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PRACTICAL RESEARCH BRIEFS

Movable Partitions Show Decreasing Emissions in Chamber Study

Many people are concerned about the emission potential of various furnishings, especially those of synthetic construction, placed in modern offices. Many IAQ professionals have blamed some of these furnishings for high levels of formaldehyde and volatile organic compounds.

A researcher for Steelcase, Inc., of Grand Rapids, Michigan, USA, has found that three types of movable office partitions tested in an environmental chamber showed initial high levels of both formaldehyde and total volatile organic compounds, but that these levels decreased rapidly within a few weeks of manufacture.

James R. Strobridge presented the report at the recent American Industrial Hygiene Conference and Exposition.

Three movable office partitions of different construction were involved in the study. The testing took place in a large dynamically operated environmental chamber of about 1,100 cubic feet, the equivalent of a 12-foot by 12-foot office. The room was ventilated at about one air change per hour, relative humidity was around 50%, and temperature was about 77°F.

The researchers took the products as soon as they were manufactured, wrapped them in plastic, and shipped them to the testing facility. At the laboratory, workers put the products individually into the chamber and began testing after an initial one- to two-hour equilibrium time.

The products, designated as Partition A, B, and C, contained materials with the following characteristics.

Partition A

Upholstery Fabric: No soil repellent or fire retardant treatments on any panel fabric. A few fabrics have a latex back coating. Fabric can be woven from varying percentages of wool, nylon, and acrylic fiber yarn.

Fabric Attachment Spline Cord: Twisted paper.

Sound Absorption Material: Fibrous molded blankets consisting of spun fiberglass bonded together with phenol-formaldehyde binder resin. The blankets contain no asbestos.

Septum Barrier: Chipboard (untreated/uncoated paperboard material).

Steel Components: Steel coated with polyester baked enamel.

Reveal Strip: Extruded polyvinyl chloride plastic.

Electrical Components: Molded polycarbonate plug-in connectors and duplex outlets: polyvinyl chloride plastic panel-to-panel connectors.

Panel Connecting Hinges: Extruded polypropylene plastic.

Note: There are no glues or adhesives used on this product.

Partition B

Upholstery Fabric: No soil repellent or fire retardant treatments used on panel fabrics, which can be woven from varying percentages of wool, nylon, and acrylic fiber yarns. Fabric is heat-molded.

Upholstery Moldable Substrate: Polyester nonwoven mat with fiberglass scrim and latex binder resins is bonded to the back of the fabric with a hot-melt powder adhesive.

Tackable Sound Absorption Material: Fibrous molded board consisting of spun fiberglass bonded with phenol-formaldehyde binder resin. This board contains no asbestos and is glued to the molded upholstery shell using a hot metal adhesive.

Core Sound Absorption Material: Fibrous molded blankets consisting of spun fiberglass bonded with phenol-formaldehyde resin. The blankets contain no asbestos.

Septum Barrier: Chipboard (treated/uncoated paperboard material).

Steel Components: Steel coated with polyester baked enamel.

Electrical Components: Molded polycarbonate plug-in connectors and duplex outlets: polyvinyl chloride plastic panel-to-panel connectors.

Panel Connecting Hinges: Extruded polypropylene plastic.

Adhesives: Hot-melt adhesive (solid when cooled); solvent-based adhesive (solvent is methyl chloroform).

Partition C

Paint: Polyester baked enamel.

Fiberglass: Fibrous molded blankets consisting of spun fiberglass bonded with phenol-formaldehyde binder resin. The blankets contain no asbestos.

Steel Components: Structural steel skins and outer trim components.

Polyurethane Foam: A rigid polyurethane foam is used between the steel skins.

Adhesive: The adhesive used is a hot melt; when cool, it is a solid. Fabric is "edge-glued" using a methyl-chloroform-based adhesive to both steel and fiberglass.

Fabrics: There is no back coating, soil repellency, or fire retardant treatment. Fabric can be woven from varying percents of wool, nylon and acrylic fiber yarns.

Reveal Strip: Extruded polyvinyl chloride plastic.

Septum Barrier: Chipboard (untreated/uncoated paperboard material).

Results

Tests indicated that both formaldehyde (CHOH) levels and TVOC levels were elevated during the first few days of testing, but declined rapidly and predictably with time. Results from the testing are shown in Tables 1 to 3.

The researchers noted that potential concentrations of pollutants from partitions depended on building parameters, such as ventilation rates, product loading within the building, and the age of the products installed.

The report also cautioned that these results do not apply to all office partitions, but only to those tested.

