



## Screening the Toxics Out of Building Materials: Interior Flooring and Finishes

Many issues guide the selection of flooring and finish materials in a health care setting such as aesthetics, comfort, and cost. Primary above all other considerations, however, must be the well being of patients, staff, and visitors. In an environment with highly vulnerable patient populations, screening the materials that are introduced into the building to keep out toxics that may impede or complicate the healing process is key.

The materials that make up the floors, furniture, walls and ceilings of the Neonatal Intensive Care Unit (NICU), the Operating Room (OR), the patient room, the nurses' station, the hallway and the rest of the health care facility can have a multitude of impacts on the healing environment of the patient. Likewise they can affect the working environment of the doctor, nurse, and other staff, and the health of the surrounding communities and the environment. These interior finishes - the carpet, tile, resilient flooring, paint or other wall coverings, and furnishings - all have the potential to off gas chemicals that can be hazardous to the health of the staff and patients. Material selection determines whether toxic chemicals will be needed to clean, wax and strip the floors. Many of these materials, like the polyvinyl chloride (PVC) in vinyl floors, also create a toxic burden on the rest of the community and global environment in their manufacture, disposal, and maintenance.

Guaranteeing good indoor air quality (IAQ) for patients and staff involves several different factors, including maintaining ventilation control and proper commissioning and care in operations and maintenance. The most reliable way to assure that building occupants are protected from hazardous chemicals is source control - choosing materials to avoid introducing those chemicals into the building in the first place. This is particularly critical in the health care environment with vulnerable patients and staff exposed through long shift hours. Recent studies in Europe further indicate that nursing satisfaction, longevity, and absenteeism can improve by making

decisions in hospitals to improve the environmental health of the building, including its interior flooring and finishes.

PVC, formaldehyde and other volatile organic compounds (VOCs), and halogenated flame retardants (HFRs) are key hazardous components of many interior flooring and finish products used. Alternative products and materials that meet health care durability and maintenance requirements and do not contain or emit these materials or chemicals are on the market and can be used safely and effectively. Some building materials certification programs screen for VOCs. Environmentally preferable purchasing should include combining screening not only for VOC emissions, but also to avoid PVC and HFR content.

Health care organizations are beginning to look carefully at the material and product choices they make to take into consideration human and environmental health concerns. Manufacturers are responding to health care customer demands and bringing to market environmentally preferable carpeting, flooring, wall coverings, upholstery and textile alternatives that are compatible with the health care marketplace.

### **Polyvinyl chloride (PVC)**

Polyvinyl chloride (PVC) should be eliminated because of its wide and potent range of chemical emissions throughout its life cycle, including many of the target chemicals listed below. It is virtually the only material that requires phthalate plasticizers (developmental toxicants and linked to bronchial irritation and asthma) and can include heavy metal stabilizers (neurotoxins and carcinogens). In addition, during the manufacture of PVC, it is responsible for the production of a large number of highly toxic chemicals including dioxins (potent human carcinogens), vinyl chloride (carcinogen), ethylene dichloride (probable carcinogen), PCBs (carcinogens, reproductive, and developmental



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toxicants), and more. When PVC burns at the end of life, whether in an incinerator, car fire, structural fire or landfill fire, it releases more dioxins. In a fire even before it actually ignites, PVC will release hydrogen chloride gas at lower temperatures long before the PVC actually ignites. This gas becomes hydrochloric acid when it contacts moisture, including moisture in the lungs of those who inhale it.

For more info on the hazards associated with PVC see Health Care Without Harm's web site and fact sheets at [www.noharm.org/us/pvcDehp/issue](http://www.noharm.org/us/pvcDehp/issue)

### Volatile organic compounds (VOC)

Volatile organic compounds (VOCs) are gases including formaldehyde, acetaldehyde, toluene, and benzene that are readily released into the indoor air by building materials<sup>1</sup>. VOCs have been associated with short term acute sick building syndrome symptoms such as dizziness, headaches, or eye, nose, and throat irritation, and other longer-term chronic health effects such as damage to the liver, kidney and nervous system and increased cancer risk. Concern has also been raised that VOCs may contribute to Multiple Chemical Sensitivity in specific individuals who exhibit reactions to indoor airborne chemicals. VOCs also react with each other and other indoor air contaminants such as ozone to create additional potentially harmful compounds.

