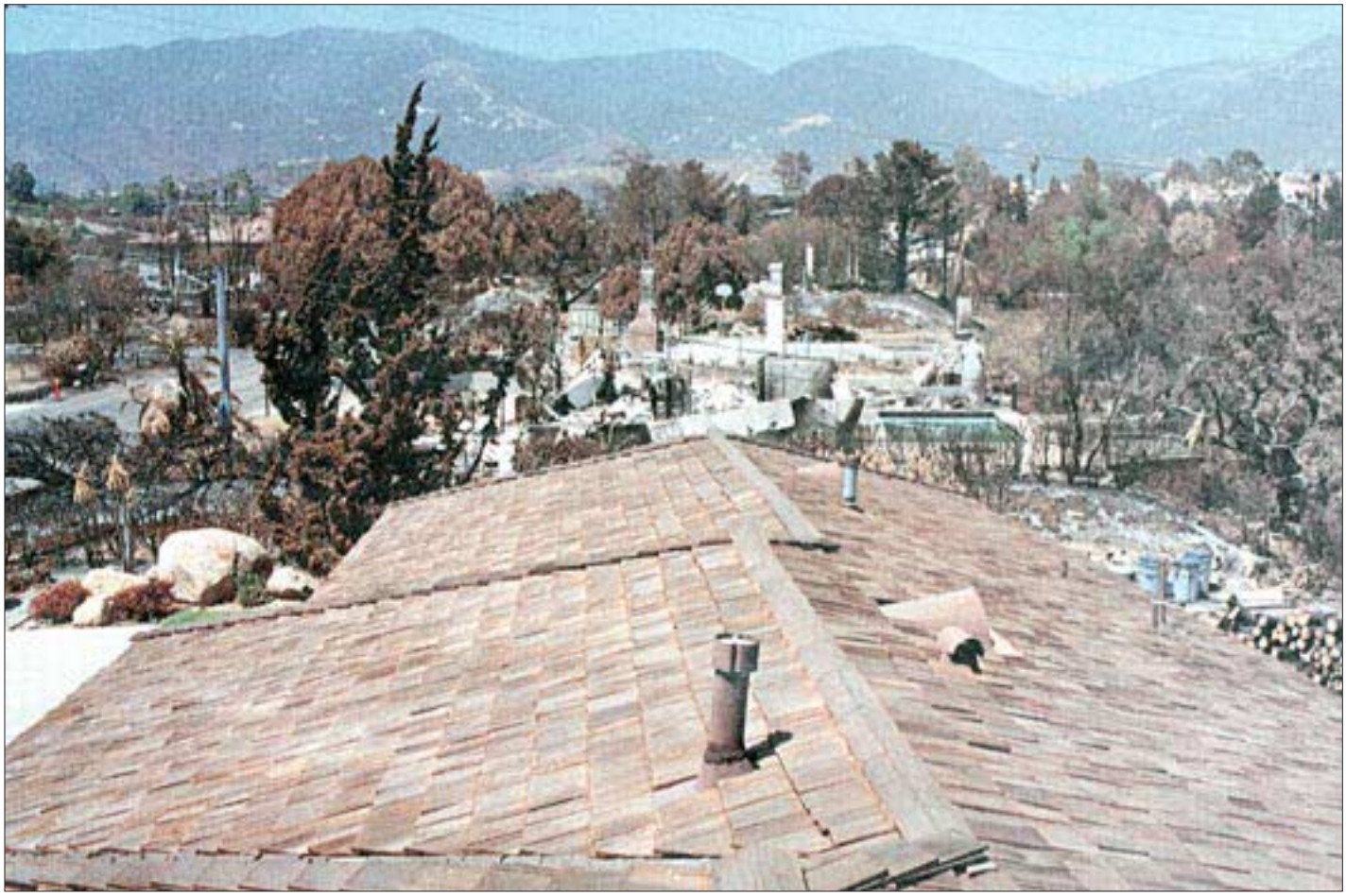
# Protecting Wood Roofs From Fire

By Brian Buchanan



CEDAR SHAKE & SHINGLE BUREAU

*This Santa Barbara home, roofed with fire-retardant cedar shakes, survived a fire that destroyed many nearby homes with untreated roofs.*

