Environmental Building News™

The Leading Source for Environmentally Responsible Design & Construction

A Publication of BuildingGreen, Inc. www.BuildingGreen.com Volume 25, Number 7 · July 2016

Celebrating Our 25th Year

Protect Your Spec: 14 Strategies

You've selected the ideal materials for your project: now get them into the building.

By Katharine Logan

Well, you've done it. You've sifted through countless product declarations on multiple transparency platforms. You've compared apples to oranges, and maybe a few pineapples.

Where no declaration exists, you've written to manufacturers encouraging them to share their secrets and confess their sins. The 50% or so who are going to respond have done so, and the 10% or so who actually have what you need have provided it. You've created color-coded matrices comparing products across multiple imperatives, and your clients, eyes glazing, have revisited recalcitrant product categories with you for the last time.

Decisions documented, you've bundled up the winning entrants' data and sent them over to your spec writer to be issued as a truly impressive compendium of some of the least toxic, most environmentally responsible materials out there. You've assured the firm's billing administrator that all, some, none (pick one) of this astonishing effort is billable, and now you're leaning back in your chair (note to self: a likely source of halogenated flame retardants; maybe put in for a new one), and giving yourself a pat on the back.

Ahem.

Would it surprise you to know that getting the right materials into the spec is only half the battle? You still have to get them into the building, and the difficulty of doing that is emerging as a common theme for project teams that are making human health a priority in material selection. Trades inevitably propose cheaper, more familiar, faster-drying substitutes. Pre-manufactured components arrive onsite full of surprises. And who would have thought the world had so much vinyl in it?

If you're going to truly avoid those toxic chemicals, and not just let them in the back door, you'll need to build a strong project culture, smarten up your spec, and watch as well as hope. Here we share insights and lessons learned from project teams who've done that.

Rallying Your Team

For its first attempt at the Living Building Challenge (LBC), Lake | Flato Architects tackled its materials priorities from first principles, asking first what could be eliminated before seeking less toxic versions of what remained. The Betty and Clint Josey Pavilion, a 5,000 ft² educational facility for the Dixon Water Foundation now certified under LBC, distills some key material strategies to the essence.

Photo: Casey Dunn

The Betty and Clint Josey Pavilion, an educational facility for the Dixon Water Foundation now certified under LBC, distills some key materials strategies to the essence.

1. Simplify the palette

The team focused not on the stringency of LBC's materials requirements but rather on how these requirements might improve the design, according to Lake | Flato's Corey Squire, sustainability coordinator at the firm. A major strategy was to ask, "How simple can we make this? What can we get away without?"

The AIA COTE Top Ten Award-winning answer is a naturally ventilated, wood-clad wood structure with low concrete perimeter walls, a metal roof, and site-built doors and lighting. With no mechanical system or curtain-wall, whole sections of the spec—with associated sealants and adhesives—fell away. ("Who needs walls?" the COTE jury commented.) The site-built assemblies let the project team control exactly what was in them: no leaded brass in the hardware, no toxic preservatives in the wood, no PVC gaskets. Lighting fixtures consist of bulbs and wires in vinegar-rusted pipes. Sounds funky, looks great.

For the topping slab, concrete straight up may be fine, but the chemical and plastic admixtures to prevent fine cracking are harder to figure out, says Squire. "Instead of just finding healthier versions of concrete retarders, we made an aesthetic decision informed by the materials." In other words, cracks add character.

While Josey Pavilion is a small, low-occupancy project, the simplified material palette is a strategy with multiple benefits that larger projects can adopt and have adopted (including the Bullitt Center; see Take Control of Your Materials: Four Empowering Lessons from Teams That Beat the Red List).

2. Add breathing room to the schedule

In all, the Josey Pavilion comprises only 186 materials and products. Even with simplifying to this extent, however, the design team found it impossible to identify every material before construction began. To accommodate the ongoing research effort, they advised the contractor, Lincoln Builders of Texas, to factor into the construction schedule two-week turnarounds for submittals.

Lincoln took the project's material-related goals to heart, maintaining a synchronized copy of the architects' material matrix, marking it off as materials were used, and policing what came onto the site.

"The contractor knew how important it was for us to receive the certification, so we didn't have any difficulties," says Squire. "It was great having a partner on the site."

3. Commit

The project team's commitment to material-related priorities is the sine qua non of the whole effort. "If there's a weak link on the team, be it the architect, owner, or contractor, it won't hurt the project; it will stop the project," says Tyler Park, an assistant project manager at Hourigan Construction. The company is construction manager at risk (CMAR) for the Chesapeake Bay Foundation's Living Building Challenge-certified Brock Environmental Center. "There's really no way to do it without 100% buy-in from everybody."

And that's not just for projects targeting the Living Building Challenge. Dell Seton Medical Center at the University of Texas, a 517,000 ft^2 healthcare facility currently under construction, is targeting a certification of Silver or better under LEED for Healthcare. Targeted credits include all of the Materials and Resources credits (other than those associated with building reuse) and the credit for low-emitting materials, which for LEED Healthcare projects includes exterior-applied products. Seton has also directed the project team to avoid products manufactured with PVC when cost-competitive and equally- or better-performing alternatives are available.

"Without every member of the team saying, 'I'm going to do this, do it right, learn how this system works, change the format of my submittals to this new format,' it can't happen," says Doug Strange, senior project manager at Ascension Health.

4. Appoint a champion

More than one project team cites a specific member whose presence from start to finish helped safeguard the project's material priorities.

"It's important to have a champion," says Paul Mellblom, AIA, principal at MSR Design. But who?

Based on his own experience with the Rose, an MSR-designed pilot project in the Living Building

Defend Your Spec from Start to Finish

This article uses insights from several projects to demonstrate 14 specific strategies for protecting the spec. Here's what it boils down to.

- **Know what you want**—Whether it's about energy use, products, or the program itself, nothing confuses the design and construction process more than unclear goals and mixed messages. In projects where material selections are a critical factor, many teams dedicate an entire goal-setting workshop to this priority alone.
- **State it clearly**—Great workshop! Now you need to document the results and share them far and wide. The ultimate expression of those goals is the spec itself: if goals enjoy owner buy-in and are clear to everyone, the spec ought to speak for itself. Make sure it's as specific as it should be.
- **Follow through**—Sure, you put it in writing, but the construction manager, contractors, and subs are used to having significant leeway. That makes sense: they are the ones held accountable for delivering the project on time and on budget. It takes a strong, determined negotiator to slow things down and insist on sticking with the original material priorities. That means you.

Want to hear more stories about how this works? Besides the strategies detailed here, check out related articles on integrated project delivery, taking control of your materials, and the top eight highest-impact product choices for green buildings.

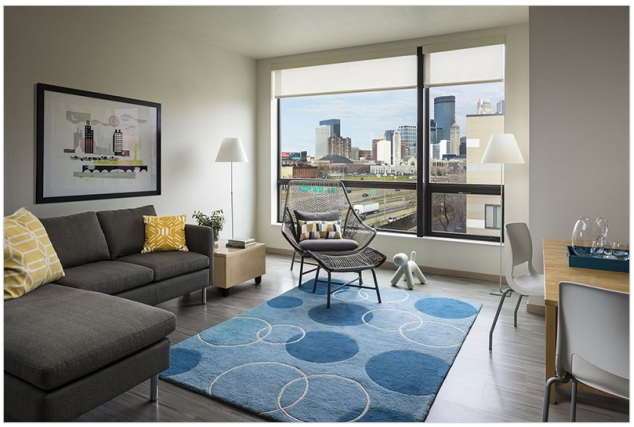

Photo: Don Wong Photo

The Rose, designed by MSR, broke new ground on material vetting for affordable housing projects.

Challenge Affordable Housing Framework, Mellblom describes "someone intimately involved in this process, who cares and is persnickety, thorough, and willing to be the bad guy—with a generous spirit." He continues, "They have to have access to the full site and to feel entitled to speak on behalf of higher goals." The architect is an obvious choice, but an owner's rep or contractor can also be a good materials champion, he explains. "For any aspiration that goes beyond the norm, you're going to need someone in that role."

5. Build a culture

Continuity of project staffing may also be ideal, but where it's not possible, building a strong project culture around materials can achieve the same effect.

On the University of California–San Francisco (UCSF) Medical Center at Mission Bay, for example, an 878,000 ft² LEED Gold-certified facility completed in 2015, the integrated project delivery method co-located the entire project team—architects, contractors, subcontractors, and owners—centrally onsite during construction.

Staff came and went over the seven-year span of the project, but "because we were all centrally located, it wasn't as big a challenge as it could have been," says Mary Lee, IIDA. She is senior interior designer at Stantec, the architect for the project in association with William McDonough+Partners. Each time new team members joined, an orientation session educated them on the project's material goals. When questions arose about a material, co-location made it easier to get answers. And when visitors passed through, the whole team heard the project's goals reiterated. "It comes up so often," says Lee, "it just becomes ingrained."

