



# Conserve O Gram

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## Selecting Carpets And Floor Coverings For Exhibit Galleries And Visitor Centers

### *Introduction:*

The first and most cost effective step in conserving and preserving cultural and historic objects for future generations, is to control the environmental conditions in which they are stored and exhibited. The stability of materials that are used to construct exhibits and storage areas is critical to the long-term preservation of objects. Conservators and the larger society are aware of the problems associated with the emission of volatile and reactive chemicals from construction and coating materials. Carpeting and floor coverings can potentially be a source of indoor pollution that can adversely affect objects.

In the past decade, heightened sensitivity to the problem of indoor air pollution has given rise to a developing applied science known as Indoor Air Quality (IAQ) testing. Most of the knowledge and standards that have been developed by workers in the IAQ field can be applied to museum situations. The Carpet and Rug Institute (CRI) has developed a testing program and certification for carpet and adhesive products that meet or exceed Environmental Protection Agency IAQ standards. Most of the testing methods and specifications also meet conservation standards for other construction products, such as coatings, and have been adapted here.

### *The Culprits*

Volatile organic chemicals (VOCs) can and will react with the chemical components of objects, causing accelerated deterioration, and in some cases, irreversible damage. VOCs are composed

of various chemical species depending upon the composition of the carpet backing polymer and adhesives. The Canadian Conservation Institute (CCI) has published a comprehensive Technical Bulletin on coatings for display and storage in museums, with lists of VOCs and their effects on objects in the appendices. Much of the background information in that publication can be applied to floor coverings as well as the main classes of adhesives used to install floor coverings. Table 1 is a summary of the compounds that can potentially damage object materials and the generally accepted control levels for preservation environments.

### *Where do they come from?*

Table 2 lists the harmful VOCs and the floor covering components that they come from. Most manufacturers are moving away from including these materials in their product lines because of the effect that they have on IAQ, but it is still necessary to review proposed floor covering materials for museum applications to be sure that the designers and contractors order products that meet conservation standards. It is a good practice to request the Material Safety Data Sheet (MSDS) for each and every floor covering product that is being proposed. Review the sheets for the chemicals listed in Table 2, or enlist the help of a professional conservator. Conservators and conservation scientists have developed various lab methods for testing proposed exhibit and storage construction materials, such as the Beilstein test (PVC), Oddy Test (general VOC), and the Chromotropic Acid Test (formaldehyde), to name a few.

### **What Are Acceptable Components for Floor Coverings?**

The primary and most inert fibers used in commercial carpets today are olefin (which is an old name for hydrocarbon-based polymers; it denotes polypropylene) and nylon. Olefin fibers have good resistance to ultraviolet light (UV), cleaning chemicals, and stains.

Nylon is the most prevalent fiber used today, and is manufactured in two types, 6 and 6,6, which refer to the structure of the polymer based on the manufacturing and dyeing processes. Solution dyed nylon has good resistance to cleaning chemicals and UV exposure, since the color is introduced into the polymer melt during extrusion.

For tile and sheet floor coverings, linoleum rather than polyvinyl chloride (PVC) is recommended, especially for storage vault applications for film-based collections.

For backings and backcoatings, avoid natural latex. It can be allergenic and have 4-Pheyl-cyclohexane as an initial emission. PVC backings must be avoided as well. Synthetic latex (styrene-butadiene rubber backings) and woven polypropylene or polyester are acceptable.

There are few acceptable adhesives available (see tables) for museum preservation application. Water-based acrylic resin formulations meeting the CRI criteria of 0.5 mg/m<sup>2</sup>-hr. or less for total VOCs are acceptable.

### **Summary and Recommendations**

There are acceptable alternatives available to low quality and harmful floor covering products. The following recommendations will contribute to acceptable IAQ within collections areas:

- Choose the recommended components, and look for the CRI IAQ “Green Label.” This indicates that the manufacturer voluntarily participates in the CRI testing programs and is identified by an assigned number in the label. The manufacturer is committed to developing ways to minimize adverse effects on indoor air

quality. The product samples are tested by an independent laboratory on a quarterly basis.

