

Notebook...

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EDITED BY TED CUSHMAN

Can Moisture Beat Housewrap?

Researchers Probe Wall System Failures

Consider a typical wooden wall assembly: A 2x4 or 2x6 stud wall, sheathed with plywood or OSB; fiberglass batt insulation and a poly vapor barrier; housewrap or felt paper over the sheathing, with wood siding nailed over that; and paint or stain on the siding.

Should be fine, right? The poly protects the wall from interior moisture, the painted siding sheds most rain and blocks most wind, and the housewrap keeps the remaining wind and water out while letting vapor escape.

But in fact, this wall assembly can fail dramatically under severe exposures, according to Joe Lstiburek of Building Science Corporation in Westford, Mass., and Paul Fisette, director of the Building Materials Technology and Management Program at the University of Mass. in Amherst.

Lstiburek says his investigations of dozens of homes in the U.S. and Canada have revealed a common pattern of paint failure and structural rot in walls of this type (see photos). And laboratory investigations by students in Fisette's program point to a vulnerability of housewraps and building papers that may explain many of the failures.

Moisture attacks. When moisture and rot attack homes, most people suspect to find a leak letting water directly into the building. According to Lstiburek, however, a more indirect path for rain water is often the real culprit. The problem starts when rain gets behind the clapboard siding, driven in by wind pressure or drawn up by capillary action. The water can soak into the unpainted back side of the siding, or be held between the siding and the housewrap. Either way, it's trouble.

When the sun heats siding that has taken up moisture, vapor coming off the wood is driven through the housewrap and absorbed by the sheathing beneath, says Lstiburek. In this scenario, housewrap's vapor permeability becomes a liability instead of an asset.

In addition, water trapped between siding and housewrap may gradually break down the housewrap's resistance to liquid water, allowing bulk water to begin reaching the sheathing and framing.

Surfactants and extractives. U.-Mass. professor Fisette put his students to work testing the water-repellency of different housewrap brands, as well as standard 15-pound felt paper. They discovered that many housewraps don't resist standing water very well. They also found that even the better-performing housewraps and building paper lost their water resistance if exposed to surfactants (chemicals found in soap that break down water's surface tension) or extractives (tannins and other substances that leach out of woods like cedar and redwood).

In the lab, Fisette's students used a test device to



In the examples shown, water trapped behind clapboards or stored within the wood siding has penetrated housewrap and soaked into sheathing, according to consultant Joe Lstiburek.



JOE LSTIBUREK/BUILDING SCIENCE CORP.

continued

The Press Hammers Treated Wood

Customers who worry about the chemicals in pressure-treated wood have more reason to be uneasy after two influential publications had hard words this spring for lumber treated with chromated copper arsenate (CCA).



A Connecticut study found high levels of arsenic in soils beneath CCA-treated wood decks. The news reached a large audience when the report was picked up by the popular *Organic Gardening* magazine.

A five-page analysis in the March issue of *Environmental Building News* called for a phase-out of the arsenic-treated wood. CCA-treated wood from structures that have outlived their usefulness is likely to pose an increasing burden for landfills, the article noted, and incineration of the wood creates a significant toxic hazard. The value of the material's durability, the *EBN* editors argued, does not outweigh the environmental costs of production and disposal — partic-

ularly when arsenic-free alternatives exist.

Organic Gardening, the Bible of natural-method backyard food gardeners, also slammed pressure-treated wood in April with a charge that families may find alarming: According to a Connecticut agricultural extension study, decks built with arsenic-treated wood contaminate the soil beneath them to a degree that exceeds state standards for toxic waste on contaminated sites. *OG* used the Connecticut report as a starting point for a long article portraying arsenic-treated wood as a major health threat. A photo of three small children was captioned with a warning not to let children play on pressure-treated playground equipment.

In a *JLC* interview, researcher David Stilwell of the New Haven, Conn., agricultural extension office, who authored the study, was more cautious about drawing conclusions. "My study didn't look at risk assessment," he pointed out. Stilwell expressed indecision about whether cedar and redwood were preferable choices to arsenic-treated wood, considering forest conservation in the balance.

But Stilwell did say that the arsenic soil contamination under treated-wood decks was an important concern. Soils under the one painted deck in his study showed the lowest contamination, he reported — at the very least, he said, builders should seal and paint decks as soon as they are built.



Offcuts ...