**While no roofing will save a house in the path of a fire storm, fire-retardant-treated wood shingles protect against flying embers**

Every year wildfires burn millions of acres of forests and brushlands. The fire that consumed the Oakland Hills area of northern California in October of 1991, considered to be the second-worst fire disaster in U.S. history, destroyed thousands of homes on hillsides overgrown with flammable native vegetation. Many of these homes were roofed with western red cedar shakes and shingles, a premium roof covering that offers good looks, excellent thermal insulation, durability, and wind and hail resistance. Unfortunately, cedar roofing is often criticized for its potential flammability in connection with massive wildland fires. In fact, fire officials and the press have tried to place blame squarely on the shoulders of cedar roofing, claiming that wood roofing contributes significantly to the spread of suburban fires.

There is an element of truth in these claims: Once ignited, untreated wood roofing will burn, producing embers that can be carried aloft and land hundreds of feet away. The resulting spot fires play havoc with fire fighters trying to control the spread of the larger wildfire.

What is usually not explained, however, is that wildfires are so severe that it is almost impossible to keep a home from being consumed, regardless of the type of construction used. A wildfire may begin like any other fire, but the conditions of its spread depend on factors other than the materials used to build the houses in its path. In the case of the Oakland Hills fire, for example, low humidity combined with high winds in excess of 65 mph to

whip a small fire into a fire storm that reached near-record high temperatures estimated at 2,000°F. Homes in its path didn't just catch fire — they literally exploded from the radiant heat. Fire hydrants and automobiles melted; even the asphalt streets were burning.

Fire storms tend to travel horizontally, entering homes through windows and patio doors that have shattered from the intense heat, and igniting the interior. When this happens, it makes absolutely no difference what type of roof covering or building design was used. The home burns from the inside out.

In a raging fire storm, a Class A roof covering probably does not offer much protection. It has been estimated, for example, that more than 70% of the homes destroyed in the Oakland Hills fire zone were Class A fire-retardant roofing systems. Many of these homes also had stucco or solid concrete walls. The same is true of other wildfires in southern California in 1993, where almost 80% of the homes destroyed had Class A roofs.

But no home is truly fireproof, and though fire-resistant roof coverings alone cannot prevent residential fires, many state and local governments are nevertheless anxious to reduce the risk of fire in any way they can.

**Figure 1.** *To simulate real-world fire conditions, the Class C burning brand test uses burning pine embers placed on a wood roof and fanned by a 12-mph breeze (above). In the Underwriters Laboratories version (UL-790), if 20% or fewer of the 1 1/2-inch-square brands burn through to the deck, the roofing receives a Class C fire rating. The Class B test exposes the roofing for the same length of time, but uses a larger 6x6-inch brand (left).*

## Fire-Retardant Treatments

Regulations concerning the use of both untreated and fire-retardant shakes and shingles run the gamut from virtually nonexistent to extremely tough. In some areas, such as Los Angeles and San Francisco, a complete ban on all wood roofing has been implemented, including Class C and Class B fire-retardant-treated shakes and shingles. As of July 4, 1995, California will enact a statewide Class C ordinance (Class B in high-fire-danger areas). No doubt other states will follow suit.

For those who want to continue to use cedar shake and shingle roofing, what options are available? Can cedar shakes and shingles be made permanently fire retardant? And what can be done to protect existing wood roofs from fire?

***Pressure process.*** Back in the '70s, the cedar shake and shingle industry recognized the dangers of untreated wood roofs in high-fire areas, and invested millions of dollars in research to develop a fire-retardant treatment for wood roofing. The result is a process that transforms cedar shakes and shingles into Class C and Class B fire-retardant roofing products.

The process uses pressure impregnation. Bundles of new shakes and shingles are locked inside a cylindrical vessel. After a vacuum is created to draw all the air and moisture from the wood's cells, a fire-retardant chemical is injected at pressures of up to 150 psi, forcing it deep into the wood. The wood roofing is then removed from the pressure vessel and placed in a dry kiln, where it is dried at temperatures up to 200°F. This thermosetting procedure locks the fire retardant permanently into the wood. The result is a natural-looking cedar shake or shingle that will not support combustion when exposed to fire, and that will not produce burning embers that could ignite adjacent structures.

