

Building a Healthy House

For a chemically sensitive homeowner, a cleaner indoor environment meant focusing on six key concepts

BY DEBRA JUDGE SILBER

Things that most of us barely notice have led Lisa Kauffman Tharp to take some pretty drastic action. Like repack her entire family the morning after arriving at an oceanfront vacation cottage because she awoke feeling like there was a pile of bricks on her chest. Like relocate from her home in Austin, Texas, to—quite literally—put some breathing room between her highly sensitive lungs and the native cedar trees. Like finally pull out all the stops to build a house in Concord, Mass., in the hope that it would allow her to live her chemically sensitive life in peace and in good health.

The final move seems to have paid off. Four months after moving into her new house, Kauffman Tharp was able to set aside her asthma inhalers and allergy medications. She is, she says, 80% healed thanks to a home that was meticulously crafted to eliminate mold, biological irritants, and chemical toxins from the indoor environment. For Kauffman Tharp, building a healing home went much further than eliminating carpets and coating walls with low-VOC paint. She wanted—indeed, she needed—her home to be healthful inside and out, through and





1 WORK WITH NATURE

Kauffman Tharp's healthful home is sited to maximize warmth and light from the south (back) side during winter, where maple trees shade it in summer. In front, north-facing windows channel breezes from the park across the street, while window and door placement encourages cross ventilation. An open stairwell acts as a "cooling chimney" to help warm air rise and vent through loft windows. In addition to respecting the environment and saving energy, these passive strategies support the elimination of heating and cooling ducts, one of Kauffman Tharp's key goals ("Minimize ductwork," p. 84).

Outside, the landscape incorporates native plantings selected from the Ogren plant-allergy scale developed by Thomas Leo Ogren, author of *Allergy-Free Gardening*, and is pruned according to his strategies for minimizing pollen.

Daylighting, maximized by clerestory windows, kitchen skylights, and interior windows that let light move through the house, helps to reduce electricity use and fills the house with sunshine.



2 MINIMIZE DUCTWORK

Topping the list of things Kauffman Tharp didn't want in her house was ductwork for heating and cooling because of its potential to spread toxins such as mold throughout the house.

Finding an alternative produced its own set of decisions, however. Kauffman Tharp's initial preference for electric heating—on

the basis that it would be more affordable to install than a hydronic system and could not leak and produce mold—fell apart against concerns about sensitivity to electromagnetic fields. She then opted for a hydronic radiant system, later modified to in-floor heating on the first floor and radiators upstairs to save money. Because the Kauffman Tharp house is so tight, however, the upstairs radiators are rarely needed.

The walls are preplumbed for minisplit ductless air conditioners, but the units have not yet been installed. So far, passive-cooling strategies, combined with ceiling fans, have kept the house comfortable in summer.



Radiant heat is fueled by a 98.6% efficient Weil-McLain modulating gas boiler (www.weil-mclain.com). Cast-iron piping is used wherever possible to limit PVC use.



through, literally from the ground up. The experience has led her to a new career in interior design, with the mission of educating clients on how to build more healthful homes, whether they are chemically sensitive or whether they simply wish to live and raise their families in a cleaner environment.

Kauffman Tharp stresses that thorough research and planning are critical to avoid missteps, to stay on course, and to control costs involved in building a healthful home. Her advice: “Do all your research before you start, or hire someone who has gone through the process

who can advise you. If you have to stop and second-guess along the way, it will add to what you'll have to pay for a healthy house.”

Before launching the project, Kauffman Tharp wrote a design brief that clearly spelled out her needs and wants: a healthful home above all, but one that was energy-efficient, space conscious, and traditional in design. Another important consideration was an in-town lot that encouraged a walking lifestyle. Achieving all those goals, she realized, would include some trade-offs and reorganizing of priorities—and here, her design brief proved invaluable. “Writing down key goals

3 BUILD FAST, DRY, AND TIGHT

Making the Kauffman Tharp home thoroughly nontoxic drove decisions and construction methods from the moment the foundation was dug. Go to FineHomebuilding.com/extras for a time-lapse video of how the home came together.

