

HIGH PERFORMANCE SCHOOLS BEST PRACTICES
**SELECTING GREEN & HEALTHY
BUILDING MATERIALS**



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**Selecting Green & Healthy
Building Materials**

Overview

- ❶ Indoor Air Quality (IAQ) in Schools
- ❷ State Environmental Specifications for Office Furniture Systems
- ❸ Section 01350: *Special Environmental Requirements*
- ❹ Environmental Considerations for Selecting Building Materials
 - Examples: Carpet, Resilient Flooring, Acoustical Ceiling Tiles
- ❺ State Resources & Ongoing activities

Indoor Air Quality (IAQ) in Schools

Children

- have higher breathing and metabolic rates than adults
- absorb and retain more toxins than adults
- have less developed immune systems

Children are more vulnerable to poor indoor air quality than adults

Factors Affecting IAQ in Schools

1) Design and construction practices

- Site selection
- Selection of building materials
- HVAC design (e.g. amount of outside air)
- Daylighting
- Building and IAQ commissioning

Factors Affecting IAQ in Schools

2) Operation and maintenance practices

- HVAC operation & maintenance
(e.g. inadequate ventilation, poor maintenance)
- Furnishings
- Cleaning products
- Mold
- Pesticides

First State Environmental Specifications

Developed as part of a state contract for Office Furniture Systems

- ❖ Contain requirements for
 - Indoor air quality
 - Recycled contents
 - Lighting
- ❖ Timeline: about one year to develop.
 - ❖ Released December 2000.
- ❖ Cost: Similar to previous contract!

State Environmental Specifications for Office Furniture Systems

❖ Included in State's 3-year, \$60 million contract

❖ State of California Solicitation No. 49118
(*Department of General Services – Procurement*)

❖ Complete specification available at

www.cal-iaq.org/VOC/

or

www.ciwmb.ca.gov/GreenBuilding/Specs/default.htm

Section 01350: *Special Environmental Requirements*

Special Environmental Requirements – What are they?

A specification for screening building materials based on:

- ⇒ Indoor Air Quality (IAQ)
- ⇒ Resource Efficiency
- ⇒ Material Recyclability

Section 01350: History

Special Environmental requirements

- ⇒ *Spring 2001*: Based on the Office Furniture Systems Specification, *Hensel Phelps* (contractor for Block 225 of the Capitol Area East End Project) releases Section 01350
- ⇒ Numerous materials were tested by 2 private labs for Block 225 based on this Specification
 - Flooring: Carpet tile, linoleum
 - Acoustical ceiling tiles
 - Thermal Insulation
 - MDF
 - Paints
- ⇒ Revised Section 01350 now included in *CHPS Best Practices Manual* and in Reference Specifications for Energy and Resource Efficiency. Complete specification available at

www.chps.net & www.eley.com

Section 01350: Indoor Air Quality (IAQ) Requirements

Specific procedures for

- ⇒ Specimen handling
- ⇒ Pre-conditioning (10 days)
- ⇒ Sample preparation
- ⇒ Chamber loading ratios and air change rate
- ⇒ Testing (ASTM Std. D5116-97)
- ⇒ Instrument calibration

Section 01350: IAQ Requirements

Specific requirements for

- ⇒ Material assemblies
- ⇒ Paint Samples
- ⇒ Cleaning materials
 - ⇒ (submit description, MSDS, and total quantity of each chemical annually)

Section 01350: IAQ Requirements

Reporting requirements:

- ⇒ TVOCs and formaldehyde emissions
 - ⇒ at 24, 48 and 96 hours
- ⇒ Individual VOCs at 96 hours
 - ① Probable or known human carcinogens
 - ⇒ Proposition 65 list
 - ⇒ ARB list of Toxic Air Contaminants
 - ② Reproductive toxicants
 - ⇒ Proposition 65 list
 - ③ Chemicals with Chronic Reference Exposure Levels (RELs)

Section 01350: IAQ Requirements

Chronic Reference Exposure Level (REL):

Airborne concentration that poses no significant health risk to individuals under indefinite exposure.

- ⇒ Based on health considerations reported in scientific literature
- ⇒ Published by OEHHA (Cal-EPA). Available at:
www.oehha.org/air/chronic_rels/allChrels.html
- ⇒ Compliance with Sec. 01350 requires that *modeled concentrations* of a chemical at 96 hours not exceed:
 - ⇒ ½ of the REL (for all chemicals except formaldehyde)
 - ⇒ ½ of 27 ppb (= 33 mg/m³) for formaldehyde
- ⇒ Compliance with Sec. 01350 for adhesives requires:
 - ⇒ No carcinogens or reproductive toxicants at > 1 % of total mass

Section 01350: IAQ Requirements

REL Equation for Modeled Concentrations

$$\begin{aligned}\Rightarrow \text{Concentration} &= \frac{(\text{Emission factor}) \times (\text{Area of Material})}{(\text{Volume of space}) \times (\text{Air change rate})} \\ &= \frac{(\text{mg/m}^2\text{hr}) \times (\text{m}^2)}{(\text{m}^3) \times (\text{h}^{-1})}\end{aligned}$$