6. Communicate early and often

The project team for the Ventura County Medical Center Hospital Replacement Wing (VCMC)—a 226,000 ft² facility scheduled for completion in late 2016 and targeting Silver under LEED for Healthcare—experienced similar advantages from integration within a design-build project delivery method. The LEED coordinator for the architect (HOK) and her counterpart with the general contractor (Clark Construction Group) jointly facilitated meetings at the start of the project and as each new subcontractor came on board. These meetings helped open lines of communication, introduce the project's material goals, and highlight the ways in which LEED for Healthcare's material requirements differ from what subcontractors might have seen before.

They also dovetailed with another important goal, forming part of LEED for Healthcare's Integrative Project Planning and Design (IPPD) credit and prerequisite. These convene an integrated team at intervals over the course of the project to build a strong culture around the project's goals. "IPPD is a good concept for all projects," says Mara Baum, AIA, vice president and healthcare sustainable design leader at HOK. "But in healthcare, it addresses a particular challenge: healthcare projects can be very big and very long."

As at Mission Bay, the VCMC project team is co-located onsite, a strategy Clark's project engineer, Katie Palmer, credits with enabling contractors and architects to work closely to ensure that the spec upholds the material requirements and that the products arriving onsite uphold the spec. Clark is partnering with a number of design-build subcontractors in the venture, and "they've all been aware of the requirements since day one," says Palmer. "Communicating early and often has really been the key to our success here."

7. Let the program lead

Human embryos are very, very sensitive to VOCs.

At Stanford Children's Health's newly opened Specialty Services Center, which includes an in-vitro fertilization (IVF) lab, the owners required a zero-tolerance approach to material health issues.

To ensure continuity, the owner retained a consultant, Alpha Environmental, to chaperone the priority to completion. The consultant developed a conceptual design manual as the basis of design and conducted orientation and expectation meetings in person with the design team, contractor, and subcontractor field supervisors.

The same consultant reviewed submittals involving HVAC, medical gas supply systems, and finish materials; conducted surprise inspections during construction to make sure things were being installed as expected; and participated in the commissioning process, including air quality testing and fine tuning.

Even projects with a less sensitive user group might learn from this how-to list. It sets out four stages for material optimization—define, communicate, monitor, and verify—that could be applied universally.

However a team structures its commitment to material selection, it relies on the spec to communicate that priority in black and white. Not uncommonly, however, a spec serves out its time onsite as a paper weight or doorstop, its instructions going largely unread.

8. Buy a highlighter pen

The specifications for the Rose set out the project's goals and the materials with which to achieve them, but "not a lot of people were necessarily reading them," says Rhys MacPherson, AIA, project manager with MSR Design. In pre-installation meetings, when MacPherson walked contractors through the project's goals and facilitated conversations about them, it emerged that, for example, although the spec called for a low-VOC drywall compound, the drywall contractor's bid hadn't factored extended drying time into the schedule. A change order was required.

Image: Perkins+Will/HGA

On the Lucile Packard Children's Hospital Stanford, the design team ensured the spec was clear about what qualified as an equivalent product for substitutions.

MacPherson also found that the contractors' orientation didn't necessarily reach their employees, and individual workers on the site weren't reliably familiar with the project's goals. During closeout procedures especially, he'd find workers about to use whatever prohibited product they usually used—and they were surprised by his objection. "I'd go through and explain it," he says, "and they'd go, 'Oh! Okay, I get it.'" With hindsight, MacPherson says he'd have saved himself some trouble by making the spec language stronger, even highlighting particular provisions—especially those pertaining to drying times—in color, and requiring an orientation for everyone coming onsite.

"To be successful," he says, "you have to be a little bit bolder about it."

9. Define "equal"

Bolder, and clearer: "Being clear about what 'or equal' means is very important," says Megan Koehler, AIA, Perkins+Will's project architect on the Lucile Packard Children's Hospital Stanford (Packard Children's), a LEED Gold-targeted 521,000 ft^2 addition to an existing facility, scheduled for completion in 2017. If, for example, a product has been specified because it's PVC-free, then that criterion needs to be included in the specification, along with the ASTM performance standards and other must-haves. That way, when a proposed substitution seeks to demonstrate equal quality and performance, PVC-free becomes part of the comparison.

A policy on Packard Children's of enforcing use of the first-named spec has also helped get optimal products into the building, according to Nick Lo, project engineer at DPR Construction, general contractor for the project. Although the spec might cite three or four products to facilitate competitive pricing, the onus of risk in using a product other than the first-named one is placed on the subcontractor. Suggesting that a sub use the first-named spec ensures that the design intent is realized in the project, says Lo.

"The first-named product in the spec is the basis of design that the architect has implemented into the project," Lo explained. It should ideally meet all the design requirements identified in the specifications. Listing multiple options as acceptable helps to get the best price, but, says Lo, "it is ultimately the subcontractor's responsibility to ensure the submitted product also meets the standards outlined in the specs." These expectations, which include putting the cost of changes on the subcontractor, are communicated during bidding, says Lo.

UCSF Mission Bay's commitment to healthier materials made use of an independent materials consultant, McDonough Braungart Design Chemistry (MBDC), to screen some 130 finish materials for carcinogens, endocrine disruptors, and a variety of reproductive toxicants. When it came to substitutions, the team couldn't adequately assess a substitution unless it, too, underwent the materials screen. So the spec required contractors proposing a substitution to cover MBDC's fee for screening their proposed alternate.

"They took it seriously," says Tyler Krehlik, AIA, senior project manager for UCSF Mission Bay (formerly with Stantec, now with SmithGroupJJR). "Usually you get haphazard substitution forms and contractors trying to sneak stuff through in the submittal without actually asking for substitutions," says Krehlik, "but we got very well documented substitution requests—for materials that weren't even in the materials screen" because they weren't interior finishes. Of some half dozen re-screenings for interior finishes, none were initiated by contractors.

The enhanced level of documentation even turned up an adhesive not legal in California, which would otherwise have gone unnoticed in the assembly it came with.

Expanding Your Scope

One way in which specifications can do better, according to Steve Sheahan, a senior project manager with DPR, is in the assemblies that are typically bid out as design-build: curtain wall, fire suppression systems, smoke detection alarms, and steel stairs, for example.

10. Manage what you can't spec

Sheahan sees aligning these self-contained components with project health goals as a frontier for the materials selection, and he suggests that their basis of design spec should comprise not just functionality but also the health goal that the rest of the team is working to achieve. "Design-build contractors aren't around during pre-construction and programming, so their companies are not aligned with the project's healthy building initiative," says Sheahan. "We need architects to start working on these companies" to exert influence in addition to "researching the materials that are in their products."

"We spec a lot, but there's a lot we don't spec," says Greg Mella, FAIA, director of sustainable design at SmithGroupJJR. An example from Mella's experience with the Brock Environmental Center is underground pipe, an item outside the scope of an architectural spec. Early involvement of the Brock Center's mechanical, electrical, and plumbing subcontractor, however, alerted the team to the local authority's requirement for PVC piping in time to source an acceptable alternative—high-density polyethylene (HDPE).

"We often focus on bringing the contractor in early," says Mella, "but really it's the subcontractors who are the least connected to the reasons for selecting a product, and they need to play a role."

11. Use the force … of LEED and LBC

Widening the circle, strengthening and clarifying the specifications, and walking everyone through them can prevent inferior substitutions happening by mistake or misunderstanding. But too often they happen accidentally-on-purpose: an architect specifies a green material. It's a little more expensive, maybe, and installers may be less familiar with it. The contractor prices it knowing that the subs don't want to use it (that is to say, high).

As the project goes along, the contractor begins to talk to the owner about alternatives to get this "expensive" product off the project. No one contacts the manufacturer, certainly not in time. And when the manufacturer can't supply tons of the specified product at the last minute, the status quo kicks in. The owner might get back some of the contractor's mark-up on the original material.

"That's where having materials credits in a green building rating system, and doing a project that's actually going to certify under a green building rating system, becomes an important counter to this rush to substitute everything," says Robin Guenther, FAIA, principal and sustainable healthcare design leader at Perkins+Will. Guenther suggests that part of the rationale behind material health credits may be a recognition that "a lot of stuff falls off between the specification and actually getting it into the project, particularly for new-entry products, which are trying to build market share, trying to transform the market, and may be slightly premium priced."

12. Rally manufacturers

One company chronically disadvantaged in accidentally-on-purpose substitutions, a manufacturer of linoleum flooring, is responding by changing its business model. In answer to three factors that regularly prevent its flooring being used to full advantage—opaque pricing, improper installation, and improper

When Goals Collide

Health is never a standalone priority; it's always part of a larger balance. For the Rose—a 90-unit mixed-income housing development in Minneapolis—participation as a pilot project in the Living Building Challenge Framework for Affordable Housing meant equally ambitious objectives for both health and energy. The decision to install a dedicated outdoor air system (DOAS) nearly brought them to a standoff.

Typically, multifamily housing relies primarily on a pressurized corridor to ventilate units by way of the gap under each unit's door. This ventilation is conditioned (heated or cooled) but not properly humidified or dehumidified, and filtration usually just protects the motor. Additional fresh air comes through windows or finds its way through walls. Heat lost through the exhaust system is not ordinarily recovered, and the typical location of exhaust vents on side walls results in pressurization issues on building façades and potential re-infiltration of exhaust air.

