

THE PRACTICAL HEALTHY HOUSE

With a few product substitutions and attention to detail, any new house can be made healthier at modest extra cost

by Clint Good

As a builder and architect with a strong interest in nontoxic homes, I've worked for many people who cannot tolerate some of the 500 or so chemicals present in the average house. These chemically hypersensitive people require homes built to extreme and often expensive specifications.

But there is another group of people, not necessarily "chemically sensitive," who simply want to stay healthy. They want a reasonably priced "generic" healthy house — one that incorporates as many healthy products as possible, but without significantly raising the costs of construction.

In 1986, I decided to design and build such a house on spec. The result was a 2,800-square-foot colonial with four bedrooms and

two-and-a-half baths. It cost us \$200,000 to build the house in Bethesda, Md., a pricey Washington, D.C., suburb. This price was about 20% more than it would have been had we used standard building materials. I've since built the same basic house several times, including a version for myself. In the process, by finding less expensive materials and learning a few tricks to speed construction, I've managed to bring costs down about 10%.

Foundation and Shell

The Bethesda house sits on a concrete block walk-out basement. Later versions feature a basement garage instead. Any attached garage must be well-ventilated and sealed with a foil barrier and caulk so that auto exhaust fumes can't enter the

living space. I also install carbon monoxide sensors, and I put a timer on the garage door openers so that they remain open for 20 minutes or so to let fumes dissipate.

While most builders use pressure-treated wood for the sill plate, we like to avoid PT because of the arsenic in the chemical treatment. Instead, we use pine or spruce sills and treat the wood ourselves by brushing on three to four coats (the manufacturer recommends two) of a low-toxic preservative called Donnos Wood Preservative (Livros, 1365 Rufina Circle, Santa Fe, NM 87501; 505/438-3448). We haven't been able to test this treatment over the long term, but the sills we treated five years ago on the Bethesda house look fine.

We avoid using a termite treat-



Houses built with nontoxic products needn't seem cold and sterile. The only people who need to know the house is "healthy" are the builder and the owners.

ment by being very careful to keep wood scraps out of the backfill, and by making sure the soil is a good 6 to 8 inches below the siding. We also use cedar siding, which is naturally unappetizing to bugs.

Sheathing. Plywood and other glued wood products are a major source of formaldehyde, which is the single most prevalent noxious substance in most conventional homes. Formaldehyde has been identified as a suspected human carcinogen, and many people find that the fumes cause eye and respiratory irritation, nausea, headaches, rashes, and fatigue. For these reasons, one of our major efforts in any healthy house is to reduce the use of materials containing formaldehyde.

Plywood sheathing is one of the first things to go. You could use a formaldehyde-free plywood, but the price is exorbitant. Exterior-grade plywood uses a more stable type of formaldehyde than interior-grade plywoods do, but I still avoid it, since doing so adds little cost and eliminates a large amount of toxin-containing material.

Instead, we use low-grade 1x4 or 1x6 solid wood planking for both exterior and roof sheathing. This adds about 10% to labor costs on the

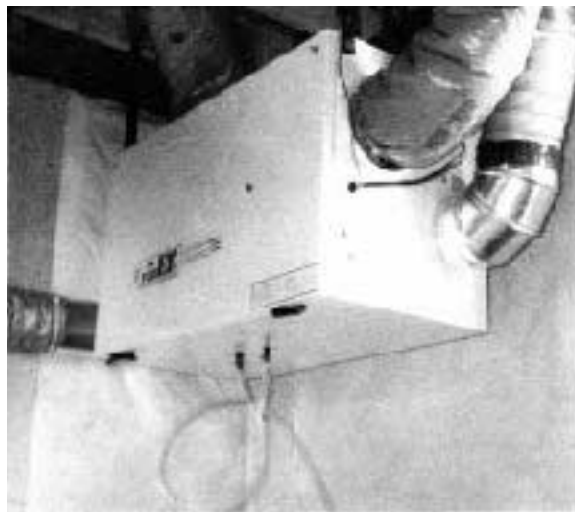


Air Krete, a cementitious foam insulation, is free of the toxins found in many conventional insulation products.

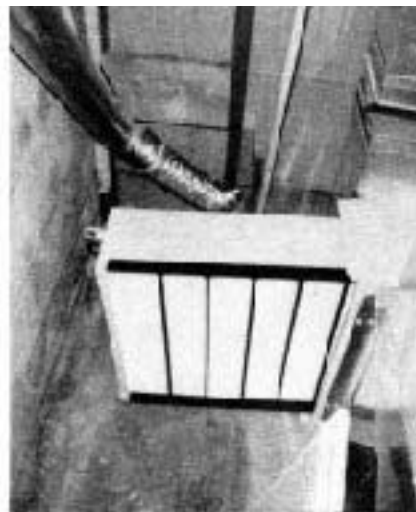
sheathing.