"Scouts" from the U.S. Department of Justice are visiting multifamily construction sites looking for violations of the Fair Housing Act, according to code consultant Kelly Reynolds. In the December issue of his *Codes and Standards* newsletter, Reynolds says violations will draw a letter from the Justice Department, which you should not ignore — heavy fines are a real possibility. A design manual for Fair Housing Act compliance is available for \$10 from the Fair Housing Information Clearinghouse in Vienna, Va. (800/343-3442). For further information, contact Kelly P. Reynolds & Associates at 800/950-2633.

Canadian lumber producers are predrilling holes in S-P-F studs to avoid the trade duty imposed by the U.S.-Canada lumber quota pact, reports the March 28 *Toronto Globe and Mail*. Predrilled studs count as nontaxed "remanufactured items" under the deal, so a predrilled 2x6 stud could be cheaper than an ordinary stud when quota taxes are in force. But the April 4 *Random Lengths* says the ruling declaring the holy studs exempt is being challenged and may be overturned. In any case, says the newsletter, Canadian exports in upcoming quarters will probably be low enough that no quota tax is triggered.

Workers could get an electric shock from fluorescent work lights produced by Bayco Products Inc., of Dallas, Texas, warns the April 1997 *ASHI Reporter*. In cooperation with the Consumer Products Safety Commission, Bayco is recalling more than 11,400 lights sold under the brand SmartLite and RiteLite (model numbers FL-600, FL-650, SL-600, SL-605, and SL-650). A metal screw in the light can contact an internal live wire, causing a shock. For information on a free plastic replacement screw, call Bayco at 800/655-8996.

Nails by the Square

Stainless steel nails are the top choice for fastening cedar and redwood siding or decking. Their retail price reflects it: Pound for pound, stainless nails can easily cost double the price of galvanized.

But you shouldn't buy by weight, according to Bart Swan of Swan Secure, Inc., a major manufacturer of steel fasteners. "You don't always know how many nails are in the box," he points out. "With 16d nails, you get 44 per pound, but with our 3 1/2-inch decking nail, you get 88 per pound."

To ease estimating, says Swan, his company now packages nails by number, not by weight. "For deck nails, we have a 350-piece box. If you use 6-inch boards, nailed 16 inches o.c. with two fasteners per board, a box contains enough for 100 square feet of decking. If you're using 4-inch boards, you multiply by 1.5 — so we have a 525-count box." For the builder, says Swan, the numbers are easy: For a 200-square-foot deck, buy two boxes, for a 300-square-foot deck, buy three, and so on.

Costs in context. Nail for nail, Swan admits,

stainless steel will still cost you more than hot-dipped galvanized. But he argues that the nails are just a small item in the overall job. "A typical 200-square-foot deck, using cedar or redwood decking, costs about \$2,700 for everything," he says. "The two boxes of our nails will cost you around \$14.50 each, retail. So for around 1% of your total job cost, you're getting the best fasteners for your redwood or cedar. That's not the upcharge for stainless — that's the total."

Cutting conversion confusion. Figuring the number of nails needed for a siding job is a little more complicated, so Swan Secure has sent lumberyards a chart of conversion factors. "For example, for 6-inch bevel siding, the nail multiplier for lineal feet is .75," Swan explains. "If you're installing 6,000 lineal feet, you multiply by .75 and that gives you 4,500 total nails needed. The siding nails come in boxes of 250, 1,000 and 5,000 nails — in this case you'd probably want the 5,000-nail box."

Not all lumberyards are up to speed on this, says Swan: "Education is a slow process." If you need more information, call Swan Secure at 800/966-2801 or visit its Web site at www.swansecure.com.



OSHA-Builder Safety Program Breaks New Ground

For years, Denver, Colorado's builder association and the Denver OSHA office have led the nation in developing a new relationship between builders and the dreaded regulatory agency. Now, OSHA and the Denver HBA have agreed to cooperate on a ten-point safety program, written by the builders, that fits into an easy-to-read pocket-size pamphlet. The deal is simple: The builders agree to follow the basic steps laid out in the little book, and OSHA agrees not to badger them about the intricacies of the agency's standard 3-inch-thick tome of construction rules.

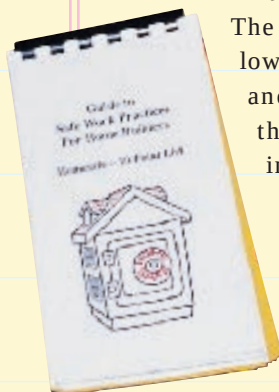
Dubbed "Homesafe," the pilot program focuses on results, not rule violations. The pamphlet's first requirement is for a clear safety plan that the boss must explain to every worker. The remaining points focus on the most common and dangerous jobsite hazards. Short and sweet explanations of required safety procedures come with cartoon illustrations — no fine

print, no bureaucratic jargon.

