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Create healthier work environments by understanding the materials that make up workplace products

living in a material world

Understanding the materials that make up workplace products can help you create healthier work environments.

The moment she walked into her new office at Chong Partners Architecture, San Francisco, Jean Hansen knew something was missing. The senior associate/senior interior designer has entered many new and newly remodeled spaces in her career, and recognized immediately what was different.

"I walked out of the elevator doors, and there wasn't that 'new car' smell."

We all know that mixture of interior aromas from new plastics, glue, and carpet that tells us we're in a new set of wheels. It's a good feeling; this vehicle is brand spanking new.

The experience is similar when we enter a new or renovated building interior. The smells are fresh, powerful, and just like in a new car, not all that good for us. That's because when many materials are new, they're unstable and give off gases, volatile organic compounds (VOCs) that may have both short- and long-term adverse health effects.

In a car, opening the window or vents helps clear out these gases. In a building, where people spend many hours each day, often with windows they can't open and HVAC they can't control, it's a different story. The US Environmental Protection Agency says VOCs are consistently higher indoors –*up to ten times higher*– than outdoors. VOCs are given off by paints, building materials and furnishings, office equipment such as copiers and printers, glues and adhesives, cleaning supplies, and on and on.

"Indoor air quality is one just part of the materials chemistry story," says Angela Nahikian, manager of Global Environmental Strategy and Programs for Steelcase. "That 'new car' smell is a symptom of material choice, a point of evidence that the materials you're using maybe aren't the right ones."

Materials chemistry asks: What kind of plastic? How is it made? What are the resins, the pigments? Where do they come from? Do they cause harm to people or the planet?

Hansen's company took the initiative in creating a space that not only avoided the "new car" smell, but is also environmentally responsible, healthy, and productive overall. "It's a very clean environment, and that's huge to a lot of people," she says.

The new workspace of Chong Partners Architecture demonstrates the enormous power that resides with architects, designers, and facilities managers to define the quality of both our internal environments and the global, natural environment.

materials chemistry 101 the "cliffs notes" version

Materials chemistry analysis is a scientific method that takes a bit of explanation, but it's worth the trip. It begins with understanding the chemicals that make up a product and how they interact with people and the environment. It's deeper than just saying: That's a plastic laminate. Materials chemistry asks: What kind of plastic? How is it made? What are the resins, the pigments? Where do they come from? Do they cause harm to people or the planet?

Materials chemistry is a critical component of an overall life cycle assessment (LCA) of a product.

Decisions made in each step of the product life cycle affect the sustainability of the final product.

five product life cycle stages

1 materials selection and extraction
2 production
3 transportation
4 use
5 end-of-use

The International Organization for Standardization has established a framework for LCAs in ISO 14040. It measures the effects of products against global environmental issues, including climate change, waste, air and water contamination. To measure those effects, we start with understanding precisely what chemicals make up each product.

McDonough Braungart Design Chemistry (MBDC) is helping define the parameters for materials chemistry analysis, evaluating the chemicals used in a product down to the 100 ppm (that's parts per *million*) against 19 human and environmental health criteria. Their intent is to help manufacturers screen out materials that are harmful. For example, recycling is a good environmental practice. But if we're recycling carcinogens, that's not so good.

Once manufacturers understand what chemicals are in a product, and their impact, they can select materials that limit the negative human or environmental impact throughout the product life cycle, "cradle to cradle." Ideally, they can use materials that have a positive impact.

chemical sleuths

The organizations that perform this high tech chemical sleuthing, called certifying, work at three different levels.

Self-certifiers, the first level, are companies that assess their own products and operations internally. There's no external review or validation.

Second-party certification involves assessment by an outside party, such as a trade association or vendor.

Third-party certification is conducted by an independent, neutral organization, based on an established set of standards. This certifier has no financial interest in the company whose products it's analyzing. The standards used and the certification process should be transparent, and all clients of the third-party certifier are treated the same. Naturally, this approach is typically more stringent than first- and second-party certification.

MBDC is one third-party certifier, and is an innovator and leader in the materials chemistry field. MBDC is assessing all Steelcase products, both new and existing, to ensure that the materials Steelcase uses in the development and production processes are healthful for humans and the environment. It's a big job.

"They make so many products, such a diverse palette," says Jay Bolus, executive vice president, benchmarking and certification for MBDC. "Just to get a basic understanding of the materials they use every day is a huge challenge."

Despite the amount of work it requires, companies in all industries are demanding more environmentally sustainable materials from their suppliers.