Eliminate ground contact

Kauffman Tharp did not want a basement or below-ground crawlspace that would allow moist, mold-laden subterranean air into the house. After reviewing the alternatives, including piers and slab on grade, ZeroEnergy designed a sealed, conditioned crawlspace outfitted with a dehumidifier and radon-exhaust fan, but with no connection to the house's interior. A small exterior door provides service access.





“We had every single plank of maybe 1800 square feet of flooring sealed, turned, sealed, turned.

—Matt Ayers, project manager

4 BEWARE OF NATURAL IRRITANTS

It’s not just chemical additives that provoke sensitivities, as Kauffman Tharp was reminded after purchasing antique heart pine for her floors. The only way to use the wood, which she loved despite her allergy to its natural terpenes, was to seal the boards on all six sides.

After testing 25 finishes, she chose Bona Kemi Floor Finish System (Bonaseal Undercoat and Bona Traffic satin finish; www.bona.com) to seal and protect the floors. While it’s not VOC-free, Kauffman Tharp says that the product has a reputation for being tolerated well by persons with chemical sensitivities. Because of this and because of concerns that the reduced durability might require refinishing sooner, she passed on the product’s lower-VOC formula, Eon 70.

and priorities, even in simple list form, helped to guide the entire process, from lot selection to hiring the right architects and builders to the final decisions on landscaping.”

Connor Homes, a Middlebury, Vt.-based manufacturer of prefab, traditional-style houses, matched Kauffman Tharp’s desire both for an authentic New England look and panelized construction, but Boston-based ZeroEnergy Design was her first choice for energy efficiency. To get the best of both, she asked the two teams to work together. “The collaboration went beautifully,” she said. “Zero

Energy did the original plans, and Connor made it traditional.” As general contractor, she chose eco-friendly builder Aedi Construction of Waltham, Mass. As the builder on site, Aedi was charged with the day-to-day decisions and rapid responses to any slips in the project’s nontoxic approach.

A kickoff meeting was held with Kauffman Tharp, the architect, the contractor, and the primary subs to discuss the project’s goals and to draft a management plan for addressing healthful home-building practices. “The important thing about the process is we were able to



Use fast, efficient panelization

Panelized construction was chosen because it’s efficient and because closing in the house quickly would mean less exposure to the elements and less opportunity for mold or other contaminants to gain a foothold. Panel materials included no-formaldehyde sheathing. The house went from foundation to rafters in seven days.



Build to shed water

GreenGuard RainDrop building wrap (www.greenguard.pactiv.com) was installed to provide a water-resistant drainage plane.

5 PRESERVE THE LARGER ENVIRONMENT

In addition to controlling energy use, the systems and materials in the house actively promote conservation. In the kitchen, a Tapmaster foot control (www.tapmaster.ca) at the kitchen

sink helps to cut down on water waste, as do dual-flush toilets in the bathrooms. Appliances are energy efficient. The house is also a model of reuse. The main-level floors are reclaimed antique heart pine (www.longleaflumber.com) and local bluestone. Kitchen countertops are wood and concrete (www.jaaronwoodcountertops.com) rather than imported stone. Sixty percent of the kitchen cabinetry was salvaged; new structures were built of formaldehyde-free plywood. In the bathrooms, remnant marble was used for shower-seat and bath thresholds, with an antique wood top and reclaimed base for the master-bath vanity.



In addition to recommending that work sites be sealed off during repairs, the job-site guidelines included using window fans to create negative air pressure and HEPA vacuums to clear dust at the source.



make informed decisions at every step,” says ZeroEnergy architect Stephanie Horowitz. “It was a calculated process, whether decisions were made for design reasons, health reasons, or energy reasons.”

At the outset, the team developed a guide to construction practices for the contractors and subs to follow. Sweeping or using a shop vacuum, which spreads particulates, were prohibited. Ventilation and heat-recovery systems were sealed until all construction work was complete, which avoided having to rely on postconstruction cleaning to remove contaminants from the system.