The DOAS system installed at the Rose is different. It provides fresh air directly to each apartment via variable refrigerant flow (VRF) units, explains Rhys MacPherson, AIA, project manager with the Rose's architect, MSR Design. The system properly mixes and tempers the air, humidifying it in winter, dehumidifying it in summer, and responding to current conditions during the shoulder seasons. A five-stage filtration process removes particulates and pollution, and ventilation is supplied at double the code-mandated rate. Energy is recovered from bathroom air before the air is exhausted. Kitchen exhaust is bundled and discharged through the roof to avoid distorting air pressure on the facades and to keep cooking smells away from open windows and the courtyard.

Energy-wise, however, the DOAS imposed a penalty. "We could have easily saved 8 to 10 EUI [energy use intensity] and been right at net zero ready," says MacPherson, "but we felt supplying fresh, filtered air was more important than just driving down the EUI of the project."

To keep the DOAS's health benefits in the design and still meet the 2030 Challenge benchmark to reduce energy consumption by at least 70%, the team decided to notch up the performance of the building envelope. A fluid-applied membrane and high-performance windows enabled the building to achieve an EUI of 31 kBtu/ft^2·yr (a 72% reduction compared to its building type baseline EUI of 111). Plus, those envelope details further improved the barrier to highway pollutants, including noise.

In the end, a commitment to a community solar energy may bring the project to net zero after all.

Photo: Prakash Patel, courtesy SmithGroupJJR

"There's really no way to do it without 100% buy-in from everybody" according to the construction manager for the Chesapeake Bay Foundation's Living Building Challenge-certified Brock Environmental Center.

maintenance—the company is rolling out an extended suite of services.

In the healthcare, education, large-scale retail, and senior care sectors, the manufacturer will no longer supply linoleum to just any installer that orders it. Instead, the company will work with installers in which it has confidence and will develop transparent pricing to show what each element of the contract should cost. In regions without reliable installers, the company will perform the installation itself. The manufacturer is also seeking to advance discussions about installation further up the construction sequence, offering input to the general contractor on concrete admixtures.

Further, to prevent the naturally anti-microbial linoleum being wrecked with harsh chemicals, the company is advancing maintenance discussions, pre-empting cleaning services for which mark-ups on chemical cleaners are a major revenue stream.

Business models in which the manufacturer is a more active participant in achieving the spec are already finding a welcome on construction sites: "We have a couple of products where the installers are also the manufacturers," says Kohler, of the Packard Children's project. "It's more straightforward, and you get what you expect."

13. Call the material police

In California, hospitals are required to retain an inspector of record (IOR) to ensure that materials installed accord with approved plans and specifications, and that every material coming onsite has an approved submittal. Nonetheless, healthcare project teams establish their own quality control programs internally: no one wants to fail an IOR inspection.

On non-healthcare projects, material verification may be more informal. During construction of the Rose, MacPherson walked the site almost daily: "I was nicknamed the material police," he says, "because I kept asking for materials to be removed."

Typically it's the architect or a sustainability consultant that sources and documents building products to support a project's health goals, and who may therefore feel a heightened commitment to getting them onsite. On the Brock Environmental Center, however, Hourigan Construction took on materials sourcing and documentation as part of its submittals process, approaching manufacturers in conjunction with the project's subcontractors to obtain disclosures.

That effort—ultimately comprising some 4,000 pages and 10,000 person hours, says Park—was more than Hourigan had bargained for, but it formed the basis for highly effective supervision of the spec's implementation. Park was onsite constantly as soon as the project broke ground and so was able to monitor the use of the materials he had found, vetted, and documented. "Obviously, after months and months of work, you have a vested interested in making sure that your work is actually used and [that] what you found is actually onsite," he says.

14. Test it

But how would you know if you missed something?

Before the Rose's residents moved in, the air quality in each apartment was tested to ensure that VOC levels registered below the target of 500 micrograms per cubic meter (mcg/m^3). An affordable housing budget wouldn't ordinarily stretch to air quality testing, but health and materials research being conducted at the Rose by the Parsons School of Design and the Healthy Building Network provided grant funding. The testing registered VOC levels in typical units between 20 and 30 mcg/m^3—almost nothing.

Image: HKS Inc.

The Dell Seton Medical Center at the University of Texas is pursuing the entire suite of new Building Product Disclosure and Optimization credits in LEED v4.

But these numbers weren't easy to get. On initial testing, VOCs registered much higher, and it turned out the contractor was using prohibited items for punch list closeout. "It wasn't that anyone was trying to do the wrong thing," says MacPherson, "but they had been directed to finish as quickly as possible." The conventional close-out procedures with non-compliant products were stopped, their impact on air quality goals explained, and the building flushed out before being re-tested—for which the contractor took responsibility.

Initial testing also found two units in particular with soaring formaldehyde levels. Forensic work on the contractor's part revealed that the cabinet manufacturer had supplied added-formaldehyde cabinetry to those units due to a delivery error and timing issue. "Without the testing, we would never have known," says MacPherson. Having also used thermal imaging to examine walls and set temperatures as part of the project's 72% energy use reduction, MacPherson sees verification as "a whole different process now, well beyond the visual world. Performance definitely requires multiple ways of examining and measuring, beyond what the eyes see."

Zooming Out

In the long term, regardless of their health credentials, materials have to prove themselves through use. Qualities such as low life-cycle cost, ease of service and repair, enduring aesthetic appeal, and a maintenance regime that saves time will ensure products chosen for low toxicity live out their useful lives and are re-ordered when the time comes. "We have to be careful not to lose track of the reasons we picked things," says Mary Phillips, UCSF Medical Center's project manager for interior design, "but hopefully the products are proving themselves the best choices for many reasons, not just their chemical aspects."

Because it entails so much work, getting preferable materials into a building is extraordinarily intense. But materials are ultimately a single—important—aspect of a larger health effort, says Mara Baum: "You can have the best materials in the world and be able to install them on the project," she says. "But if you don't incorporate that materials focus into a holistic approach, all of the great work you did can be lost."

As examples of equally important elements in a holistic approach, Baum points to:

- sequencing and installing materials to enable them to function as intended
- commissioning mechanical systems to ensure optimal ventilation
- duct cleaning to protect air quality
- preventing moisture intrusion
- cleaning with low-toxicity products

"There are a lot of ways you can mess up," she says, "and when teams put all of their eggs in one basket"—like looking only at hazardous ingredients in materials—"they may miss some of the opportunity. Healthy building needs to be a much bigger picture."

EDITORIAL

A Quarter Century of Changing the World

Going on 25 years, we still don't have all the answers. What gets us excited about the next 25? Working with you to ask the right questions.

by Nadav Malin and Alex Wilson

Enough with all the eco-babble! Just give us the answers!

Those words were the most memorable of the extensive and varied feedback we received from readers after introducing *Environmental Building News* in 1992.

The comment arrived on a paper reader-response card we'd inserted into the printed issue on its way to the post office.

ISSN #1062-3957

Environmental Building News

A Bimonthly Newsletter on Environmentally Sustainable Design and Construction

Volume 1, Number 1 July/August 1992

Welcome to *Environmental Building News*

Buildings have a tremendous impact on the environment. In North America, buildings and the building industry account for about 30% of carbon-dioxide emissions, 35-40% of ozone depletion, 20-30% of municipal solid waste, vast quantities of natural resource consumption, and dramatic loss of open space each year. What can we do about it? How can you and I as builders, designers, and others involved in the building industry have an impact in turning the tide on this environmental destruction?

The challenges we face in bringing greater environmental sustainability into the building industry seem tremendous—indeed we need to be careful not to feel discouraged. Yet the opportunities, too, are tremendous. There is so much room for improvement that the strides we can make as an industry are huge.

Environmental Building News seeks to be a voice in the transition to environmentally sustainable building practices. In the pages of EBN we will expose the faults in our current practices, but more importantly, we will present the options we have for turning things around. We will provide a wide range of information on environmentally sustainable design and construction—from leading-edge case studies of sustainable design that will stimulate your creative juices, to hands-on construction details that will help you integrate these ideas into your daily work.

In each issue of EBN we will provide one or two in-depth feature articles—like the pieces on rigid foam insulation and site-work in this issue. In these articles we will try to probe deeply into an issue—getting into more detail than is found in most newsletters. Also in each issue, you will find information on new products and materials, news about environmental trends that relate to construction, reviews of pertinent publications and events, and a regular reader's forum.

Now here's where we need your help. We want *Environmental Building News* to be *your* publication. We want to direct it to your needs and interests. To do this we need to hear from you. Send us your thoughts, your opinions, your suggestions of what we should cover. If you are using construction details that you feel particularly good about, or if you come across interesting new products or materials, let us know about them. Also keep an eye out for information resources that would benefit EBN readers: conferences, seminars, books, periodicals, obscure technical publications...we'll review these materials and pass the information on to our readers.

Finally, thank you. Launching a new publication is a bit scary. When we mailed our first promotion a little over a month ago, we really had no idea what the response would be. We have found tremendous interest. While that makes us feel good about the prospects for EBN succeeding, more importantly it gives us a sense of optimism about meeting the broader challenges we face. We've heard from dozens of builders and architects that the time is right for this publication. Let's hope that the time is also right for a major shift within the building industry toward environmental sustainability.

