

US EPA ARCHIVE DOCUMENT

# Indoor Air Quality: Materials Selection

## HEALTHCARE - TOP 5 GREEN BUILDING STRATEGIES

EPA Publication 909-F-07-001

**What?** Building materials can have a major impact on air quality and can affect occupants, especially sensitive ones including children, the elderly, and patients who are immunocompromised or have respiratory problems. Careful selection of materials along with proper ventilation, operation, and maintenance can improve air quality.

**Why? Enhanced Community Reputation:**

- Improves indoor air quality and promotes community awareness
- Enhances reputation as caring facility
- Better air quality attracts patients and helps recruit and retain staff

**Environmental/Staff/Patient Benefit:**

- Provides healthy surroundings for patients, workers, and visitors
- Supports "Primum non nocere" ("First do no harm")
- Often requires less cleaning chemicals

**Cost Competitive:**

- Initial cost often offset by reduced maintenance
- Less use of finished surfaces can reduce costs

**How?**

- Minimize the need for surface coatings
- Meet low emission standard (low VOC): LEED, regulatory agencies, or labeling organizations
- Collect air quality data during commissioning and occupancy

**Case Studies**

- Emory University
- University of Florida
- Kaiser Permanente
- Discovery Health Center

**Green Guide for Health Care (GGHC) Criteria:** *Construction: Environmental Quality and Operations: Integrated Operations* [www.gghc.org](http://www.gghc.org)

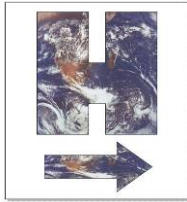


This is one of 5 **Building Healthy Hospitals** case studies developed by EPA's Pacific Southwest Regional Office, with Resource Conservation Challenge and Pollution Prevention funds.

[www.epa.gov/region09/waste/p2/projects/hospart.html](http://www.epa.gov/region09/waste/p2/projects/hospart.html)

**Indoor Air • Sustainable Flooring • Process Water Efficiency • Lighting Efficiency • Energy Efficiency**





**CASE STUDY: LOW-VOC MATERIAL SELECTION**

Applicability:	New construction, major renovation, or remodeling projects.
Environmental Impact:	Not quantified.
Other Benefits:	Not quantified.

**Background**

Many healthcare construction projects, including many of the case studies profiles here, incorporate interior finishes and products characterized as “reduced or non-toxic,” low-VOC or PVC-free. After flooring (see Strategy #3), most of the focus for low-VOC product selection falls on products applied in liquid form that cover, adhere, or seal interior surfaces.

All of the healthcare facilities completed their analysis and selection of these materials based on the intuitive assumption that they will reduce exposure to occupants to potentially dangerous or harmful chemicals. At the same time, the facilities have collected scant empirical data documenting any actual difference or benefit following the initial construction and commissioning phase. While this lack of data likely leads to underestimating benefits, most healthcare organizations proceed as part of “green building” initiatives and out of concern for people involved in building construction.

Discover Health Center, Emory University and the University of Florida pursued IAQ credits to achieve LEED certification and in so doing considered a broad spectrum of materials when selecting low-VOC materials, including:

- Adhesives
- Caulk
- Finish
- Sealants
- Coating
- Paints

In addition, Kaiser is developing specifications that eliminate harmful chemicals from entire categories of building materials including moldings and paints to add to their efforts with more sustainable carpet specifications.

**Performance**

Discovery Health Center: Discovery specified and installed low-VOC and “low-toxicity” finishes, including paints, stains, cabinetwork, sealers, and adhesives, but did not collect data on any potential benefits during construction or after installation.

University of Florida: The Orthopedic Center used low-VOC interior finishes, mainly focusing on paints and adhesives and used the LEED standards as guidance. Though staff (building



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management and janitorial) are generally positive about the products, the University of Florida has not collected additional data on potential benefits.

