house or in the attic, inviting mold, rot fungi, and termite destruction. Architects can help reduce builder and homeowner worries by specifying project materials that pre-empt those wood and water battles. When all of the wood framing components have been protected against moisture-related problems, wood building products can continue to be the products of choice by quality conscious builders. ■

See Quiz on the Next Page

To receive AIA/CES credit, you are required to read the additional online text, which can be found at **http://construction.com/CE/articles/0711woodsmart-1.asp**
The quiz questions below include information from this online reading.

Program title: **"Preventing Moisture-Related Problems in Residential Wood Framing" (11/07).** AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare credit. (Valid for credit through November 2009). **Directions:** Refer to the Learning Objectives for this program. Select one answer for each question in the exam and fill in the box by the appropriate letter. A minimum score of 80% is required to earn credit. **To take this test online, go to construction.com/CE/**

Learning Objectives

After reading this article, you should be able to:

- Explain the moisture-related problems that plague wood frames in homes and multi-dwelling units.
- Describe three preventative treatments that protect wood frames from mold, fungi rot, and termites.
- Compare and contrast preventative treatments with regard to environmental impact, ease of installation, and influence to the wood components.

Questions

1. What percentage of annual construction defects is caused by moisture-related problems?
- ❑ **a.** 25%
- ❑ **b.** 40%
- ❑ **c.** 50%
- ❑ **d.** 80%

2. Which of the following is NOT true?
- ❑ **a** The combination of wood and water does not create a feeding ground for mold, rot fungi, and termites.
- ❑ **b.** In order for mold to grow and reproduce it requires an environment rich in oxygen, a food source, an acceptable temperature, and a sufficient mount of water.
- ❑ **c.** Most wood rotting fungi must have a direct supply of water at the site of the decay.
- ❑ **d.** Termites are vulnerable to drying out, so they must keep their homes moist and are attracted to moist food supplies like damp and rotting wood.

3. What is the best protection against mold, rot fungi, and termites in residential construction?
- ❑ **a.** Build air tight houses
- ❑ **b.** Store project lumber uncovered, outside, on the ground
- ❑ **c.** Control the wood's moisture absorption
- ❑ **d.** Use white, untreated wood as the framing material

4. How much do homeowners pay every year to replace wood damaged by fungal decay and wood ingesting insects?
- ❑ **a.** $500,000
- ❑ **b.** $1 million
- ❑ **c.** $500 million
- ❑ **d.** $2 billion

5. Mold is currently being investigated for causing which of the following:
- ❑ **a.** Runny noses, itchy eyes, wheezing and skin rashes
- ❑ **b.** Hemorrhage in the lungs of infants
- ❑ **c.** Infections
- ❑ **d.** Sick building syndrome

6. When in the job process is the job site spray applied?
- ❑ **a.** After the superstructure is erected
- ❑ **b.** Before the lumber is shipped to the job site
- ❑ **c.** After the house has been finished out
- ❑ **d.** At multiple intervals throughout the construction project

7. The two-step coating process protects wood framing against:
- ❑ **a.** Mold only
- ❑ **b.** Termites only
- ❑ **c.** Termites and rot fungi
- ❑ **d.** Mold, rot fungi, and termites

8. Which of the following is NOT a special handling instruction for working with pressure-treated wood?
- ❑ **a.** Direct skin contact should be prevented.
- ❑ **b.** The use of both dust masks and eye protection is highly recommended.
- ❑ **c.** To prevent splits, contractors should pre-drill any nail or screw holes within an inch of the end of the board.
- ❑ **d.** Pressure-treated wood does not require any special handling.

9. Which of the wood protective treatments adds a control mechanism to the absorption and loss of moisture within wood, which helps the treated wood to resist twisting, cupping, and splitting?
- ❑ **a.** Job-site spray
- ❑ **b.** Two-step coating
- ❑ **c.** Pressure treatment
- ❑ **d.** None of the above

10. Which correctly describes the difference between the disposal of wood that has been two-step coated and the disposal of pressure-treated wood?
- ❑ **a.** Both types of treated wood may be disposed of in the same way that white, untreated wood is disposed.
- ❑ **b.** Wood treated with the two-step coating can be disposed of in local landfills; the metals used in the wood preservative infused into the wood during the pressure-treatment process require special disposal.
- ❑ **c.** Pressure-treated wood may be used in mulch; coated wood may not be used in mulch.
- ❑ **d.** Neither type of wood may be recycled.

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Material resources used: Article: This article addresses issues concerning health and safety.

I hereby certify that the above information is true and accurate to the best of my knowledge and that I have complied with the AIA Continuing Education Guidelines for the reported period.

Signature **Date**

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