The understanding of materials chemistry and issues relating to a product's overall life cycle assessment varies from client to client, according to Brian Rock, an associate and interior designer with BNIM Architects, Kansas City. "Some clients are more savvy than others as far as sustainability is concerned. It's our task to help them on this issue. There's a lot we can bring to the table through design and certain strategies to promote a more sustainable environment and a more sustainable structure."

down to a fine science

A look at the work of MBDC reveals the science that leads to a healthier environment.

The base chemicals of a product are first identified, then evaluated according to their impact on human and environmental health. This includes evaluating the chemicals as single and compound ingredients, since two neutral chemicals in combination may have deleterious effects. Ingredients are then coded according to their level of impact.

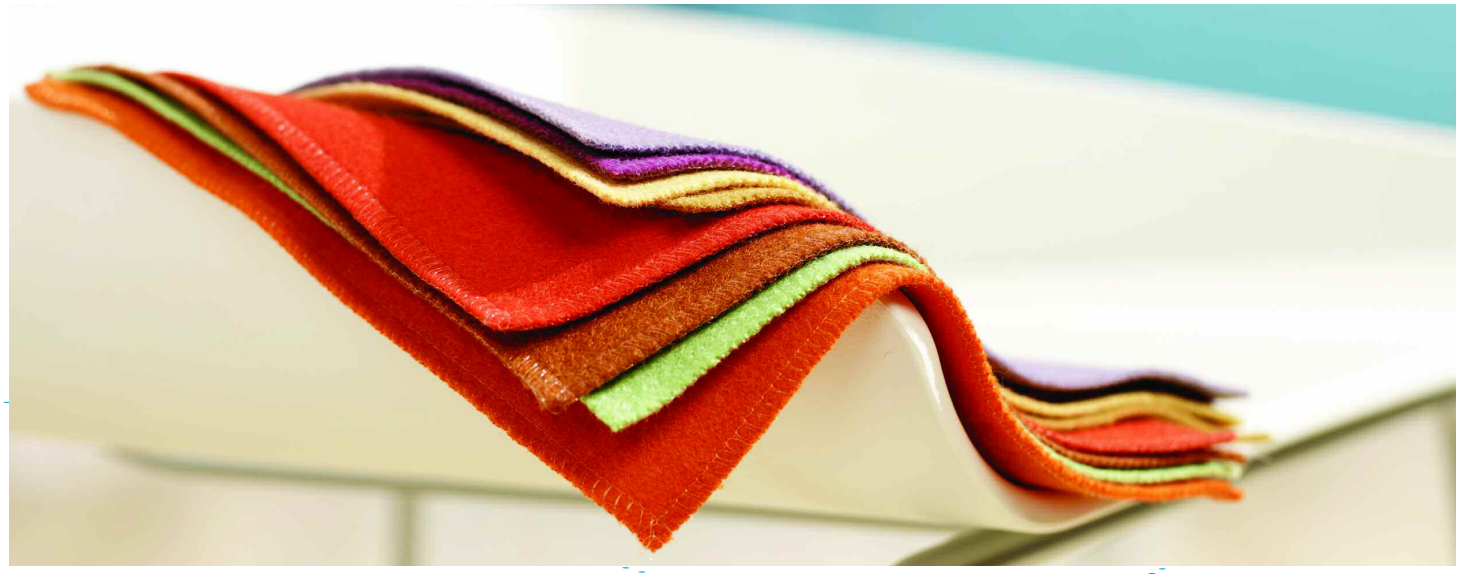
Human and environmental health hazard levels for each single and compound ingredient can range from little or no hazard, to low or moderate hazard,on up to high. Sometimes there is not enough data to assess the level of hazard.

Each chemical name, its Chemical Abstract Service number (a standard based on the chemical's molecular structure), its concentration, and its function, is recorded. The concentration and function of each chemical are important because this helps assess risk. Certain chemicals in low quantities, for example, or used in reaction, may be low risk.

Understanding the purpose of each chemical also helps find alternatives, if necessary.

MBDC identifies exactly what chemicals are in the product. Advisory comments help identify which chemicals should or shouldn't be used, based on their impact on human and environmental health.

Their final report guides the manufacturer through an evaluation process: what chemicals are kept? which to purge? what new chemicals are needed?



examining a common solvent

Here's how the process works for a typical chemical found throughout the furniture industry: methyl ethyl ketone. MEK is a solvent used in painting and wood finishing, and in some adhesives. It's a popular chemical, found in the manufacturing process and in final products. It has a watery white color, a pungent odor, and it's very flammable.

MBDC's chemical analysis concluded that MEK has the potential to cause minor central nervous system depression in high concentrations (far beyond what you would find in a work setting). There is also no evidence that MEK causes permanent damage to the nervous system or changes in behavior. In the class of organic solvents, MEK is better than most. The report concludes that MEK is recommended for use if no suitable low level solvent is available.