Alex Wilson

(continued on page 11)

In this issue

printed on recycled paper

Rigid Foam Insulation and the Environment

Ozone depletion and global warming are two of our most serious environmental problems—and foam insulation materials containing CFCs (chlorofluorocarbons) contribute significantly to *both* of these problems. The environmentally concerned builder or designer should make it a highest priority to avoid them. Even many of the non-CFC alternatives that manufacturers are now switching to are still damaging to the environment—though less so than CFCs. This article takes a detailed look at various types of foam insulation materials—how the materials are produced, what their environmental impacts are, and what the alternatives available to you are.

Rigid foam has played an important role in the energy-efficient construction revolution we have witnessed since the mid-70s, permitting wall and roof R-values to be boosted dramatically with only minimal increases in wall thickness. The foam has such a significant effect in part because it covers the framing members, thus reducing the thermal bridging that occurs through framing members when only cavity-fill insulation is used. The increasing popularity of foam-core stress-skin panels—some of which are produced with CFC-based foams—for use in both timber frame and structural panel (frameless) buildings is further increas-

Image: BuildingGreen, Inc.

The first edition of EBN did not yellow with age. It's just that In 1992, recycled paper wasn't white.

As we now begin our 25th year of publishing, we still like to give our readers plenty of context so that you can understand our recommendations and make your own decisions. And, with your help, we'd like to think we're asking the right questions. Sometimes that's more important than having all the answers.

Silver anniversary

In 1992, the world was different. *Environmental Building News*—now embedded in BuildingGreen.com—was the first North American publication devoted to the nascent field of green building, and the Internet was mostly for scientists.

In 1992, the U.S. Green Building Council didn't exist. LEED, the program that eventually came to define green building in the U.S., wouldn't emerge for another eight years. The only national organization in this space was the American Institute of Architects' (AIA) Committee on the Environment.

Before we launched *EBN*, BuildingGreen (founded in 1985) was a technical writing company that split its time between freelance writing for various magazines and contracted

Photo: Alana Fichman/BuildingGreen, Inc.

BuildingGreen believes in having fun while saving the world.

projects for such entities as utility companies and state energy offices. The contract work kept food on the table, but the freelance writing was more satisfying—especially when we got to write about the issues that most excited us.

Our promise to you … then and now

We launched *EBN* to help transform the building industry—which has one of the biggest environmental footprints of any industry.

We didn't know much about publishing when we started out, but the desktop publishing revolution and new-fangled laser printers made it a lot easier to break into the business without much capital.

And if we were publishing our own newsletter, we reasoned, we could write about whatever we and our readers were excited about—rather than having to please editors in New York City offices, or kowtow to the advertisers that are the true customers of most magazines (and now, most websites).

Our promise, in the very first issue of *EBN*, was this:

> *Environmental Building News* seeks to be a voice in the transition to environmentally sustainable building practices. In the pages of *EBN*, we will expose the faults in our current practices, but more importantly, we will present the options we have for turning things around.

Our most disruptive articles

We've had that promise in mind ever since, and it's led us to sacrifice some sacred cows in the pursuit of the truth.

In many ways, the best part of writing *EBN* over the years has been the opportunity it affords to call up leaders and experts in the field—people like you—and learn from them. The insights we gleaned from that wide array of smart, engaged leaders provided the basis for lots of transformative articles, including:

- Our 1997 feature article on disposal of preservative-treated wood called for a phase-out of chromated copper arsenate (CCA); that came about in 2002.
- A widely referenced 1999 piece, "Small Is Beautiful," noted the significance of house size on environmental performance.
- Our 2004 article on brominated flame retardants in building materials first brought this concern to the attention of building professionals.
- In 2007, "Driving to Green Buildings: The Transportation Energy Intensity of Buildings" pointed out that more energy is often used getting to and from a building than in the building itself.
- Our view of a topic typically evolves as we conduct research, but rarely as dramatically as in 2009 when we were excited about the growing practice of putting wind turbines on buildings. The headline of that piece, "The Folly of Building-Integrated Wind," shows you where we landed after we followed the data.
- We were as shocked as many others about the negative impact of common foam insulation on global warming when we researched and covered this topic in 2010.
- In one of our most-cited articles, we asked in 1994, "Should We Phase Out PVC?" Twenty years later, the conversation continues, as we chronicled in "The PVC Debate: A Fresh Look."

There has never been a shortage of topics for us to explore and demystify for our readers. If any of our articles have affected your practice over the years, please share those stories on the attached reader-response card…oh, sorry…in the comments online!

More disruption to come

We see the next 25 years as even more pivotal and disruptive than the last.

Climate change is a slow-moving crisis. As a society, we have been slow to respond, but that's about to change. People have survived and thrived on this planet for millennia only by rising to any occasion when the stakes are high enough. Winston Churchill's clever quip applies to people

everywhere: "You can always count on Americans to do the right thing—after they've tried everything else."

The same dynamic applies to other ecological challenges: loss of habitat and biodiversity, access to clean water, and toxic releases affecting both our built and natural environments.

Eventually, there will be a response to these problems on the scale of the Manhattan project, the Marshall Plan, or the New Deal. When that happens, those organizations that have been proactive in developing and implementing climate-friendly, ecosystem-safe, low-toxicity solutions will be positioned to capitalize on their foresight.

That's what we mean when we talk about "market transformation" in the context of green building. And you're a big part of that change.

Our 25-year mission is all about you

Like many of you, we are committed to helping companies and institutions do the right thing—taking steps that make economic sense even in current conditions but are essential to be prepared for the future. We are doing that on the pages of BuildingGreen.com, in our curated lists of BuildingGreen Approved products, and through online help tools like LEEDuser.

We are also doing more and more of this work—informing, advising, teaching, training, and facilitating—on a custom basis to help you make an impact.

Whether it's researching and writing an authoritative report for a professional association, helping a real estate owner implement a smart list of preferred products, or reviewing construction details in plans and specs, we've always leveraged the reach of our publications and websites to solve our clients' specific problems. Consulting and other custom services were the foundation of our business before we created *EBN*, and they have been a core part of our offerings ever since.

We have an ambitious mission:

> To bring about a healthier relationship between human society and the natural world by helping building professionals create and nurture high-performance, resilient, and inspiring buildings and communities.

We can only achieve that mission by leveraging both our publications and our direct services to help realize great buildings and communities. We can't afford to wait another 25 years before seeing meaningful results.

How can we help you today?

For more information

BuildingGreen.com/about

NEWS ANALYSIS

Chemical Risk Assessments Come to LEED v4

A controversial pilot credit developed with the American Chemistry Council looks into toxic exposure risk from building materials for installers and occupants.

by Paula Melton

If there's a carcinogen in your insulation but you never come in contact with it, can the carcinogen give you cancer?

Of course it can't. But if you or someone else—like a factory worker—does come in contact with that substance, a deadly illness could result. Knowing that, might it be better to simply eliminate the chemical, or replace it with a less toxic alternative?

A battle has been raging in the green building world for years about the relative merits of flagging and eliminating *hazards* (like carcinogens) versus assessing and managing *risks*

Photo: Ian Boggs. License: CC BY-SA 2.0.

Lightning is a hazard whose presence we cannot control; we can only manage our risk of being harmed by it. With human-made chemicals, should the same logic apply?

(the likelihood that people will come in contact with carcinogens and get cancer).

It's a nuanced and often contentious conversation, and a new pilot credit in the LEED v4 rating systems could help resolve some of the conflict—or could make it worse, depending on whom you ask.

A new approach

The new pilot credit, Building Material Human Hazard & Exposure Assessment, was crafted by the U.S. Green Building Council (USGBC) in partnership with the American Chemistry Council (ACC). (Pilot credits are temporary incentives introduced to the LEED rating systems to help explore future permanent changes. Project teams can attempt them under the Innovation category while providing feedback on the requirements.)

The credit appears to be an answer to longstanding chemical-industry critiques of LEED's approach to product selection in v4. Other recent LEED updates have responded to these critiques as well; see USGBC, Chemical Industry Reach Historic Compromise on Product Optimization and New Ways to Meet LEED v4 Ingredient Disclosure.

It addresses exposure to chemical hazards during two phases of the

Hazard and Risk

"Hazard" and "risk" are two words that laypeople tend to use interchangeably, but in toxicology they are distinct. Consider this overly simplistic but useful formula:

Risk = Hazard x Exposure

To say it in slightly more complicated way, risk is the statistical probability that someone will be harmed. This probability is based on 1) how dangerous something is and 2) how someone is exposed to it—how it gets in, how much of it, how often.

Lightning is a hazard. It's so hazardous that it can cause grievous, permanent harm (including instant death) if it touches any part of you. Let's give this hazard a random but high number: a bajillion. Most of the time, for most people, the exposure is effectively zero, so your risk of being harmed is also zero. But if exposure goes up to 1, that instantly makes your risk of grievous harm 1 bajillion. Not good.

Since we can't control whether lightning is present in our lives or not, our best bet is to avoid getting exposed—for example, by staying out of swimming pools during thunderstorms. Listen to the lifeguard: this risk is just too great.

But what about very hazardous things whose presence in our lives we can control? This is where it gets tricky—and where the arguments begin.