- Use tackless strip installation, if possible.
- Make certain that the installation is done exactly to manufacturer specifications.
- Do not apply anti-microbial treatments to the carpet surfaces. They are not effective and can create VOCs.
- Plan the installation so that there are at least four weeks for off-gassing and relative humidity (RH) equilibration in the space before installing artifacts.
- Avoid carpeting areas below grade or where there is danger of water accumulation.

For information on performance, quality, ease of maintenance, etc., check the web sites for Consumer Reports ([www.consumerreports.org](http://www.consumerreports.org)) and Green Seal ([www.greenseal.org](http://www.greenseal.org)).

### **References**

Tetreault, J. “Coatings for Display and Storage in Museums.” *Technical Bulletin 21*. Ottawa, Ontario: Canadian Conservation Institute, 1999.

Muller, C. *A New Standard for Environmental Assessments in Preservation Environments: Considerations for Monitoring and Classification of Gaseous Pollutants*. Doraville, Georgia: Purafil, Inc., 1999.

Carpet and Rug Institute Web site:  
<[www.carpet-rug.com/](http://www.carpet-rug.com/)>  
(800) 882-8846

### **IAQ Resources for Information and Testing**

Institute for Environmental Assessment, 7101 Northland Circle, Brooklyn Park, MN 55428, (800) 233-9513

Legend Technical Services, Inc., 775 Vandalia Street, St. Paul, MN 55114 (612) 642-1239

**Table 1. Levels and Effects of Harmful VOC's on Selected Object Materials**

(Adapted from CCI Technical Bulletin #21 and Purafil "A New Standard for Environmental Assessments in Preservation Environments" [2000])

Material	VOC	General Product Containing VOC	Maximum Level (ppm)	Effects
Copper alloys	Ammonia	Film forming adhesives	0.001	Tarnish and corrosion
Copper alloys	Formaldehyde	Urea-formaldehyde adhesive films	0.005	Tarnish and corrosion
Copper alloys	Hydrochloric acid	Decomposition of chlorinated plastics and adhesive films	0.003	Corrosion
Copper alloys	Hydrogen sulfide/sulfur dioxide	Hardener in some adhesives; wool fibers	0.0001	Tarnish and corrosion
Silver	Formaldehyde	Urea-formaldehyde adhesive films	0.005	Tarnish and corrosion
Silver	Sulfur compounds	Hardener in some adhesives; wool fibers	0.004	Tarnish and corrosion
Calcium-based objects: shells, eggs, minerals	Acetic acid	Wood products; deterioration of vinyl acetate adhesive films	0.004	Efflorescence, brittleness
Calcium-based objects: shells, eggs, minerals	Formaldehyde	Urea-formaldehyde adhesive films	0.005	Efflorescence, brittleness
Rubber	Acetic acid	Wood products; deterioration of vinyl acetate adhesive films	0.004	Efflorescence, brittleness
Textiles	Sulfur compounds	Hardener in some adhesives; wool fibers	0.004	Tarnish and corrosion
Textiles	Nitrogen oxides	Decomposition of urethane adhesives and plastics; decomposition of cellulose nitrate plastics	0.001	Staining, brittleness
Color photographs	Hydrogen sulfide/sulfur dioxide	Hardener in some adhesives; wool fibers	0.0001	Discoloration
Organic and Inorganic pigments	Nitrogen oxides	Decomposition of urethane adhesives and plastics; decomposition of cellulose nitrate plastics	0.001	Discoloration

**Table 2. Harmful VOCs from Floor Covering Components**

VOC	Origin	Floor covering component
Acetic Acid	Polyvinylacetate	Carpet adhesive formulations, backcoating on fiber backings
Ammonia	Polyurethane	Adhesives, backcoating on fiber backings
Formaldehyde	Polyurethane	Adhesive, backcoating on fiber backings
Hydrochloric Acid	Polyvinylchloride	Adhesives, backcoating on fiber backings, tiles and sheet products
4-Phenylcyclohexane (4-PC)	Styrene-butadiene rubber	Backing component (synthetic latex backing)
Nitrogen oxides	Polyurethane	Adhesives, backcoating on fiber backings
Sulfur oxides	Natural protein-based polymers	Wool fibers

Paul S. Storch  
 Objects Conservator/Section Head  
 Daniels Objects Conservation Laboratory  
 Minnesota Historical Society

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