Emory Winship Cancer Institute: Emory specified low-VOC adhesives, sealants, paints, and carpets be used throughout the Winship Cancer Institute. Post-construction commissioning analysis did not include air monitoring for chemical contaminants. Defining “low-VOC” for each product type was dictated by the LEED criteria. In many cases, LEED references standards specific to the product type and defined by its respective industry association (see Exhibit 1). For example, the carpet used in the Winship Cancer Institute met the requirements of the Carpet & Rug Institute's (CRI) Green Label Indoor Air Quality Test Program. CRI's Green Label indicates that the manufacturer participates in a voluntarily program to test products to ensure it meets established requirements that define the lowest emitting interior products on the market. Specifications for other product categories are evolving and

**EXHIBIT 1 | SUMMARY OF LOW-VOC BUILDING MATERIALS**

Material	Applicable Low-VOC Standard	Cost Premium
<b>Adhesives</b> used for all finishing applications.	California Air Resources Board (CARB): 15% current; 1.5% proposed	5 to 20%
<b>Carpeted</b> flooring installed throughout the facility.	Carpet and Rug Institutes Green Label Indoor Air Quality Test Program. <ul style="list-style-type: none"> <li>▪ Total VOC &lt;0.5 mg/m<sup>3</sup></li> <li>▪ 4 -Phenylcyclohexene) &lt;0.05 mg/m<sup>3</sup></li> <li>▪ Formaldehyde (to prove that none is used) &lt;0.05 mg/m<sup>3</sup></li> <li>▪ Styrene &lt;0.4 mg/m<sup>3</sup></li> </ul>	10-20% initially, but depending on the type can yield significantly cost savings over useful life
<b>Caulk</b> applied to tile, wall and flooring seams, and other applications.	CARB: 4.0 % currently, 0.5% proposed  Green Guard ( <a href="http://www.greenguard.org">www.greenguard.org</a> ) Environmental Institute—do testing for all interior finishing products	5 to 20%
<b>Finish</b> applied to woodwork, casing, and other applications.	--	10-50% (but increasingly commonly available and cost competitive)



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### EXHIBIT 1 | SUMMARY OF LOW-VOC BUILDING MATERIALS

Material	Applicable Low-VOC Standard	Cost Premium
<b>Interior paints</b> used for walls, fixtures, and other applications.	<b>Green Seal:</b> Interior <50 grams/liter  <b>GreenGuard:</b> <ul style="list-style-type: none"> <li>▪ Individual VOCs&lt;0.1 TLV (Threshold Limit Value)*</li> <li>▪ Formaldehyde &lt;0.05 ppm</li> <li>▪ Styrene &lt;0.07 mg/m<sup>3</sup> (milligrams per cubic meter)</li> <li>▪ Total VOCs &lt;0.5 mg/m<sup>3</sup></li> <li>▪ Total aldehydes &lt;0.1 ppm</li> </ul> <b>US EPA:</b> Zero-VOC <5 grams/liter	Minimally more costly; paint quality is primary cost factor
<b>Sealants</b>	CARB: 4.0 % currently, 0.5% proposed	20-50% (but increasingly commonly available and cost competitive)

Note: The Green Guide for Healthcare contains a good summary of more stringent and emergent standards. <http://www.gghc.org/>

The application of low-VOC products is in many instances identical to that of standard products. Based on their experience applying and maintaining low-VOC products, Emory University and the University of Florida have noted the following:

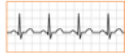
- **Color Availability.** Emory indicated that very low-VOC and no-VOC paints are not as widely available in dark or vibrant colors.
- **Application.** Low and No-VOCs paint can be applied in nearly the same way as conventional, high-VOC paints. Both Emory and University of Florida maintenance staffs indicated that low-VOC paints are thinner than standard paints and require an additional coat for complete coverage. The Emory construction manager stated that use of low-VOC sealants had a “significant impact on indoor quality, primarily during construction, but the impact after construction was not as significant.”
- **Waste Management.** Low-VOC and no-VOC paints are not considered hazardous waste materials, so disposal is much easier than with standard paints.

#### Cost

All of the organizations specified low-VOC building materials where they were available and did not conduct a cost/benefit analysis or cost comparison with more conventional choices where a low-VOC option existed. In the absence of empirical data on cost comparisons, the



facilities estimated from 5-15% higher initial costs for the low-VOC alternatives depending on the product, but no higher than a 10% overall increase in initial costs of the building for specifying low-VOC materials. In fact, most cited a lower overall cost of interior finishes as a result of minimizing the need for paints and finishes from other sustainable material choices (e.g., natural products like linoleum, concrete, steel, and wood).



### **Case Study *Vitals***

The following summarize success criteria for implementing this project at other healthcare facilities:

- Low-VOC products are widely available and increasing available for all interior finish products; specifications are product category-specific (e.g., different acceptable levels for adhesives versus paints).
- Specifying low-VOC materials should begin with design of underlying materials to minimize the need for finishes.
- Facilities select and specify low-VOC materials based on their assumed effect during construction and do not measure benefits past the commissioning stage.