We rely heavily on expertly crafted chemical formulations to help us create comfortable, energy-efficient, attractive buildings. But those formulations often come with tradeoffs, including carcinogens and many other hazards. Like lightning, these can be deadly—but, much like lightning, they can't hurt us even a tiny bit if we are never exposed to them.

Unfortunately, there may be multiple points during the life cycle of building products at which people are likely to come into contact with these hazards—especially during manufacturing of the chemicals themselves (including in manufacturing waste streams) as well as during manufacture of the products they're put into. Sometimes that exposure could also happen during installation, use, or demolition, or after disposal.

But with chemical exposure, it's no longer as simple as a lifeguard blowing a whistle when the thunder rolls in. It's not always clear which stages of the life cycle might result in exposure—let alone how much, how many times, and through what pathways.

To help with that, chemical companies and product manufacturers perform internal risk assessments to evaluate the likelihood that their products might make people sick or pollute the environment. These assessments depend on assumptions about who's likely to handle the materials and what they're likely to do with them. But these assessments and their contents—including what hazards the item contains and the assumptions used to judge the likelihood of exposure—typically are not available to those who purchase or use the product.

So some health advocates push for disclosure of hazardous ingredients through tools like the Declare label or the Health Product Declaration (HPD); they claim this allows building professionals to use their own judgment to make better-informed decisions. Many also push for minimizing hazardous ingredients in products or choosing alternative products that contain no highly hazardous contents. They prefer that approach for two reasons: first because they don't trust industry-funded risk assessments, and second because many chemicals are toxic to the environment as well as to people. Even if the risk to specific human populations is low, hazardous substances can escape into the environment and affect local and global ecosystems. It's very hard to do a risk assessment that includes all potentially affected species.

Historically, the mainstream chemical industry has disagreed with these "hazard-based" approaches. End users might actually end up making poorly informed decisions, they argue, by misinterpreting the information that's provided. In choosing to avoid hazardous ingredients, users may opt for lower-performing products—even though, manufacturers claim, the risk their products pose to people's health is low.

But many green building advocates aren't willing to accept industry assurances of safety at face value. They argue for greater transparency about hazards and the likelihood of exposure throughout the product's life cycle so that independent experts can perform their own risk assessments.

Read more about risks and hazards in these articles:

Building Products and Health: A Look at Risk vs. Hazard

The Five Hazard Warnings You Can Usually Ignore

Green Chemistry Meets Green Building

Toxicological Riddles: The Case of Boric Acid

product life cycle—installation and use. To achieve the credit, project teams must select five products that have undergone the required assessment; these must come from two different manufacturers.

The assessment is performed by the product manufacturer and has two steps:

- The **hazard assessment** requires screening of product ingredients to 1,000 parts per million (ppm) based on the same criteria already required for some manufacturers by the U.S. Occupational Safety and Health Administration (OSHA). This is the exact information you would find in a safety data sheet (SDS)—but for most manufacturers of finished articles (rather than chemicals and chemical mixtures), the SDS is voluntary.
- The **exposure assessment** must align with one of a variety of regulatory frameworks, including the type of assessment used to consider chemicals to be banned through the European Union's REACH program (abbreviated ECETOC TRA). The assessment must calculate a risk score from all possible exposure pathways (oral, respiratory, etc.) and express the results as a *risk characterization ratio* (RCR) that must be equal to or less than 1.

The assessment assumptions and results are submitted directly to Green Business Certification Inc. (GBCI), which will determine whether the assessment meets the requirements; disclosure to project teams is not required.

Does it pass the laugh test?

Officials at the U.S. Green Building Council (USGBC) told BuildingGreen that feedback on the pilot credit so far has been mixed.

"Because we did this with the members of the American Chemistry Council, there's very positive feedback on that side—basically a feeling that there's an alignment between the kind of science they do and potential

credit language," said Scot Horst, chief product officer at USGBC. He cites a historical "tendency to talk *at* each other and not accept each other's terms" and sees the pilot as a way to move toward dialogue rather than debate.

"This stuff is complicated," adds Brendan Owens, P.E., USGBC's chief of engineering, acknowledging that some concerns about these types of assessments are legitimate. "There are certainly risk-assessment scenarios and strategies that I don't think pass the laugh test." Such approaches have led to mistrust, he adds, but he claims that these misguided methods shouldn't color all attempts at risk assessment—which is used by regulatory agencies all over the world to set limits on toxic chemicals in drinking water, wastewater, and consumer products, and more. "There is a pretty broad spectrum of practice, and this gives us the ability to start to unpack what some people are considering an all-bad thing. Hopefully the outcome of this credit will start to show people it is much more nuanced than that."

BuildingGreen sought feedback on the credit language and the referenced standards from Frankie Wood-Black, Ph.D., principal at environmental consulting firm Sophic Pursuits and a member of the American Chemical Society experts' panel. She does not work with the building industry or LEED.

Wood-Black said the ECETOC standard is designed to look at "how the material is to be used, and the potential routes of exposure, throughout the material life cycle—creation through disposal" and is a widely accepted risk-assessment methodology. "If you are planning on registering your material in the EU, you are likely to be performing this type of assessment" already, she added. Likewise, the Globally Harmonized System is internationally accepted as a classification system and aligns with newer regulatory screening and disclosure requirements in the U.S.

"The difficulty comes into play when there are conflicts between the references or a lack of information," continues Wood-Black. Manufacturers sometimes "have the data for a closely related material but not the actual material itself," she explains, "or there is limited experimental information on a particular substance, i.e., only one or two data points." In these cases, models must be used to extrapolate results, which requires making assumptions and using professional judgment. "This has been an issue in past SDS reviews and risk assessments, resulting in conflicting requirements or recommendations."

That has always been par for the course with risk assessments, Wood-Black says. She was more concerned about the risk characterization ratio. "I can see some potential issues in how the data is rolled up into a single number," she says. "Given that there may be different tools involved, arriving at a single number may be a bit problematic." She adds that single ratios may complicate decision-making in some cases. "Which is better? Using a very, very small amount of really bad stuff … or a very large amount of bad stuff to accomplish the same task? It depends upon the particular situation and the balancing of the various potential exposures and risks."

Wood-Black concluded, "Hopefully, because it is a pilot program, the particular issues will spotlight some of the more difficult aspects of evaluating alternatives."

Can it be trusted?

"We do need to start talking about exposure assessment," says Tom Lent, policy director at the Healthy Building Network (HBN), a nonprofit that advocates for less-toxic building materials and products. Yet he also has concerns about past attempts to use a purely quantitative approach to such a complex issue.

"With all these things, the challenge is in the numbers," Lent told BuildingGreen. "What do we have the numbers on, and what are the estimates for all the numbers we don't have?" Although risk-related probabilities can have a large margin of error, for example, they are often summed up as a single number.

Lent continues, "This is a process where you're multiplying factors together, so you're multiplying your errors." This process, he says, can have the effect of hiding, rather than exposing, things we don't know. Although he agrees that "estimating is better than zero," Lent also argues that it's "very open for abuse, [which is] the reason why you get such a strong reaction against risk assessment in the environmental community." (Lent has published detailed critiques of the pilot credit in Healthy Building News and on the Pharos Project website.)

Architects BuildingGreen contacted had some concerns as well.

"Risk assessment should not be used to substitute for ingredient inventory and hazard screening," argues Russell Perry, FAIA, principal at SmithGroupJJR, and a board member for the Health Product Declaration Collaborative. "In fact, ingredient inventory and hazard screening are the first two steps that must precede risk assessment." Perry says he is willing to support risk assessment, provided the process is transparent: "Give us the underlying science as a starting point—ingredient disclosure and hazard screening—then produce a risk assessment that is transparent as to uncertainties."

Perry adds, "Remember: it was risk assessment that proved that tobacco smoke was not a health hazard."

Others may hesitate to adopt the credit due to professional liability.

"Risk is risky," quipped Michael Davis, FAIA, principal at Bergmeyer Architects, a leading expert on the legal issues associated with ingredient transparency. "Architects *must* say that we are unable to evaluate whether the presence of a substance in a building material presents a risk of harm" in order to remain within their own

professional scope, he claims. "We can read and assemble data compiled by others on the presence (or lack thereof) of hazardous substances, as defined by others. This is one of the best practices that keep us within the parameters of what our professional liability insurance covers."

The structure of the credit—which requires disclosure directly to GBCI rather than to architects or contractors—could mitigate such concerns.

"We aren't gutting the rating system"

Yet Owens and Horst believe most fears about the new pilot credit will prove to be unfounded—and they expressed hope that the process will ultimately lead to major environmental progress.

"When you look back on some of the mistakes that we've made in the past … they didn't tank the entire system. We learned from that mistake, and we moved forward." Although Owens views the newer, more industry-friendly pathways in LEED as a promising complement to other material-related options, "if they end up being mistakes, it's not the end of the world."

Horst concurs, while acknowledging that USGBC is making concessions to players that, according to many environmentalists, have a questionable track record. "We've had a powerful industry that has seen us as a threat to their business," he said. But fighting didn't work. "Has telling them they're wrong all this time been a good way to get them engaged on a massive scale?"

Horst sees the potential benefits as far greater than the risks. "I feel pretty strongly that it's okay to try some different things," he said. "We're not gutting the rating system."