Insulation. Fiberglass insulation offgasses low levels of the formaldehyde used to bind its fibers together. To avoid this, in the Bethesda house we tried Air Krete insulation (P.O. Box 380, Weedsport, NY 13166; 315/834-6609), a cementitious foam product, but we eventually decided this was overkill. To save money, we now use conventional fiberglass or cellulose and carefully seal the interior from the insulation cavities. We either place foil wrap beneath the wallboard, or use foil-faced insulation. In either case, we carefully tape all the seams to effectively seal the space.

We also drill holes into the top and bottom plates on each floor to provide ventilation — 3/4-inch holes



A heat recovery ventilator (left) provides energy-efficient ventilation; a high-efficiency HEPA filter in the furnace ductwork (right) traps dust and other particulates.



at 6 to 8 inches on-center, so that each stud space has a couple of holes in it, top and bottom. This lets the offgassing dissipate into the attic or soffit space, where it is exhausted by soffit and ridge vents.

Windows. Windows present a difficult problem. You can't find wood windows that don't contain some sort of mildewcide or preservative, unless you go with exotic and expensive tropical woods. Vinyl windows are full of chemicals. Metal windows are a healthy choice, but they present aesthetic and energy problems.

Given all this, I've decided the best alternative is to use wood windows, either bare or preprimed, and seal them with a nontoxic finish to reduce the offgassing of preservatives and mildewcides.

Two such finishes are Acrylacq, a water-based, silicated lacquer substitute with a minimum of volatile petroleum solids; and Polyur seal, a similarly formulated polyurethane replacement. Both are made by AFM Enterprises (1140 Stacy Ct., Riverside, CA 92507; 714-781-6860), which carries a full line of low-toxicity products. These sealers have minimal offgassing and effectively seal the toxins within the wood. Some of the paint products listed later in this article will do the same.

Healthy HVAC

If there's one main ingredient for a healthy house, it's a good ventilation system. We use a VanEE heat recovery ventilator (Conservation Energy Systems, 2525 Wentz Ave., Saskatoon, SK S7K 2K9, Canada; 800/667-3717) to introduce fresh air and maintain energy efficiency. We couple this with a SpaceGard high-efficiency particulate accumulator (HEPA) filter (Research Products Corp., P.O. Box 1467, Madison, WI 53701; 608/257-8801), readily available at mechanical supply houses.

We put the HEPA filter in the furnace's return air duct. While this doesn't give you operating-room cleanliness, it traps many more particulates than standard fiberglass filters do. HEPA filters range from \$100 to \$130 for parts and up to \$500 with installation. Also, the filter canister, which retails for \$25 to \$50, has to be replaced every six to eight months.

Avoiding backdrafting. The easiest way to avoid backdrafting and spillage of combustion fumes into the living space is to use electric water heaters, furnaces, and appliances, which produce no fumes. In the Bethesda house, we used an electric heat pump, which in that climate is cost-effective.

Where fossil fuels are more economical, you should use sealed-combustion furnaces and water heaters. Properly maintained, these units effectively seal the combustion unit from the living space.

You can even get a sealed-combustion gas fireplace, such as the GDV-5000 (Superior Fireplace Company, 4325 Artesia Ave., Fullerton, CA 92633, 714/521-7302). This operates on the same principle and satisfies some customers who want a healthy house but also a fireplace.

Radon. Back in 1986, when we built the Bethesda house, the radon issue was in its infancy, but getting a lot of attention. We embedded 4-inch perforated piping, 4 feet

Warning: Builders May Be Liable

Despite good intentions, contractors claiming to build healthy houses can set themselves up for increased liability if they promise health-related results.

"Anytime you make medical claims, you're holding yourself out for litigation," says Earon Davis, an environmental health consultant and a lawyer. "This shouldn't scare you or keep you from building a healthier product. But it's something you should be aware of."

Davis recommends that builders include a disclaimer in their contracts making it clear they will not take medical responsibility for the home. The disclaimer might go as follows: "While we have endeavored to comply with the purchaser's requests for safer products, we cannot warranty that the house will be free from indoor pollution, or that those who reside in it will

be free from any health effects from indoor pollution."

Legally prudent healthy-house contracting, then, becomes a matter of doing everything reasonable to make a house healthy. Oliver Drerup's company, Drerup-Armstrong Ltd., in Ottawa, Canada, has been building homes for chemically sensitive people for years. He stresses the importance of carefully following the directions on all healthy products, and of hiring reliable subs who will do things right. He also gives the clients a list of all the healthy products he'll be using.

"Let them know exactly what you're doing to reduce levels of indoor pollution," he says. "But whatever you do, avoid telling them they will be healthier as a result."

—Wendy Talarico



A wall-vented, sealed-combustion gas fireplace can provide some of the coziness of an open fireplace, along with considerable heating power — and no backdrafting danger.

on-center, in the gravel under the slab, exhausted passively. These days I space my perforated collection pipes at about 12-foot intervals (three pipes for an average-sized house), running them through a 4-inch gravel bed topped by a cloth mesh, a poly vapor barrier, and finally the slab or basement floor. These tubes connect to a single vertical vent pipe with a fan, if needed.