***Does it last?*** Fire and code officials have questioned the permanence of pressure-treated fire-retardant wood roofing. Some say the chemicals are degraded by sunlight and weathering; others claim the active chemical is susceptible to leaching by rainfall.

However, recent testing of 10- and 16-year-old cedar shakes at both Underwriters Laboratories and the U.S. Forest Service Forest Products Laboratory confirmed that pressure-impregnated and thermally set fire-retardant chemicals are permanent and will last the life of the roof. Roofing materials are tested under the internationally accepted Underwriters Laboratories Standard UL-790, a procedure that closely simulates real-world fires. *All* roofing materials, including cedar roofing, must pass three tests: intermittent flame, flame spread, and burning brand tests. Wood shakes and shingles are then subjected to another *three* tests: the flying brand test, 12-week rain tests, and long-term field exposure tests of up to 10 years. The same wood roofing panels are then subjected to the flying brand, flame spread, and burning brand tests for a second time.

***Burning brand test.*** The most significant fire test for wood roofing is the burning brand test because it simulates the real-world conditions of burning embers that fall onto the roof's surface. In the Class C burning brand test,

# Where to Buy FRT Cedar Roofing

Although a number of companies offer fire-retardant treatments, only the two companies listed below have passed UL-790 testing for wood roofing and have qualified for Class A, B, and C fire ratings. Contact the manufacturers and treaters for more information.

At present, only *FTX* chemically treated shakes and shingles have passed the UL-790 10-year natural weathering test. *Cedar Plus* treated shakes and shingles are scheduled to undergo a 10-year exposure test this fall.


*Cedar Plus* (*Class B & C*)
The Clark Group
P.O. Box 515
Sumas, WA 98295
800/663-8707

*FTX* (*Class B & C*)
Wesco Cedar Inc.
P.O. Box 2566
Eugene, OR 97402
800/547-2511


25 small burning brands made of white pine are placed on the shingle surface while a 12-mph wind fans the embers (see Figure 1). The test continues until the brands are completely consumed and all evidence of flame, afterglow, and smoke has disappeared. If five or fewer brands penetrate the shingle surface and burn through to the underside of the test deck, the roofing passes. If the roofing also passes the other UL-790 tests, it is given a Class C rating.

Class C treated-wood roofing materials are as safe as any tile or composition roof covering, and most fire officials and local building authorities will permit the use of treated wood roofing that carries a UL-certified label or its equivalent.

***How much protection?*** Class A, B, and C wood roofing are all tested for the same duration of exposure to fire. The only difference is in the size of the brand used in the test. For a Class C roof, the brand is $1\frac{1}{2}$ inches square; for a Class B roof, it's 6 inches square; for Class A, 12 inches square. Unless you build houses in a tinderbox, Class C wood roofing will give more-than-adequate protection against ignition from burning embers that are thrown or that fall on a roof from bottle rockets or a nearby fire. The roof will char, but it will not support combustion or burn through. (Class A wood roof "systems" can be achieved by installing Class B shakes or shingles over a fire-resistant subdecking, such as gypsum board. Ask the treating manufacturer for details.)

Fire-retardant-treated shakes and shingles are available through local roofing and building supply dealers and distributors nationwide (see "Where to Buy FRT Cedar Roofing," above). Prices vary depending on location and availability, but you can expect to pay 25% to 30% more for fire-retardant-treated wood roofing compared with untreated products. The current price in the Dallas area is about $135 to $150 per square. Although more expensive than composition roofing, treated-wood roofing is competitive with most tile, slate, metal, and fiber-cement roofing materials.

## Treating Existing Roofs

Pressure impregnation works well on shakes and shingles *before* they are installed, but the process can't be

**Figure 2.** *Untreated wood roofs can be protected by direct surface spraying of an approved fire-retardant chemical. Protection is temporary, however, since the fire retardant does not penetrate well into the wood surface, and the active chemical leaches quickly in the rain. Some formulas dissipate completely within a few months.*


**Figure 3.** *The Texas Forest Service's Forest Products Laboratory recognizes DeFyre X-138 as the only effective surface-sprayed fire-retardant coating for existing wood roofs.*

adapted for existing wood roofs. The only way untreated wood roofs can be protected is by direct surface spraying of a fire-retardant chemical (Figure 2, previous page).