These changes are relatively minor in comparison to the scope of LEED as a rating system. But in partnering with the chemical industry, USGBC has disappointed groups that had hoped to see LEED as a market driver of ingredient transparency and hazard avoidance.

NEWSBRIEFS

Leadership Transition as Healthy Building Network Grows

HBN founder Bill Walsh will shift to heading strategic development as president of the nonprofit, while affordable housing leader Gina Ciganik becomes CEO.

by Tristan Roberts

The Healthy Building Network (HBN), a national nonprofit known for advocating for getting toxic chemicals out of buildings and building materials, has announced a leadership transition.

Bill Walsh, who founded the organization in 2000, is passing executive leadership responsibilities to Gina Ciganik as CEO. Walsh isn't going anywhere: he will serve as president of the board and continue working full time at HBN, where he'll head up strategic thinking and collaborations for HBN and will do more to get HBN's message out publicly. In addition, Larry Kilroy is taking on the role of chief technology officer, while Susan Sabella remains chief operating officer.

Walsh credits the organization with helping bring "health from a niche to a central issue" in the building industry, he told BuildingGreen. "We have never had more opportunities, more demand for our time and services," he said.

According to Walsh, the organization has doubled in size in recent years to 14 staff people, and he hopes to attract larger sources of funding and grow further. "We are preparing ourselves to lead the coming large-scale transformation in the way that products are made, which will be driven by radical transparency, open innovation, and a commitment to environmental justice," Walsh said in an official announcement.

Ciganik joined HBN in 2015 and piloted the organization's focus on healthy materials in the affordable housing sector, including through its HomeFree initiative. Previously, she worked for 18 years at Aeon, the Minneapolis-St. Paul area affordable housing developer, most recently as vice president of housing development. Notably, she led development of The Rose, a 90-unit apartment in

Photos courtesy HBN

HBN's new leadership team, clockwise from upper left is: Bill Walsh, president; Gina Ciganik, CEO; Susan Sabella, COO; Larry Kilroy, CTO.

downtown Minneapolis that set a new standard for material vetting use in affordable housing.

Ciganik's work at HBN has been motivated by "finding solutions that everyone can access," says Ciganik. Through projects like the Rose, and work through HBN in supporting similar projects around the U.S., Ciganik hopes to spur market transformation. Someday, "no one will be able to use the excuse that they can't find healthy, high-performing material" that's affordable, she told BuildingGreen. "Someday, doctors will be able to write a prescription for a healthy place to live as a way of healing," she predicts.

Photo courtesy BuildingWise

The Bloc in downtown Los Angeles will be among the first projects to undertake BREEAM In-Use. The Bloc is undergoing renovation into an open-air urban destination.

BREEAM USA Jolts Existing Buildings Market

The forebear of all green building rating systems, LEED included, is arriving from the U.K. as an accessible alternative.

by Tristan Roberts

Before there was LEED, there was BREEAM.

While the LEED rating systems might have more buzz, the Building Research Establishment Environmental Assessment Methodology is the world's oldest and most widely used green building rating system. Created in 1990 by the Building Research Establishment (BRE) in the U.K., the system is responsible for 544,600 certified projects worldwide, according to BRE. (By comparison, LEED currently has around 75,000 certified projects.)

Now BREEAM is coming to the U.S. through a partnership announced by BRE and BuildingWise, a U.S.-based LEED certification consultancy. A new organization, BREEAM USA, will make the BREEAM In-Use standard available to commercial buildings of any size, age, and condition. The standard offers benchmarking and certification for existing buildings.

BREEAM In-Use available to all commercial buildings

According to BREEAM USA, BREEAM In-Use is an "independent, science-based, and inclusive assessment" that gives building managers and owners a framework for improving their operational sustainability as well as reducing energy and water costs.

Barry Giles, CEO of BuildingWise, will lead BREEAM USA as CEO. Giles told BuildingGreen, BREEAM is "a way for getting in this vast number of existing buildings that don't have an option for a certification program." LEED for Existing Buildings (LEED-EBOM), the best-known certification of its kind, includes a number of prerequisites. Most significantly, the current version of its energy-efficiency prerequisite requires a minimum Energy Star score of 75, which by definition excludes 75% of buildings from LEED eligibility.

Giles—a LEED Fellow who helped launch LEED-EBOM as a founding member of its Core Committee and who actively consults on LEED-EBOM projects—laments the current market response to LEED. Its uptake has been poor, he notes, and with LEED v4 raising the bar, he worries that relief is not in sight. "Even Class A buildings are beginning to reject LEED recertification because of cost, paperwork, and time," says Giles. (Recertification is required every five years in LEED-EBOM.) "The smaller they are, the harder it is to offer a fiscally sound package to them," he says. That's where BREEAM In-Use comes in: for a flat fee, it helps projects benchmark themselves and gives them a road map forward.

The U.S. Green Building Council (USGBC), for its part, is investing in its LEED Dynamic Plaque as a magnet for attracting building projects. Responding to the news about BREEAM USA, Scot Horst, chief product officer at USGBC, told Bloomberg news, "We need to keep coming up with innovative ways to get people onto a path to improvement. We see the same need. We just have different approaches."

It starts with an online questionnaire

Engaging with BREEAM USA will start with an online questionnaire that building owners will pay $1,000 to access for up to a year, says Giles. The questionnaire is in three parts:

- Part one covers the asset: the building, construction date, materials used, glazing type and percentage, etc. "With that, we're able to calculate quite well what

the energy consumption should be," says Giles.

- Part two covers the operations of the building. "Nine-five percent of the questions are associated with production of operational data," according to Giles.
- Part three covers the tenants. According to Giles, there is "a series of questions to give themselves a rating on how they deal with the space that they lease, rent, or borrow."

"If you're savvy with your building, it's probably not more than a week in total filling the questionnaire in," says Giles. That's not a week in front of the computer; plan on fishing around for some data. You get scored as you go, and each question leads to additional questions that, according to Giles, provide a roadmap to the next level of success. For example, if you answer "yes" to having a water meter, the next question asks whether you have a year's worth of water bills, and a subsequent question asks about sub-metering. There are no prerequisites, emphasizes Giles.

That initial score is unverified. The next step, if a building owner wants certification, is to hire an independent third-party assessor licensed by BREEAM USA who will come onsite and verify the data (at a cost based on the assessor's bid). "The assessor's job is to assess, not to consult," notes Giles. Their report is sent to BREEAM USA for quality control, and BREEAM may ask the assessor for follow-up information. If it all passes muster, BREEAM will issue an official certification.

Along with energy and water, BREEAM covers a total of nine environmental categories, including waste, materials, pollution, health and well-being, land use and ecology, transport, and management.

Fundamentals unchanged from U.K. origins

While Giles has his eye on what he counts as 5.6 million uncertified existing buildings in the U.S., "Our biggest focus is to have well-trained assessors out in the marketplace before having a flood of buildings." BREEAM USA will offer assessor training starting in October 2016, but it is also starting an "early adopter" program for buildings now.

BREEAM is being Americanized, says Giles, though its fundamentals won't change, in order to maintain its international relevance. For example, BREEAM USA will align with the data input to the widely used Energy Star Portfolio Manager, but it won't use the output of that benchmark. European standards are being replaced with American standards (like ASHRAE's), and some concepts are being explained differently for the American audience.

BREEAM's rigor has not been compared with that of LEED-EBOM, according to Giles, but he noted the strong desire by BRE and BREEAM USA to bring more data to the marketplace, working with the U.S. Green Building Council and other organizations.

Read more

More BuildingGreen articles on existing buildings

Six Ways Existing Buildings Can Save the Planet

Design Strategies for Occupant Engagement—and Why They Boost Performance

BREEAM In-Use Ratings

ASSESSMENT SCORE (%)	ASSESSMENT RATING	STAR RATING
< 10%	Unclassified	–
10%–25%	Acceptable	★
25%–40%	Pass	★★
40%–55%	Good	★★★
55%–70%	Very Good	★★★★
70%–85%	Excellent	★★★★★
≥85%	Outstanding	★★★★★★

Source: BREEAM USA

PRODUCT NEWS & REVIEWS

SIREWALL: The Next Generation of Earthen Walls

Made from local earth, rebar, and polyiso, SIREWALL rammed earth walls are beautiful, durable, and are stronger than concrete with less portland cement.

by Brent Ehrlich

The first rammed-earth walls used dirt combined with simple, natural materials like straw, all compacted together and dried. Later, lime, pozzolans (which can act like cement), and other ingredients were added to improve the compressive strength, moisture resistance, and other characteristics.

SIREWALL takes rammed earth and modernizes it by constructing walls made from carefully selected local inorganic soils precisely mixed with portland cement, pozzolans, iron oxides for color, and proprietary admixtures that improve strength and resistance to moisture and efflorescence.

Besides updating the timeless formula for an earthen wall, Sirewall has earned third-party recognition for its sustainability through the International Living Future Institute's (ILFI) Living Product Challenge

(LPC) certification (see Living Product Challenge Logs First Certifications).

What is SIREWALL?