VOCs are typically emitted at high levels when a product is first installed and taper off to lower levels as time goes on. Wet applied products, like paints and adhesives, typically emit VOCs very intensely for the first few days or weeks and taper off rapidly – although temperature and humidity changes may increase them again. VOC emissions from solid materials, such as flooring and furniture, may start at a lower level than the wet products, but will taper off much more slowly and contribute to more of a long term problem.

<sup>1</sup> Note that while VOCs are sometimes defined as only those that contribute to outdoor smog formation, in this document we are referring to all organic compounds that readily evaporate from solids or liquids and may cause a hazard for human health.

Note that use of waxes and cleaners may result in far more VOC emissions than the installation of the product. Architects and designers should consult with the medical facilities' cleaning staff to determine how material selection might drive the use of different cleaners and sealants.

Semi-volatile organic compounds (SVOCs) such as phthalates and halogenated flame retardants (HFRs), are released much more slowly than VOCs and often will attach to dust and other particles. In some cases, products may actually emit more SVOCs at later points in the life of the product. A range of chemicals of concern used as treatments for fabrics and other building materials including HFRs and perfluorochemicals (PFCs) are showing up in increasing concentrations in human milk, blood and tissue samples, raising concerns about their growing potential for causing cancer or other health effects.

There are many certification programs that measure formaldehyde and other VOC emissions and/or certify low VOC content for building materials and products, using many different standards. Currently the best programs for evaluating long term exposure hazards are generally based at least in part upon the **California Special Environmental Requirements Section 01350 Standard for Emissions Testing**. This standard, known as Section 01350, sets emissions testing protocol and exposure standards for formaldehyde and 80 other individual VOCs. The Section 01350 should be considered a minimum requirement for VOC emissions and should be used in conjunction with other screening suggested in this fact sheet. The Section 01350 test is a 14 day process that only addresses long term chronic exposure, not the short term acute exposure risks from the intense emissions during and immediately after installation. Further description of the 01350 standard can be found on the Healthy Building Network website at [www.healthybuilding.net/healthcare](http://www.healthybuilding.net/healthcare)



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## Halogenated Flame Retardants (HFRs)

The widespread use of plastics and other synthetic materials in electronics, textiles, upholstery and construction materials has increased the flammability of these products, making it necessary to modify them to meet fire safety standards. One approach has been to add flame retardants to many products to meet these standards. Recent research, however, has raised concerns about the persistence and toxicity of many flame retardant chemicals.

Some flame retardants are now ubiquitous in the environment, including in remote areas such as the Arctic and deep in the oceans. Rapidly increasing levels have been measured in sediments, marine animals and humans, indicating a significant potential for damage to ecological and human health. Growing evidence suggests some of these chemicals are toxic in ways that are similar to other halogenated, persistent, bioaccumulative toxicants such as PCBs (polychlorinated biphenyls), which were banned in 1977 due to toxicity and widespread diffusion in the environment. Fortunately, numerous and effective alternative flame retardants are beginning to be used worldwide.

Many chemical classes are used as flame retardants. Of greatest concern are those with halogens attached to the carbon backbone, particularly the halogens chlorine and bromine. The latter, called brominated flame retardants (BFRs), are widely used in consumer products - especially plastics for electronics, foams, and textiles - because they are a cost effective means of retarding flame while also allowing continued durability and performance of the material. Chlorinated flame retardants (CFRs) are used in textiles, paints and coatings, plastics, and insulation foams. Like BFRs, some chlorine-containing flame retardants persist in the environment, may accumulate in the tissues of humans and other animals and are suspected of causing serious health concerns.

Flame retardants are often found in plastics, particularly fabrics, foams, and electronic equipment. The widely used PBDEs are subject of the most scrutiny, but all halogen-based flame retardants, are likely problematic. Health care institutions should

ask all vendors for information about the use of halogenated flame retardants and express a preference for halogen-free products. For more info on the hazards associated with flame retardants see Health Care Without Harm's web site and fact sheets at [www.noharm.org/us/bfr/issue](http://www.noharm.org/us/bfr/issue) and [www.safer-products.org](http://www.safer-products.org).