Table 1 — Emissions from Partition A

Elapsed Exposure Hour	Emission Factor µg/m³/hour	Predicted Air Concentration µg/m³
CHOH		
1	158	52
48	37	12
TVOC		
25	>4	24
581	<6	2

Source: James R. Strobridge

Discussion

A new generation of environmental testing chambers is allowing manufacturers to test products and components during design to measure their pollution potential. (see ***IAQU***, February 1993,

Table 2 — Emissions from Partition B

Elapsed Exposure Hour	Emission Factor µg/m³/hour	Predicted Air Concentrations µg/m³
CHOH		
4	986.88	92
8	858.38	91
24	812.12	82
48	727.31	71
72	549.98	64
96	534.56	61
TVOC		
4	200.46	20
8	141.35	14
24	2,305.29	226
48	1,241.31	122
72	35.98	4
96	0.00	<1.0

Source: James R. Strobridge

Table 3 — Emissions from Partition C

Elapsed Exposure Hour	Emission Factor µg/m³/hour	Predicted Air Concentrations µg/m³
CHOH		
4	1,529.15	26.1
8	1,241.31	26.0
24	621.94	25.9
48	842.96	25.3
120	593.67	23.6
168	925.20	22.5
408	588.53	15.6
528	714.46	17.7
672	544.84	13.6
TVOC		
4	154.20	3.6
8	125.93	3.0
24	92.52	2.2
48	372.65	8.8
120	102.80	2.4
168	53.97	1.3
408	<13.00	<1.0
528	<13.00	<1.0
672	<13.00	<1.0

Source: James R. Strobridge

Testing Firm Unveils New Small Environmental Chamber.)

Strobridge told ***IAQU*** that Steelcase has conducted over 50 such studies to date in an effort to bring its products within acceptable limits for emissions. However, he is correct in noting in his report that building managers bear some of the responsibility for how they introduce new furnishings into an office environment. Not to account for initial offgassing and other effects of new furniture is to invite IAQ problems.

For more information, contact James R. Strobridge, Senior Industrial Hygienist, Steelcase Inc., P.O. Box 1967, Mail Code PS, Grand Rapids, MI 49501, USA; (616) 247-3190.

ETS Raises Lung Cancer Risk for Restaurant, Bar Employees

Most discussions of smoking in bars and restaurants revolves around the desires of patrons. (See related story on Page 11.) However, a recent review of cancer statistics shows that environmental tobacco smoke (ETS) in those establishments increase the risk of cancer for employees.

The literature review by Michael Siegel, MD, MPH, appeared in the July 28, 1993, issue of the Journal of the American Medical Association.

In conducting the review, Dr. Siegel tried to answer two questions: What is the relative exposure of bar and restaurant employees compared to employees of other businesses and to individuals who live with a smoker, and does ETS exposure at work lead to an elevated risk of lung cancer.

Part 1

To answer the first question, Siegel included published studies that reported measurements taken in restaurants and offices that allowed smoking anywhere or measurements taken in the nonsmoking area of places that allowed smoking in a designated area.

He excluded measurements taken in smoking areas or under totally smoke-free conditions.

Residential studies included those where there was at least one smoker.

Siegel found that mean concentrations of ETS components were between 1.6 and 2.0 times higher in restaurants than in offices and 1.5 times higher than in homes with at least one smoker. In bars, ETS constituents measured between 3.9 and 6.1 times higher than in offices and 4.4 to 4.5 times higher than in homes.

Adjusting for the difference in time spent in the various environments, including the time spent sleeping at home, Siegel estimated that total exposure for restaurant workers is at least 1.5 times higher than that for persons who live with a smoker and 4.4 times higher for bar workers compared to someone with domestic exposure.

Part 2

To determine whether there is an increased cancer risk, Siegel used a number of studies that looked at risk among various occupations, eliminating those that didn't control for active smoking.

He determined that food service workers have an excess lung cancer risk of 50% compared with the general population. Siegel considered bar workers and other food service workers separately, and found that the excess risk exists for both groups.

Siegel admits the possibility of alternative explanations for the elevated risk. Among them:

- Residual confounding by active smoking;
- A variable associated with both lung cancer and food service employment;
- Publication bias; and
- Carcinogenic exposure other than ETS.

Siegel rules out these possibilities through several avenues. Many of the studies, he explains, involve detailed smoking histories. In addition, adjusting for smoking produced little change in the elevated risk for men.

As far as a common variable associated with both cancer and employment, the studies involved controlled for one or the other of the possible variables. As far as publication bias, Siegel noted that the studies considered a wide variety of occupations, minimizing the possibility that studies were either accepted or refused for publication because of the food service connection.

In examining whether there might be some other carcinogenic exposure, Siegel ruled out the most likely cause, which would be cooking fumes. While cooks are exposed to cooking fumes in