Detailed information about the chemicals that make up a product, applied across the life cycle of the product, helps everyone involved in the manufacture, planning, and specification of these products make more informed decisions.

thinking green

"Recyclability is much more important than recycled content," notes MBDC's Bolus. "It's important to know that at the end of the product's useful life, there's a system in place to take back or recycle the materials.

"A good example is EcoWorx®, an environmentally sustainable carpet backing from Shaw Industries. This is a non-PVC backing that can be recycled into more EcoWorx product. It's essentially a cradle-to-cradle product.

"The Think® chair is another one. Only materials safe for the environment are used in the chair. There's no PVC, no benzene, lead, mercury, etc. It disassembles in five minutes, and every part that weighs more than fifty grams, or about two ounces, is clearly labeled for recycling. It's 99% recyclable.

"So for the same amount of money you can get products that are recyclable as well as have all the other performance attributes, and that translates into higher quality products."

There are some common misconceptions about the cost of designing for sustainability "Most people have the idea that green is expensive, or sustainability has a certain price tag," says BNIM's Rock. "Sometimes there are upfront costs that make it slightly more costly upfront, but the payoff over the long haul proves that sustainability pays dividends."

Hansen agrees, "Products that don't provide a healthy indoor air quality probably aren't costing what they ought to cost, because at this point there are ways to hide those issues.

"That's not the way it should be. We shouldn't have to pay more to have a healthy environment."

In fact, sustainable products and buildings can cost little or no more than traditional approaches. A study conducted in 2004 by cost-management firm Davis Langdon concluded that building green has minimal effect, if any, on construction costs *if* sustainability is integrated early in the design process. The U.S. General Service Administration studied its own LEED certified buildings and found that when projects take advantage of many "no cost" and "low cost" credit options, the overall cost premium is surprisingly limited, even at higher rating levels.

At the product level, buying green can deliver multiple benefits, including reduced waste, energy efficiency, and yes, a cost advantage. For example, Yale University, a large consumer of many products, maintains its own "Green Purchasing" web site. According to the Yale Procurement Office "Contrary to the common belief that environmentally sustainable products cost more than traditional products, green products can actually lead to a reduction in operating and maintenance costs and direct and/or indirect cost savings."

mills and materials

In the marketplace today, there are a vast number of products referred to as "green". There is an equally broad set of definitions for what defines an environmentally friendly product. Fabric selection is a prime example.

"When it comes to fabrics," says Hansen, "I ask where a product comes from, transportation issues, water issues, if there's heavy metals or dyes. I like to know front end information. I actually went on a tour in Switzerland of a number of different textile manufacturers."

One mill she visited in Switzerland produces Climatex fabric for Designtex, a Steelcase company. The mill generates no pollutants. None. The water flowing from the plant after the manufacturing process is safe enough to drink. The mill recycles all scrap with a consortium of strawberry farms, since the scrap fabric is biodegradable and makes great ground cover and plant insulation.

"It was the last mill I went to, and all the other textile mills had their own bent when it came to the environment. One mill was quite noisy, and none of the staff working there had earplugs. I found that quite shocking. Another mill was quite dusty and nobody wore masks."

"We ought to be able to design facilities and processes where you don't have to wear a mask because it's so dusty. The Climatex mill was able to do that. It was a much cleaner place. The smells associated with dyeing were there, but much subtler. You could really see the differences and appreciate them. It was amazing, absolutely amazing."

It's all about the "stuff"

It's a given that we can't all tour the mills that make the fabrics we select, or the manufacturing sites for the workplace furniture we specify. But each of us can demand more information about the "stuff" that makes up those products (see "12 simple questions"). Educating clients about the chemical and material make-up of the products they're interested in can in turn help them make more informed, sustainable choices. The benefits of those choices are healthier environments for all of us, inside and out.

healthy products?

Some questions to ask manufacturers and suppliers:

1. What are the specific chemicals in this product?
2. What are the effects of those chemicals on the environment?
3. How do those chemicals affect human and environmental health?
4. How much of the product content, and which specific materials, are recycled?
5. Do you have third party certification of the materials chemistry of the product?
6. Where is the product manufactured?
7. What are the manufacturer's practices in regard to environmental sustainability?
8. How is the product shipped to the job site, and how far?
9. What are the manufacturer's end-of-life strategies for its products?
10. Can the product be easily disassembled for recycling?
11. Are the component parts labeled for recycling?
12. Does the manufacturer help customers recycle its products?