Unfortunately, protection from this superficial application is short-lived at best. The fire retardant does not penetrate well into the shingle surface, and the active chemical leaches quickly in the rain. Some formulas dissipate completely within a few months, leaving the roof susceptible to fire.

Still, many companies have built successful businesses over the years by playing on homeowners' fears of fire, especially in California and other high-fire-danger states. None of the fire-retardant chemicals these companies peddle are sold over the counter. Instead, the treatment requires costly applications by the company using specialized spray equipment. Costs run as much as $2 per square foot, depending not only on the amount of fire retardant applied, but also on the extent of precleaning required and the number of repairs made to the roof.

Despite claims made by some direct-spray applicators, the fact is, there are no fire-retardant treatments available today for existing wood roofs that provide *permanent* Class A, Class B, or even Class C protection. Surface-applied fire retardants can, however, provide some protection. The question is, how much and for how long? You cannot expect to achieve the same level of performance with a topical coating as with pressure impregnation. Fire-retardant coatings for wood roofs need to be evaluated in a slightly different manner, making allowances for reduced fire resistance and durability.

***Tough standard.*** Most fire officials agree that the greatest threat to wood roofs is from burning embers falling on the shingle surface. Years ago, the Los Angeles Fire Department (LAFD) developed a test procedure for evaluating fire-retardant coatings that claimed to protect wood roofs from this type of hazard. The test is part of LAFD Standard No. 52 (LA-52), and involves both accelerated weathering (467 inches of rainfall over a period of 42 days) as well as long-term field exposure (up to 3 years) of coated test panels.

The only fire test required by LA-52 is the Class C burning brand test, the same test specified in UL-790 for pressure-treated shakes and shingles. However, the LA-52 standard interprets the results of the fire test much more strictly than does UL-790. In the LA-52 version, if just *one* out of 25 burning brands penetrates the shingle surface and burns through to the underside of the test deck, the coating is considered a failure (UL-790 allows 5 of 25 brands to burn through). If a coating is successful in the first series of tests (no burn-through), a series of duplicate test panels are placed on long-term field exposure in Los Angeles. Every six months for up to three years, the panels are subjected to the burning brand test.

I believe this standard is too severe for any coating to pass. In fact, no fire-retardant coating has ever passed the LA-52 standard. And only the E.T. Horn Company of La Mirada, Calif., has achieved respectable results in the LA-52 test procedure: In recent tests at the United States Testing Company in Los Angeles, only 3 of 30 burning brands produced a burn-through. This 10% score is good enough to pass the UL-790 20% burn-through standard for pressure-impregnated fire-retardant wood roofing.

To date, Horn's coating — called DeFyre X-138 — is the *only* fire-retardant coating recognized by the Texas Forest Service's Forest Products Laboratory as an effective, durable coating for existing wood roofs (Figure 3). DeFyre X-138 is warranted by the manufacturer for five years from the time of application by certified applicators. For more information concerning DeFyre X-138, contact the E.T. Horn Co. (16141 Heron Ave., La Mirada, CA 90638; 714/523-8050).

Because the LA-52 certification is not required outside the city of Los Angeles, many companies promoting and spraying fire-retardant coatings for wood roofs simply ignore it. Some companies claim to have passed the UL-790 burning brand test, but they have submitted product samples of unweathered material. Since the chemicals have not been exposed to leaching, the coated shingles may pass the test, but they provide little or no protection after a few months' exposure to rainfall. Other companies perform unrelated fire tests, such as the ASTM E-84 flame spread test, on coated shingles. But this test is normally performed on unweathered lumber and structural panels to determine fire resistance for *interior* use, and says little about a coating's suitability for exterior use.

The only way to be sure the coating you and your customers are planning to use will provide the protection you want is to make sure the product has been tested for both fire resistance and durability, preferably according to the LA-52 or UL-790 standards. Some states, including California, require that any company selling or spraying a fire-retardant coating on any structure must be approved and registered by the state fire marshall's office. Check with state and local fire authorities to see if the company you're dealing with has been approved. ■

*Brian Buchanan worked as a specialist in wood roofing and fire-retardant research for 18 years at the Texas Forest Products Laboratory. In the fall of 1993, he started Buchanan & Associates, a consulting firm in Lufkin, Texas, specializing in applied research and product development in forest products.*