Even with all these precautions, contaminants still slipped through. “There are things you specify in advance, but then there are myriad products that come onto a job that are generic that aren’t chosen by the architect or the general contractor,” says Horowitz. On this project, the culprit was a hardening agent mixed in with the adhesive used to affix a marble seat in the master-bath shower. Kauffman Tharp noticed the smell the moment she walked onto the site. Aedi’s response was instantaneous: The seat came out, fans were turned on to ventilate the space, and the heat was turned up to “bake out” the substance.

Insulate well

A layer of 2-in. XPS helps the house to maintain comfort year-round with less reliance on mechanical systems. Inside, Icynene open-cell foam was applied to wall cavities. Although the R-value of open-cell foam is lower than that of closed-cell foam, it is vapor permeable and off-gasses less.



Promote drying with an airspace

Furring strips between the drainage plane and the fiber-cement siding create an airspace that allows the exterior wall assembly to dry if needed.





6 SPECIFY NONTOXIC MATERIALS AND FINISHES

To choose nontoxic and nonirritating products, Kauffman Tharp relied on the experts around her, read extensively, plowed through material-safety data sheets, and when in doubt, opened bottles and took a whiff. “There were times I would just open the bottle and sniff and wait a minute to see if I had a reaction,” she says. Materials used in the house’s interior include formaldehyde-free plywood, cabinetry, and MDF; low- and no-VOC paints; a low-VOC hardwood-floor finish; and nontoxic grouts, sealers, and adhesives. Among her recommendations:

- **ECOS Organic Paints** (www.ecospaints.net). Kauffman Tharp paid dearly to have this paint—dubbed “liquid gold” by the painting crew—for the upstairs floors shipped from the United Kingdom. The zero-VOC paint is now available in the United States at \$75 a gallon. The underside of the oak flooring was coated with AFM Safecoat Flat Zero VOC paint (www.afmsafecoat.com) to seal in oak terpenes. Mythic paint and primer (www.mythicpaint.com) was used on interior walls, ceilings, and cabinetry, as well as exterior siding and trim.
- **Laticrete 317 thinset** (www.laticrete.com). Kauffman Tharp warns that additives should be avoided in this Greenguard certified product. She also suggests C-Cure 911 (www.c-cure.com) and Bostik D-5 (www.bostik-us.com).
- **Bostik Hydroment Ceramic Tile Grout** (www.bostik-us.com). Kauffman Tharp had hoped to use a homemade grout recipe, but scheduling pressures and difficulty coloring the grout resulted in a switch to this locally produced, zero-VOC product. No additives were used. The grout was sealed with AFM Safecoat Grout Sealer (www.afmsafecoat.com).

With construction complete, the house relies on several mechanical systems to maintain a pure, nontoxic environment. A radon fan and dehumidifier detoxify the crawlspace, while an energy-recovery ventilator (UltimateAir RecoupAerator; www.ultimateair.com) ventilates and automatically balances humidity and air pressure in the living spaces. Paired with the energy-recovery ventilator, an air filter (Pure Air Systems 600 HS Plus; www.pureairsystems.com) uses a HEPA filter to ensure that air entering the house is free of allergens and exhaust fumes, particularly important given the home’s in-town loca-

tion. The house’s water supply is filtered by a Rhino 300 EQ Whole House Water Filter (www.aquasanastore.com). The whole-house system filters not only drinking water, but also shower and bathing water, eliminating contaminants that could be absorbed through the skin or aerosolized and inhaled while showering. □

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Protect from above
The roof is covered with an adhesive rubberized membrane for extra protection against water infiltration and mold growth.



Choose a durable roof
A standing-seam metal roof (www.ironhorseroofing.com) was chosen for its traditional look and its durability.



Use durable siding
The home’s Hardie-Plank fiber-cement siding (www.jameshardie.com) and exterior trim were painted with Mythic low-VOC exterior paint (www.mythicpaint.com).