HOW TO MARKET AND SPECIFY FIRE RETARDANT TREATED WOOD

BY

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I am pleased to be with you today to discuss how we market and specify fire retardant treated wood. In sharing with you, I would like to present the information in the audio/visual format that we have found to be most effective with building officials, architects, engineers, builders, lending institution representatives and other designers, specifiers and users of fire retardant treated wood, in the United States.

Since, in all probability, the uses and applications of FRTW in Canada are the same as in the United States, our approach, as an American trade association, in promoting the expanded use and acceptance of fire retardant treated wood, may be of interest to you.

Where pressure preservatively treated wood is <u>required</u> by the three U.S. model building codes (BOCA, Southern Standard and Uniform), FRTW is <u>permitted</u> through exceptions to the requirements for specific use of materials and assemblies. Building officials, designers, engineers and architects should know that the treatment and testing is bona fide and in accordance with the appropriate ASTM and AWPA standards.

Most professionals do not realize that FRTW is an old established product and was first recognized by the building code

of New York City in 1905. Initial experiments with wood to make it fire retardant actually occurred in the late 1880's. In fact, the testing of full scale structures was conducted in New York City in 1895 and subsequently in the cities of Boston, Atlanta, and London.

In these full scale fire tests, the structures used were normally 8' x 8' x 8' or 12' x 12' x 12'. Following the tests, which normally ran for one hour, the structures were sold. This was possible because there was little damage to the thick, solid wood structures themselves. The structural integrity of the kiln was sufficient to make the structures still serviceable.

In any event, the tests were viewed as extraordinary because everyone knows that wood burns, but, in the case of fire retardant treated wood, does it?

These tests led to the use of FRTW as supplementary framing and for interior finish in high-rise structures. Later it was to be used for doors and trim in multi-family high-rise buildings in New York City. At the same time, the U.S. Department of the Navy also specified its use on quite a few of their new vessels.

During World War II, FRTW was used as an alternate to steel construction in the erection of Navy aircraft hangars and other large structures. Some of these buildings were 1,000 ft. long and 100 ft. high, with 200 to 300 ft. of clear span. Subsequent fires which started from materials in these structures verified the outstanding performance of fire retardant treated wood.

For your information, let's review briefly how wood is pressure treated to provide for a remarkable degree of fire retardance.

FRTW, of course, is treated under pressure in a cylinder commonly called a "retort". The wood is placed on a flat bed car

or tram and wheeled into the retort. A vacuum is drawn and continued for a short period of time, usually thirty minutes, at which time, valves from the supply tank holding the chemical formulation are opened and the solution pumped into the cylinder, up to a pressure of 150 psi. Maximum pressure is held at that level for a period of time depending upon treatability of the species, about four to eight hours. After impregnation is completed, the solution is pumped back into the supply tank and the "charge" is removed from the retort.

After a short period to allow the wood to drip dry, the freshly treated wood is either sent to the dry kiln, or air dried, to a moisture content of 19% or less for lumber and 15% or less for plywood. After the material has been re-dried following treatment, it is ready for the marketplace.

What is the difference between untreated and fire retardant treated wood when exposed to a fire? A series of chemical reactions takes place when untreated wood is heated from an ambient temperature to its ignition temperature, which, usually, is around 480°F. When the temperature of the wood reaches 212°F., the free and bound water is driven off. As this water is evaporated from a given zone in the wood, that zone of wood begins to rise above this temperature and the cellulose molecules begin to break down. Increased quantitites of combustible gases and tars are then vaporized, leaving behind carbon as a residue. At the point of ignition, sufficient gases are present for burning to begin when an open flame or spark is applied.

Fire retardant treated wood goes through the same breakdown process. However, instead of letting the gases and tars escape to burn, the fire retardant salts act to catalize further interactions

between these products. What happens is that a large percentage of the combustible components interreact with the fire retardant chemicals to form harmless, non-burnable, carbon dioxide and water, plus additional carbon char.

The difference in the rate of heat release between treated and untreated wood is, in actuality, the determining factor in the selection and use of the two materials. Fire retardant treated wood retains its structural integrity when compared to untreated dimension, and even unprotected steel bar joists, for example, under the same or similar fire conditions.

FRTW has been extensively tested by various agencies, including the National Bureau of Standards, the Forest Products Laboratory, the Underwriters Laboratories, Ohio State University, Oregon State University, Factory Mutual Laboratories, the University of California and the United States Testing Company, as well as others in the United States and, I am sure, Canada. Much of the testing involved various rate of heat release calorimeters and produced results quite similar to gypsum wallboard and other related noncombustible materials.

Building codes do not now establish criteria for product use based upon the "rate of heat release". However, for scientific, legal and logical reasons, they will have to consider this soon, because determining the use of a product solely on the basis of its potential fuel contribution to a fire is erroneous. A case in point is the difference between a steel girder and steel filings, both noncombustible, but with a far different reaction to fire. Too, the fluidity of unprotected metal, such a steel bar joists, compared to heavy timber or glue-lam assemblies, fire retardant treated or not, are quite opposite in terms of fire performance, as

well.