Ten Steps to Safety

Homesafe's pocket-size pamphlet covers these ten program elements:

- 1. Safety policy.** Must be easy to learn and clearly communicated to workers.
- 2. Personal protective equipment.** Hard-hats always; respirators, ear protection, and eye protection as needed.
- 3. Scaffolding.** Specific standards for wood and metal scaffolding.
- 4. Ladders.** Rules cover safe use, including heights and angles. No site-built ladders.
- 5. Electrical power and cords.** Construction-grade cords; rated waterproof junction boxes. Repair only with heat-shrink tape or equivalent.
- 6. Access and housekeeping.** Daily cleanup, designated disposal areas; cleated ramps or temporary stairs on drops of 19 inches or more.
- 7. Guarded openings.** Rails or covers for stairwells and door or window openings.
- 8. Fall protection.** Guardrails, safety harnesses, or slide guards for workers above 6 feet.
- 9. Excavation and trenching.** Standards followed for shoring or sloping; vehicles kept away.
- 10. Power tools.** Safety standards for saws and other equipment.



HOUSEWRAP

continued

compare the performance of five housewrap brands (Tyvek, Typar, Amowrap, Pinkwrap, and Barricade) and one brand of 15-pound asphalt-impregnated felt paper. The students wrapped each brand over the bottom of a 3-inch PVC pipe, then filled each pipe with water to a depth of about a foot, enough to simulate the pressure of a 70-mph wind. Under these conditions, only Tyvek and asphalt paper proved completely impermeable to water. The tubes wrapped with Amowrap, Pinkwrap, and Barricade began to leak within seconds, and drained completely in under an hour.

Typar's performance proved sensitive to the way it



PAUL FISETTE/UMASS

Experiments by students at the University of Massachusetts found that water could penetrate most housewraps. Water laden with wood extractives or surfactants could penetrate any housewrap or building paper under the lab conditions.

was handled, reports Fisette. "If the students handled it carefully, it didn't leak much," he says. "Only a few beads of water formed on the underside. But if they stretched it tightly over the opening, or touched it with their fingers, then it leaked just like the others."

After wetting the housewraps with soapy water, Fisette's students observed that all brands, including Tyvek, leaked in the test apparatus — and so did 15-pound felt paper.

Next, Fisette's students prepared an "extractive tea" by soaking cedar shavings in water, and used that solution in their test pipes. Only Tyvek stood up to the extractive-laced water — all the other housewraps, and the 15-pound felt, let the water through.

Since Tyvek, along with the other brands, has experienced occasional field problems, the students devised a tougher test: They placed some Tyvek in a

shallow pan and covered it with a half-inch of the extractive tea, then allowed the tea to evaporate completely, leaving a brown extractive residue on the Tyvek. This time, when the Tyvek sample was subjected to the tube test, it leaked just like the other brands. But Fisette isn't sure yet whether it's the extractives that degraded the Tyvek; he plans further tests to see whether repeated wetting and drying with plain water alone will break down the material's water resistance.

Lstiburek, who says the student who devised the evaporation test "should get a Nobel prize," is now showing audiences a scrap of brown-stained Tyvek he recently removed from a house. Extractive-laden water trapped between cedar siding and the housewrap has made the housewrap water-permeable, he concludes, making it ineffective as a drainage plane.

Recommendations. Fisette is reluctant to draw conclusions about any building products from what he says is still "very preliminary research." But Lstiburek has a prescription for builders who want to apply wood siding to wood-framed walls under tough weather conditions:

- Use 15-pound or even 30-pound felt paper, not housewrap.
- Create a "vented rain-screen" by nailing furring strips over the sheathing and building paper to hold the siding off the building.
- Back-prime and end-prime all the siding to prevent it from acting as a moisture reservoir.

Stephanie Mogavero, a spokeswoman for DuPont Tyvek, said DuPont wanted to look more closely at Fisette's research before commenting. But she pointed out, "There are more than a million homes that have been wrapped in Tyvek, and we have had very few problems over the years attributed to Tyvek." Mogavero had no objection to the rain-screen idea, however, saying, "We agree with that. That's just good building practice."



For more information, contact:

Joe Lstiburek
Building Science Corporation
68 Main Street
Westford, MA 01886
508/589-5100

Paul Fisette
Room 126
Holdsworth Natural Resources Center
U.-Mass.
Amherst MA 01003
e-mail: pfisette@forwild.umass.edu
Web site: <http://www.umass.edu/bmatwt>