- ⇒ Air Change Rate (ach)
 - ⇒ Average weekly for schools: 0.9 ach
(40 hours at 3.0 ach, and 128 hours at 0.2 ach)

Section 01350: IAQ Requirements

Other IAQ Requirements:

- ⇒ Temporary construction exhaust ventilation
 - ⇒ When materials emitting high VOCs are installed

- ⇒ 30 – day flush-out following substantial completion and prior to occupancy

Environmental Considerations in Selecting Building Materials

- No adverse effects on human health
- Contribution to comfortable indoor environment
- Availability of emissions testing data
- Recyclability & amount of recycled contents
- Embodied energy
 - (production, manufacturing, transportation)
- Pollution
 - Generated during mining, manufacturing, transport, installation, use, and disposal
- Resource Efficiency

Environmental Considerations in Selecting Building Materials, *continued*

- Maintenance & cleaning requirements
- Durability
- Cost
- Availability in local market
- Special installation procedures
- Aesthetics
- Flexibility

Selecting Building Materials: Examples

Examples of Environmental Considerations for

- Carpeting
- Resilient flooring
- Acoustical ceiling tiles

Building Materials: Carpeting

Advantages

- ✓ Good barrier for subfloor emissions
- ✓ Resource efficient options are available
 - 50% min. recycled content; 100 % recyclable
- ✓ Thermal comfort
- ✓ Physical comfort (cushion)
- ✓ Noise control

Building Materials: Carpeting

Disadvantages

- ✗ Emits VOCs during & after installation
- ✗ Can adsorb VOCs and re-emit (desorb) later
- ✗ Requires VOC-emitting adhesives & cleaning products
- ✗ Can harbor dust & allergens
- ✗ Mold growth potential if wet
- ✗ Less durable, stains easier than other options
- ✗ Debris generated during replacement
 - **Emissions testing is needed: Carpet & adhesives**

Building Materials: Resilient Flooring

Advantages

- ✓ Excellent barrier for adhesive and subfloor emissions
- ✓ Environmentally preferable options are available
 - e.g. vinyl- and chlorine-free; but may cost more
- ✓ Low first cost; life cycle costs less than carpet
- ✓ Durable, easy to clean
- ✓ High reflectivity
 - May enhance daylighting

Building Materials: Resilient Flooring

Disadvantages

- ✓ Adhesives and maintenance chemicals emit VOCs
- ✓ Most are not recyclable or biodegradable
- ✓ Potential for VOC emissions
- ✓ Less thermal and physical comfort than carpet

➤ **Emissions testing is needed: flooring & adhesives**

Building Materials: Acoustical Ceiling Tiles

Advantages

- ✓ Zero-formaldehyde options available
- ✓ Recycled content materials available
 - 79-85 % recycled (tile); 25 % (suspension systems)
- ✓ Limited reclamation programs available
- ✓ Tiles often cost less than wallboard ceilings
- ✓ Do not require painting or other finish
- ✓ Easy installation; easily reused; flexible

Building Materials: Acoustical Ceiling Tiles

Disadvantages

- ✓ Tile collects dust and absorbs odors
 - ✓ Tile and plenum require periodic maintenance
- ✓ Because of grid organization, tile may not be as adaptable to renovations as gypsum board
- ✓ May emit formaldehyde

➤ **Emissions testing is needed**

State Resources & Ongoing Activities

- 1) DHS Advisory on Relocatable and Renovated Classrooms**
- 2) California Portable Classroom Study**
- 3) Building Materials Emissions Study**

State Resources & Ongoing Activities

Advisory on Relocatable and Renovated Classrooms

- Design
- Construction
- Maintenance

www.cal-iaq.org/ADVISORY.pdf

State Resources & Ongoing Activities

California Portable Classroom Study

- AB 2872 (Shelley, 2000-01) directs ARB and DHS to
 - Review design & construction specifications
 - Review school maintenance practices
 - Assess school IAQ (toxic contaminants, mold etc.)
 - Prepare a report by June 30, 2002
 - summarize findings; recommend actions to remedy & avoid unhealthful conditions in portable classrooms

www.arb.ca.gov/research/indoor/pcs/pcs.htm

State Resources & Ongoing Activities

Building Materials Emissions Study

- Conducted by DHS, funded by CIWMB
 - Compare emissions of materials with high recycled contents to emissions of materials with low- or no-recycled contents*
- *PHASE 1*: Portable classroom construction
 - Completed testing of **19 samples (Report: April, 2002)**
 - ➔ carpet (7) ➔ resilient flooring (5)
 - ➔ MDF (3) ➔ composite wood (2)
 - ➔ Vinyl-covered tack-panels (2)
- *PHASE 2*: State office buildings construction
 - Start: March 15, 2002; Report: October 2002