Tests on the rate of fuel contribution of FRTW and steel members in an assembly have been conducted at the National Gypsum Company and the Forest Products Laboratory and monitored by Factory Mutual Labs. The results of testing for the rate of fuel contribution showed practically no difference between the two.

The basic uses of FRTW as an alternate for requried noncombustible materials in types I and II construction are 1) roof systems, 2) partitions, 3) backing for interior finish, 4) decking where parapets are eliminated, 5) nonbearing exterior walls, 6) fire retardant wood shingles and shakes, 7) exterior trim and architectural appendages, and 8) other minor accessory uses.

It is important to know that there are three types of fire retardant treated wood, two interior types and one exterior type.

Applications such as exterior architectural trim and balconies, of course, require exterior FRTW. Of course, architects and engineers may specify exterior type FRTW for interior uses, such as decorative paneling and trim, because the material is more stable and lends itself more effectively to finishing.

If the occupancy of the building is prone to high humidity, 75% or more, or if FRTW may be exposed to relative humidity of 75% or more, it is advisable to specify an interior fire retardant which has a low hygroscopic reaction that can be safely used in the presence of moisture.

It is also important to review insurance rating schedules before beginning the design of a structure. The Insurance Service Office (ISO), in their new rating schedule, recognizes the performance of FRTW in fires and thus provides for its acceptance on the same basis as noncombustible. FRTW, with a flame spread

rating of 25 or less, is classed as a "slow burning material".

A building would be considered masonry-noncombustible if the exterior walls are fire resistive construction of not less than one hour masonry and with noncombustible or "slow-burning" floors and roof.

A building would be considered noncombustible if exterior walls, floors and roof are noncombustible or "slow-burning" materials supported by noncombustible or "slow-burning" supports.

For this reason, any rate differential between FRTW and steel is virtually eliminated by ISO. The benefit of lower insurance rates between FRTW roof deck in an ordinary building, over untreated wood, is also significant.

It is also important to note that there are examples of the performance of fire retardant treated wood in fires. They include, for example, a school is Sumter, SC, Navy blimp hangars in Florida and Oregon, a service building in Massachusetts and a high-rise structure in Columbus, Ohio. In each and every case, the FRTW performed as expected and did not contribute to the fire nor cause the fire to spread beyond the point of origin.

This experience conforms to three especially important criteria. 1) no progressive combustion, 2) the limitation of flame to five feet when exposed to temperatures of over 1,400°F. for a period of thirty minutes, and 3) a low rate of fuel contribution.

The definition of FRTW contained in the model building codes is also the basis for writing a specification for its use. The specification should go a step further, however, and also specify handling and protection of the material at the job site.

It is not uncommon to hear of problems involving the use of fire retardant treated wood. However, investigation into the

problems generally reveals, for the most part, that the problems are caused by the misuse or misapplication or mishandling of the material and not the FRTW itself.

Because wood is a hygroscopic material, in other words, it takes on and gives off water at a fairly rapid rate, it is susceptible to problems associated with moisture. This, of course, is no less true of untreated wood. When used correctly in the right environment, any potential problems with interior fire retardant treated wood may be kept to a minimum. Normally, hot-dipped galvanized fasteners are suitable for use. However, often silicon-bronze, copper or stainless steel may be specified, but in no instance should electroplated galvanized fasteners be used with treated wood.

Further, FRTW must be pressure treated in accordance with Standard C20 of the American Wood Preservers Association for lumber and AWPA C27 for plywood.

After pressure treatment, FRT lumber and plywood must be redried to a maximum moisture content of 19% or less for lumber and 15% or less for plywood. Generally, for economic reasons, this is accomplished by using a dry kiln. There is no exception to this redrying provision in any specification. If the FRTW is not dry after treatment, it should not be used.

When FRTW is stored at the treating plant, at a supply house, or at the job site, it must be covered to protect it from the weather. Each course of FRTW must be separated by stickers and set up above the ground and the entire covering shall be set apart from the material in order to permit the free flow of air. Again, if the FRTW is not covered or protected and is exposed to the weather, it should not be used until it has been redried, again. Ideally,

FRTW, following pressure treatment and redrying after treatment, will be stored inside a building until it is ultimately used and closed-in to protect it from the elements. While exterior FRTW will be exposed to the weather, we nonetheless recommend that it be protected as well so that people handling FRTW will automatically and always think to protect "FRTW" and handle it correctly.

FRTW must also be identified by a stamp on each piece of lumber or plywood as having been tested and inspected by an inspection agency having a follow-up inspection service. Presently, there are three agencies that provide this service and are recognized as qualified to certify FRTW. They are the Nationwide Consumer Testing Institute, Underwriters Laboratories, and Timber Products Inspection. Further, exterior FRTW must also certify, via the label or stamp, that it has been tested under the Standard Rain Test, U.L. designation, or ASTM Standard D-2898. This applies as well to exterior FRTW used on the interior of a building.