Typically used in high-end residential or commercial buildings, SIREWALLs (the name stands for "Structural Insulated Rammed Earth") are 24″ thick (though 18″-thick walls are also possible), and incorporate a 4″ core of Johns Manville ENRGY 3.E halogen-free polyiso insulation sandwiched between 8″-inch-thick exterior and 12″-thick interior wythes. The walls contain approximately 6%–10% portland cement (it varies depending on local soils and pozzolans) with rebar and insulation added for additional structural and thermal performance. They are built on concrete foundations using forms that contain the mix, which then is compacted by pneumatic tampers.

To construct a complete SIREWALL system requires careful coordination throughout the building process. According to Meror Krayenhoff, president and founder, SIREWALL has spent more than $2 million developing its three-step system.

1. The company analyzes local soils for composition and other factors. That data plugs into a computer program that generates the optimum mix. The company then builds sample walls to test for strength and aesthetics.
2. SIREWALL provides support for architects and engineers who may not be familiar with structural rammed earth's design and performance benefits and limitations.
3. Local contractors form, mix, and install the system; SIREWALL provides them with training and support.

Structural performance

The combination of earth, cement, and tamping creates a sandstone-like material that has a compressive strength of up to 6,600 psi, twice the strength of traditional concrete using as little as half the cement (more on this later). This mix is compacted in 2′-deep lifts, with additional structure provided by a piece of horizontal rebar laid on top of each lift and tied to vertical rebar from the foundation, forming 2′ x 2′ grids; additional rebar connects wythes through the insulation. The company has built load-bearing walls 51′ high.

Photo: David Smith

SIREWALL uses local soils and iron oxides to create walls that blend in with the natural surroundings and should last hundreds of years.

Thermal performance

Unlike with uninsulated rammed earth, SIREWALL's insulation layer isolates the interior wythe from the exterior, improving the thermal performance of the 24″-thick, R-32 wall and making the system suitable for use in cold climates.

Because of the wall's mass (and the layer of internal insulation), it can use passive solar more effectively, allowing the interior room temperature to stay consistent by reducing thermal stratification. This concept is not new (it is found in concrete "sandwich" construction), but it is difficult to quantify due to differences in climate and other factors. "We get stuck saying our R-value is 32," said Krayenhoff, based on the thermal properties of the materials, but he claims SIREWALL has a "dynamic" R-value between R-48 and R-72.

Note that the terms "effective" or "dynamic" R-values are often misused for marketing purposes, which is why researchers from Oak Ridge National Laboratory (ORNL) propose use the terms "dynamic benefit from massive systems (DBSM)" and "R-value equivalent for massive systems" instead. ORNL data has confirmed, however, that insulated mass wall systems such as SIREWALL can be very effective when the mass is on the building interior. (Also see Thermal Mass: What It Is and When It Improves Comfort.)

To demonstrate this, and the system's resilience, the company placed sensors on the north side of an unoccupied, unheated 2003 SIREWALL home for a month. Though exterior temperatures averaged 44°F with a low of 32°F, interior temperatures in the home averaged 60°F with a low of 57°F; humidity also remained stable between 40% and 65%—in a reasonable range for providing comfort with low risk for mold growth (25%–60% is generally considered ideal).

Environmental performance

Because SIREWALL resists fire, wind, insects, and floods and is rated for seismic zone 5, which includes the most active earthquake areas, Krayenhoff expects these walls to

Photo: David Smith

SIREWALL (shown here at the Sublette Public Library in Pinedale Wyoming) needs almost no maintenance, does not require any interior finishes, maintains consistent interior temperatures and low humidity, and does not promote mold growth, helping create good long-term indoor air quality.

survive for hundreds of years. At the end of their lifespan, the primary wall materials can be disposed of with few negative environmental impacts (foam insulation is another issue, but that's not unique to SIREWALL).

The ingredients used in the wall system have low toxicity. Along with its LPC certification (at the "Imperative" level, representing the lowest-tier LPC certification), SIREWALL is Living Building Challenge compliant. The company does not use fly ash or blue or green tints due to toxicity concerns, and the Johns Manville polyiso was a 2015 BuildingGreen Top 10 product for being the first foam board insulation for building applications to remove halogenated flame retardants. The walls also don't require an interior finish or paper-faced gypsum board, eliminating a medium for mold formation as well as the need for added chemicals.

One drawback of rammed-earth walls is their use of portland cement, which has very high embodied energy. Cement manufacturing is a major global source of carbon emissions.

We asked structural engineer and alternative construction expert Bruce King, P.E., to compare SIREWALL's cement use with that of concrete. Using a standard concrete wall containing 20% cement (the high end of the range used in concrete on the West coast) as a baseline, King estimates that a 24"-thick SIREWALL containing 6% cement would contain less overall cement, but a SIREWALL with 10% cement would contain more.

Krayenhoff counters that SIREWALL's initial embodied energy is minimal compared with the energy saved over the building's 100-year-plus useful life. Still, the company claims it is working to lower the percentage of cement further.

Beautiful but not for every project budget

SIREWALL's use of primarily local, natural materials give these walls a unique "organic" look that blends into the surroundings, promoting a connection to place and nature (Beauty and Place are Imperatives in LPC). And in the interior, the walls are part of the design. "We all talk about the nature deficit we have living in this modern world," said John Carney, FAIA, principal at Carney Logan Burke Architects. His team used SIREWALL on a 13,000 ft^2 addition to the Sublette County Library in Pinedale, Wyoming. "It was a wonderful way to tie it into the landscape and the existing building, which was all log."

The library extension was successful, according to Carney, providing a quiet, comfortable building, but the entire structure is not rammed earth. "We just used it where we get the most bang for the buck," he said. "It is definitely an expensive material, so clients need to know that going in." SIREWALL estimates the cost at around $120 per face foot but notes that it is a well insulated, complete wall system that does not require weather barriers or interior or exterior finish and requires little to no maintenance.

SIREWALL has an impressive environmental story, but it may not please every client. Those concerned with the immediate climate impact of cement may want to look at low-embodied-energy alternatives, but for those needing a low-rise building that is beautiful, durable, thermally efficient, and resilient, SIREWALL is worth looking into.

For more information

SIREWALL

SIREWALL.com

Green Multifamily Cabinetry: Three Top Options

Need multifamily millwork that's attractive, high-quality, domestically manufactured, low-emitting, and sustainably sourced? You're not alone.

by Paula Melton

Despite the current high volume of multifamily construction, it can be hard to find green products in some parts of this sector. Kitchen cabinetry is one such area. Have you ever tried to find residential cabinets that can be ordered in volume and are also made 1) in North America 2) with low-emitting materials and 3) wood or fiber certified to the Forest Stewardship Council (FSC) standard?

We have. It took a long time. Hopefully this article will save you from replicating the same search for your next multifamily project.

Regional millwork

When multifamily project teams can't source green cabinetry in volume, they often go in one of two directions: settle for lower-quality mass-market cabinets, or find a regional cabinetmaker to build onsite.

We recommend against the mass-market versions: we haven't found any that meet our standards (explained in the sidebar). On the

BuildingGreen Approved: Multifamily & Residential Cabinetry

Our BuildingGreen Approved program recognizes manufacturer leadership in meeting or exceeding green building criteria. Since leadership differs category by category, so do our criteria—and commercial casework vs. residential cabinetry is a great example of why.

For commercial office products, we require level 3 certification under the BIFMA e3 multi-attribute standard; this encompasses certification of low emissions. But it's almost unheard of for residential cabinetry to go through whole-product testing or meet a multi-attribute standard. Cabinetmakers are more accustomed to meeting formaldehyde limits (CARB Phase 2) for the engineered wood used in their products and then handling finishes and adhesives separately.

Though we'd like to see the residential cabinet industry adopt full-product emissions testing, this is not necessarily practical since many cabinets are built onsite.

BuildingGreen approves residential cabinets that meet the following criteria:

- Sustainably sourced wood or fiber—either salvaged or FSC certified
- *and* verification of low emissions through whole-product testing according to CDPH standard method v1.1-2010 or related certifications
- *and* no PVC

In combination, the following are an acceptable substitute for whole-product emissions testing:

- Engineered wood that complies with CARB Phase 2—containing no added formaldehyde (NAF) or meeting formaldehyde emissions standards required by the State of California
- *and* zero- or low-VOC adhesives, sealers, and coatings—meeting our respective VOC limits for wood adhesives, stains and clear finishes, and interior paints and paint colorants

other hand, hiring local subcontractors is a great option. Whether they will be able to deliver the work on time and within your budget will depend on a lot of project-specific factors. Remember that if you are getting custom work and require FSC wood, you'll have to ensure the cabinetmaker holds a chain of custody certificate.

Another alternative is to hire a larger, regional millwork company. The ability of these manufacturers to meet your needs on time and on budget is similarly project-specific. We list some in our collection of BuildingGreen Approved residential cabinetry on Designer Pages.

Three national companies

Manufacturers that distribute green residential cabinetry nationally *and* can produce at high volume are rare, but they're out there. Here's the handful we discovered in our search.

Crystal Cabinet Works: Early adopter

As one of the earliest mainstream cabinet companies to offer a green line, Crystal has been a BuildingGreen standby for years. Available with either plywood or medium-density fiberboard (MDF), the cabinets are made with no added formaldehyde (NAF) and the option of FSC wood and fiber.