## Developing Better Standards

No IAQ standard or certification program yet comprehensively covers all issues of concern for building materials relating to IAQ. None address all of the VOCs (there are hundreds more), only one addresses any SVOCs, and none cover heavy metals, halogenated flame retardants and many other chemicals of concern that can affect indoor health. Furthermore, many of the major certification programs are run by the trade associations whose mission is to protect the interest of the industry they are certifying. Development of reliable, truly comprehensive IAQ certification programs for building materials will require:

- a) Development of more comprehensive IAQ standards that include more VOCs and other chemicals of concern and better address short term exposure, expanding upon Section 01350;
- b) Transparent participatory standard setting processes that are managed by government or independent public interest organizations; and
- c) Third party certification programs that are not managed by trade associations.

## Finding Healthy Interior Products

Until certification becomes more comprehensive, selecting healthy products for interiors requires designers to screen for all of these chemicals. HCWH and HBN developed a PVC-free interior flooring and finishes chart for several categories of products, including carpeting, furniture, privacy and cubicle curtains, resilient flooring, shower curtains, upholstery, wall coverings, wall/ door guards, and window coverings. The chart indicates whether each of these PVC-free products are HFR free and have been tested for VOC emissions.

[www.noharm.org/us/healthyBuilding/issue](http://www.noharm.org/us/healthyBuilding/issue).



## VOC Certification Programs for Interior Finish Materials

### Collaborative for High Performance Schools (CHPS)

CHPS maintains a table listing products that have been certified by the manufacturer and an independent laboratory to meet the CHPS Low-Emitting Materials Criteria-Section 01350-for use in a typical classroom, including **adhesives, sealants, concrete sealers, acoustical ceilings, wall panels, wood flooring, composite wood boards, resilient flooring (includes rubber) and carpet**. This list also includes paint listings, but CA 01350 is not currently considered a robust standard for wet applied products and therefore not a replacement for low VOC paint screening. [www.chps.net/manual/lem\\_table.htm](http://www.chps.net/manual/lem_table.htm)

### FloorScore

Scientific Certification Systems (SCS) certifies for the Resilient Floor Covering Institute (the trade association that promotes resilient flooring) that **resilient flooring** meets the 01350 VOC emission requirements. [www.scscertified.com/iaq/floorscore\\_1.html](http://www.scscertified.com/iaq/floorscore_1.html)

### GreenGuard: Certification for Children & Schools

Air Quality Sciences (ACS) certifies for GreenGuard that **furniture & indoor finishes** meet the lower of 01350 VOC emission requirements or 1/100 of TLV (Threshold Limit Value an industrial workplace standard developed by the American Conference of Governmental Industrial Hygienists (ACGIH)) that covers many VOCs not covered by 01350. Ask for the **Children & Schools Certification**. GreenGuard's basic certification program (under which many more products have been certified) is significantly less rigorous. [www.greenguard.org](http://www.greenguard.org)

### GreenLabel Plus

The Carpet & Rug Institute (the trade association that promotes carpet) certifies that **carpets and adhesives** meet 01350 VOC emission requirements. Ask for GreenLabel **Plus**. CRI's basic GreenLabel standard is significantly less rigorous. [www.carpet-rug.com/News/040614\\_GLP.cfm](http://www.carpet-rug.com/News/040614_GLP.cfm) .

### Green Seal Certified Products

**Paints & coatings** that meet the GreenSeal VOC (volatile organic compounds) content standards do not contain certain excluded chemicals and meet certain performance requirements. This is a VOC *content* certification only and does not deal with emissions. [www.greenseal.org/certproducts.htm#paints](http://www.greenseal.org/certproducts.htm#paints)

### Indoor Advantage Gold

Scientific Certification Systems (SCS) certifies that **wall coverings, systems furniture, casework, insulation and other non-flooring interior products** meet 01350 VOC emission requirements. Ask for Indoor Advantage **Gold**. SCS's basic Indoor Advantage program is significantly less rigorous. [www.scscertified.com/iaq/indooradvantage.html](http://www.scscertified.com/iaq/indooradvantage.html)