So, any specification for FRTW should require treatment in accordance with the appropriate AWPA standards, testing in accordance with the tunnel test for a period of 30 minutes and a flame spread not to exceed 25, and identification by a qualified inspection agency having a follow-up inspection service. The specification should also require drying after treatment and protection of the material at all times prior to installation. It would also be worthwhile to require protection after installation and before the structure is closed-in if the FRTW may be exposed to the weather.

To avoid any potential problems with respect to the fire retardant treatment of hardwoods where appearance is important, as

well as the selection of species, the architect, designer or specifier should consult with the treater, the wood preserving chemical supplier, or a wood preserving trade association. Also, for appearance and finishing, a moisture content limitation of 12% should be specified. In addition, it would be prudent to check with the treater to see whether boards can be treated face to face in order to eliminate sticker marks. It is also important to determine, in consultation with the treater, what species are eligible for refinishing and still be certified. In all cases, each job or project should be considered separately.

The treatment of heavy timber members may pose a problem due to the glue line and the size and configuration of the assembly. Again, consult with the treater on each, individual job. It may be that treating the individual pieces, sanding all four sides and laminating after treatment, may be the best solution. Again, discoloration and/or sticker marks may pose a problem, so remilling following treatment may be necessary. This is true of any lumber treated where appearance might be a factor.

Except for exterior FRTW, many of the precautions we've reviewed are important also relevant to the possible corrosion of fasteners. This is another reason why it is important to make certain that FRTW is redried after treatment to a moisture content of 19% or less for lumber and 15% or less for plywood. It is also critical to prevent the use of first generation interior FRTW where it may be exposed to weather or high humidity. In any building where the humidity is over 75%, but less than 92%, low hygroscopic FRTW should be specified. Of course, low hygroscopic FRTW may be used at any humidity level up to 92%. The low hygroscopic fire retardant is the recommended type today except

when the humidity may exceed 92%, or the material will be used in exterior applications, in which case, exterior FRTW is required.

In a continuing high humidity or condensation environment, protective sleeves of plastic should be specified when piping may come into direct contact with interior FRTW. If FRTW is used in open buildings, even though protected from direct contact with moisture, an exterior FRTW should be specified. In a sense, it really is a judgement matter for the architect or specifier. In fact, the specifier should determine the possible exposure to moisture and react accordingly in writing the specification for FRTW.

Many architects and engineers take advantage of the opportunity to discuss their treated wood requirements, including FRTW, the correct fasteners to use, and the correct specification of pressure treated wood with wood preserving associations, such as the Society of American Wood Preservers, Inc. Others simply send copies of their carpentry specifications in and ask that they be reviewed to make certain the FRTW or pressure preservative treatment is correct and that what they need for the project will be delivered.

Of the many millions of board feet of FRTW used in the United States since 1900, there are but a few isolated cases of serious corrosion. In most instances, it has been proven that the problems resulted from the misuse of FRTW and/or the non-adherence to approved standards.

Like any building material, FRTW has its advantages and disadvantages. Its effective use depends upon the adherence to standards, the correct specification, good construction practices, and appropriate protection. And, like any other building material,

fire retardant treated wood has a useful place in construction, will provide structural integrity and warmth, and will perform in an outstanding manner if specified and handled correctly.

In closing, I'd like to summarize for you the important points I hope you have gleaned from my remarks.

1) Start with the right quality and proper grade of grademarked whitewood;
2) Require that FRTW be pressure treated in accordance with AWPA Standard C20 and C27, as appropriate;
3) Remember that there are three types of FRTW, one exterior formulation and two interior types: A new low hygroscopic formulation and the first generation formulation which is more hygroscopic. Specify to your need!;
4) Require that FRTW be redried after pressure treatment to a maximum 19% moisture content for lumber and 15% for plywood;
5) Require the identification mark of an agency with a re-inspection service on each piece of FRTW and remember that simply specifying the UL label, for example, does not automatically take care of the drying-after-treatment requirement. The UL label merely certifies flame spread, smoke development and/or fuel contribution, <u>never moisture content</u>. The "redry after treatment" provision is <u>in addition to</u> the label identification mark;
6) Consider the insurance recognition of FRTW when designing for efficient, cost-effective construction and savings;
7) Provide for the protection of FRTW on the job site;
8) If you are a specifier, enforce your specification. If you are a building official, enforce the treated wood

provisions of the building code utilized in your model code jurisdiction.

So, how do you market FRTW? By understanding how, where and for what it will be used, how it is specified, what is needed under a correct specification, and then producing a quality product for the end use that will assure continued consumer acceptance.

Any time you have questions or need assistance, please feel free to contact SAWP. Many architects and engineers do; certainly, we will be happy to hear from other users and interested parties as well.

I appreciate this opportunity to discuss FRTW with you and hope that the information is helpful. You've been a very courteous audience. Thank you for your consideration and attention.