Interior Finishes

Because they're exposed directly to living spaces, interior finishes warrant close attention.

Floors. Thin-set tile adhesive is noxious stuff. To avoid using it, we set ceramic tile in mortar in the kitchen, breakfast area, baths, and laundry room. Vinyl flooring is also an acceptable alternative in small areas such as laundry rooms and half-baths. AFM makes a vinyl sealer called Vinyl Bloc that the company claims reduces emissions from the vinyl by about 80%.

For oak flooring, I use Hydroline Wood Floor Finish (Basic Coatings, 2124 Valley Drive, Des Moines, IA 50321; 800/247-5471). Because this urethane finish is water-based, it takes a little getting used to its application. But it has excellent durability, lasting around five years before it needs a recoat; most of the other water-based finishes I've tried require recoat after about two years (see "Waterborne Finishes for Hardwood Floors," 10/91).

Walls and paints. We use a low-toxic, ready-mixed joint compound, made by AFM, that contains a less toxic mildewcide than that used in ordinary compounds. However, this compound requires one or two more coats than ordinary compounds, because it is less workable and requires thinner coats.

Another route is to use ordinary joint compound and minimize offgassing of the chemicals it contains with a good sealing paint, such as AFM's SafeCoat.

This brings us to paints, which have received plenty of attention from makers of low-toxic building materials. Livos, AFM, and several other companies make water-based paints containing little or none of the petroleum-solvent emulsifiers common in conventional latex and oil-based paints. They replace these emulsifiers with plant-based products such as citrus terpene, derived from citrus trees. These paints also use fewer or no biocides, fungicides, and mildewcides. Using them can greatly reduce the offgassing of toxic and

polluting fumes as the paint cures.

Further reduction can be achieved through the use of thinner coats of paint. As a general rule, the thinner the coat, the faster any emissions will dissipate. That's why some of the low-toxic paints are formulated so thin. Some low-toxic varieties, such as AFM All-Purpose Enamel, can require up to four coats. If you can stand the extra labor costs, this paint produces a good finish that stands up well in kitchens and baths and other heavy use areas. For walls that face less of a beating, such as living and dining rooms, we use Livos' Dubron Natural Resin Wall Paint. This brand coats more quickly, but doesn't stand up as well to moisture or abrasion.

Kitchens and baths. Since the fiberboard substrate in stock cabinetry is a major source of formaldehyde and other chemicals, we used metal cabinets in our Bethesda house. Made by Davis Kitchens (P.O. Box D, New Buffalo, MI 49117; 219/873-0358), these cost about half as much as stock cabinetry and have a nice baked enamel finish that fits well with the slick styles of the 1980s. We slicked them up further with some fancy hardware.

These days, we're meeting the demand for the wood look in kitchens by using wood fronts on metal cabinets. We have them fabricated by a local cabinet maker and finish them with the same type water-based finishes we use for windows. The wood adds cost, but since the metal cabinets are so much cheaper, the final cost runs about the same as stock cabinetry.

We might also splurge on bathroom vanities and have them made from solid wood. While these cost about twice as much as stock models, they are a nice touch.



To reduce the use of formaldehyde-containing fiberboard, the kitchen uses high-gloss metal cabinets instead of veneered fiberboard. The counters are plastic laminate, glued with low-toxic adhesives to solid wood substrates.

Conventional countertops of fiberboard topped with laminate present another major formaldehyde source. Modern solid-surfacing products such as Corian and others offer one good alternative. Despite the nasty chemicals they contain, these are generally well tolerated even by chemically sensitive people. Stainless-steel countertops, available from commercial kitchen suppliers, are another good alternative, though expensive.

Another option is to use two layers of 3/4-inch plywood and seal the plywood with a nontoxic sealer before applying plastic laminate. For glue you can use DAP's low-volatility "Environmentally Friendly Construction Adhesive," readily available at building supply centers.

Better Planning Needed

We've tried hard to develop a practical approach, using materials that aren't hard to find. Even so, building a healthy house takes even more patience and management skill than usual, especially at first. Many products must be special ordered, which takes time and money. And as with super-energy-efficient housing, healthy house contracting means spending extra time at the job making sure things such as vapor barrier seals are done properly.

Another problem we faced with our first few healthy houses was finding subs willing to work with the new materials. They weren't hostile to the "healthy" aspect; they just resisted working with unfamiliar products, or were devoted to a single brand. It's hard to convince a painter faithful to an old favorite to try an AFM paint that requires twice as many coats. And there are floor finishers who refuse to try water-based finishes, even if the chemicals in the petroleum-based products make them nauseous.

This attitude is changing, partly because of the increasing attention given to the health and environmental problems posed by conventional products. And there are plenty of tradesmen who've had to leave their work because of sensitivities they've developed over the years. These developments are encouraging more tradespeople to try healthier products.

The technology exists to make houses virtually nontoxic. But it's important to weigh benefits against costs. Looking at the house as a system, you can use healthy products where they will make a real difference, but still keep costs under control. ■

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