The company also offers a variety of finish options, which can be specified as zero- or low-VOC, depending on project requirements. Information about VOC content of adhesives is available to designers to aid selection.

Executive Cabinetry: Green leadership

Only three cabinet manufacturers have achieved Greenguard Gold certification, and Executive is one of them. The company claims to sell the only all-wood cabinets that meet the standard. The cabinetry, including all components, is made in the U.S. (final assembly is in South Carolina), which is also rare.

The company offers a wide variety of door finishes, including wood veneer and melamine or metal laminates (beware thermofoil laminates; see below). There's also an option for all-aluminum doors. The company offers bathroom cabinetry and living area casework as well. Looks range quite widely, from old-fashioned beaded and paneled styles to sleek, contemporary options.

Executive is available from dealers throughout the U.S. and Canada.

Mod Cabinetry: Euro style, U.S. manufacturing

Mod isn't a manufacturer. This company—an Internet spinoff of the Berkeley, California brick-and-mortar store Ecohome Improvements—is an online retailer that offers a range of standard sizes, with some customization of finishes available. The company offers low-cost design services. It also manages lead times and delivery by working directly with its manufacturing partner, and it can accommodate large volumes, according to the company. Volume discounts are negotiable for larger projects (with better pricing if you're getting all your cabinets delivered at once).

Mod partners with Executive Cabinetry (see above). "We specify lead time, pricing, and construction details that are not available to standard Executive retailers," explains company cofounder Taja di Leonardi. Mod prides itself on offering a stylish, frameless European look that's produced affordably on U.S. soil. The cost is comparable to that of mass-market options available at major retailers, claims di Leonardi, but they are made with hardwood plywood, they arrive assembled, and they feature high-quality hardware.

The standard Mod cabinets are made with PureBond and have no added urea formaldehyde (NAF) and are Greenguard Gold certified. FSC is optional and comes with a 20% premium.

Importing? Check the VOC label

There's another way to find green cabinetry: import it. Many designers are going this way anyway for the cleaner geometry, minimalism, and greater capacity of European cabinetry,

Image: Mod Cabinetry

Mod Cabinetry offers a unique online business model that includes affordable design services. The company prides itself on its affordable European-style cabinets, which are produced in the U.S.

all of which combine to align with contemporary tastes as well as storage requirements. It's worth noting, though, that European-style cabinetry is becoming more widely available from domestic manufacturers.

Depending on what you find and whether you have building certification goals under LEED or the Living Building Challenge, there are a few things you should watch out for. We still recommend looking for CARB-compliant and FSC-certified wood or fiber products.

What about third-party emissions testing? If you're importing, the product might come with an unfamiliar indoor emissions label. All of the following international testing standards are considered acceptable for either the general emissions evaluation or the composite wood evaluation required under Low-Emitting Materials under the LEED v4 rating systems. This is provided for information purposes only, though, because as far as LEED documentation goes, these standards are only acceptable for non-U.S. projects. But they are a reasonable guideline if your core concern is the indoor air quality of the project rather than getting the LEED point. (A complicating factor: the LEED rating system you choose—Homes, Multifamily Midrise, or New Construction—and whether your cabinetry is site-built or factory-made could change whether the composite wood or furniture evaluation is required.)

- German AgBB Testing and Evaluation Scheme (2010), an indoor emissions standard developed by the German Institute for Building Technology (DIBt)
- A combination of several ISO 16000 standards (16000-3: 2010, 16000-6: 2011, 16000-9: 2006, 16000-11:2006)
- CEN/TS 16516
- EN-717-1:2004 (tests for formaldehyde only—not equivalent to CDPH Standard Method)

Beware thermofoil

There's one other thing to watch out for if you like that sleek European style.

The attractive, biophilic finishes on many of these cabinets aren't the wood veneers or melamine laminates you may be used to: they're usually a material called thermofoil that's thermally fused onto MDF. And though it sounds like metal, thermofoil is actually made of PVC. So if you're doing a Living Building Challenge project or are avoiding PVC for other reasons (see The PVC Debate: A Fresh Look), watch out for thermofoil.

Tell us your favorites

There are plenty of millwork manufacturers that focus on commercial and institutional markets, and we'd love to see them develop green, high-quality products for the multifamily market. Consider asking companies like Cohen Woodworking, AMC Millwork, and Trend Millwork if they'd like to try their hand at some larger residential jobs.

Do you know about another national or regional millwork company that can provide FSC-certified, low-emitting cabinetry for multifamily projects? Let us know in the comments online. We'll vet these manufacturers against our BuildingGreen Approved criteria and add them to our listings.

For more information

Multifamily & Residential Cabinetry
BuildingGreen.com

PRIMER

TSCA Reform: Chemical Regulations, at a Cost

In a world where we can't even ban asbestos, a new law revamps how the federal government regulates chemicals—but some worry it steps on the toes of progressive states.

by Candace Pearson

Until now, the Toxic Substances Control Act (TSCA) was the wobbly leg of the three-legged stool that is the core of our environmental legislation in the U.S. Unlike the other two legs—the Clean Air Act and the Clean Water Act—it hadn't been revised for 40 years.

This legislation gives EPA the authority to issue regulations on all chemical substances and mixtures except for those used for drugs, cosmetics, foods, or pesticides. The U.S. Environmental Protection Agency (EPA) has so far managed to restrict or ban just five existing chemicals under TSCA (polychlorinated biphenyls, fully halogenated chlorofluoroalkanes, dioxin, asbestos, and hexavalent chromium). The asbestos ban was largely overturned when industry supporters sued.

So why was the law so ineffective? For one thing, it left most chemicals in the

Photo: The White House (public domain)

TSCA reform was finally achieved after 40 years of ineffective chemical regulation.

clear right out of the gate. There was no requirement to review the safety of chemicals in existence when the bill was first passed in 1976—a loophole big enough to allow 62,000 chemicals through. For another thing, TSCA allowed new chemicals to hit the market without any judgment of their safety. Instead, EPA bore the burden of identifying whether any chemical in use was dangerous.

If EPA did happen upon a chemical that it wanted to study or regulate, it faced multiple hurdles. It could only require testing through a formal rule-making process, which could take years. And to initiate a study, it had to demonstrate that the chemical might pose an "unreasonable risk of injury to human health or the environment" or have "substantial exposure" to humans—the very things EPA hoped to learn from a study.

Another problem: EPA was not allowed to rule on the safety of a chemical without first knowing the "least burdensome" way of addressing the risk posed by a chemical. For nearly ten years, this clause locked EPA in a cycle of performing cost-effectiveness analyses on every conceivable way to regulate asbestos, a known human carcinogen, and that was the primary reason that the ban wasn't upheld in court. Asbestos is still legal to use for new products today. (Its use has become outmoded in most applications due to civil lawsuits, not regulatory action.)

A bill reforming TSCA was signed into law in June 2016. It makes significant improvements:

- The law makes TSCA a "health-only" safety standard, meaning that a cost analysis can't slow down a decision about whether to regulate.
- Once a chemical is listed as "high priority," EPA must conclude its safety review, called a *risk evaluation*, within three years.
- If the findings show that the chemical should be regulated, then costs and other non-health factors must be taken into account in developing a policy, but a rule must be finalized within two years.
- The public can sue the agency if it doesn't meet these deadlines.

All chemicals currently in use are to be reviewed and designated low- or high-priority, although in theory this could take centuries, as EPA is only required to have 50 designated by 2021. New chemicals must pass a yet-to-be-determined safety standard before being released into the market. And the law gives EPA new authority to ensure it has sufficient information to make these decisions, including the ability to order testing without first having evidence of risk or high exposure.

Some of the other changes:

- EPA must explicitly protect vulnerable populations, like children and pregnant women, who are at elevated risk.
- In developing the first list of ten high-priority chemicals, EPA must prioritize those that are persistent and bioaccumulative, are known human carcinogens and have high toxicity, or are stored near significant sources of drinking water.
- Manufacturers must substantiate their reasons when they claim certain substances as confidential business information, and those claims have to be re-substantiated after ten years.

Some groups consider one part of the law to be a big trade-off. If EPA decides to conduct a risk evaluation of a chemical, a state cannot create restrictions on that chemical for the same use while the EPA is conducting its study (though it can still impose other requirements like reporting, monitoring, or disclosure). This is called "preemption." Once EPA makes a final ruling on a chemical, the preemption is permanent. So if EPA decides to limit a chemical, a state will no longer be able to raise the bar with an outright ban or any other more stringent restriction.

There are a couple of exceptions. States can apply for special waivers. Also, any state prohibition or restriction of a chemical enacted before April 22, 2016, will not be preempted. California's Proposition 65 and Massachusetts' Toxics Use Reduction Act are thus preserved.

However, some state legislation that appeared to be on the brink of passing could be overridden, such as Washington's proposed ban on a group of flame retardants and Maine's proposed ban on four types of phthalates.

The provision is necessary to avoid patchwork regulations, proponents argue, and most environmental groups back the TSCA reform law in the spirit of compromise. It was cause for the Environmental Working Group (EWG) to withdraw its support, though. "States have been the only cops on the chemical safety beat, regulating scores of chemicals and driving marketplace innovation," stated EWG on its website. "Any legislation that claims to be better than current law would permit state action until an EPA rule is final."