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Transmittal

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Date: 8/26

Job Name: Poster

Job No: –

To: Hal Levin
c/o William McDonough

Description: ☐ Prints ☐ Tracings ☐ Shop Drawings ☐ Other

Via: ☐ Messenger ☐ Mail ☐ Blueprint ☐ Overnight

Remarks:

Hal –

Apologies for the delay –

Please note this is just a color plot. The final poster will be on smooth finish paper w/ better quality images.

Anthony and I look forward to your comments.

Liza

Sent by: LG.

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Healthy Buildings 1997

MATERIAL SELECTION FOR THE PUBLIC LIBRARY

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ABSTRACT

Design for good indoor air quality (IAQ) in the San Francisco Main Library was advocated by the Architect and requested by the librarians. Design for good IAQ requires an integrated four-part process with material selection (source control) included. A qualified professional team needs to be selected. Target materials are prioritized and product information is requested from the manufacturers, including MSDSs and Environmental Chamber Test Reports. Products are evaluated and found to be "acceptable", "acceptable with specific installation procedures", or "unacceptable". Flush-outs are used to improve the air quality when limited product information is available. Building commissioning provides further IAQ protection. No industry-wide product evaluation and screening procedures are available, but material selection can be achieved using available data and project requested data. Manufacturer's data should be carefully screened and interpreted.

INTRODUCTION

The architects proposed that good Indoor Air Quality (IAQ) criteria be included in the design for the new San Francisco Main Library. This proposal was accepted only after the library staff supported and reinforced this request at staff and public meetings. The challenge for the architects was to develop and incorporate IAQ strategies for this 35,400m^2, seven-story library, designed between April 1990 and August 1992, and constructed between March 1993 and April 1996. The contractor was selected through a public bid process where the lowest bid was accepted.

Four major IAQ strategies were developed: Source Control (including material selection), Ventilation Control, Building Commissioning and a Maintenance Plan. While it is acknowledged that the four strategies are interrelated and need to be applied concurrently, this paper will focus exclusively on the material selection, referencing other strategies where appropriate.

Building materials have been identified as major emission sources in buildings and with careful attention to materials selection, potentially harmful emission may be reduced or eliminated (1, 2). The objective for this project was to gather and evaluate information about the materials, products and furniture, and then make selections with the goal of reducing odor, total volatile organic compounds (TVOC), and individual VOC emissions. Project contract documents were developed to specify products that satisfied the IAQ criteria without any compromise to functionality, aesthetics, color, durability, warranties and cost criteria.

METHOD

This was a large project with many requirements. Therefore, specific IAQ strategies were developed using the following methods:

1. Team Development and Empowerment:
   Once IAQ design criteria were included in the project, a smaller team of consultants was assembled within the larger project team to focus on the IAQ issue.

2. Establish Priorities:
Many products and furnishings are used in buildings and it is almost impossible to obtain and evaluate carefully IAQ information on all the products within the project schedule and available design fee. Therefore, an initial screening was done to identify and prioritize target materials based on quantity, location, known odor characteristics, porosity, known high VOC emitting materials, and maintenance requirements (3, 4, 5).

3. Request and Review Product Data:
For products prioritized high on the target materials list, the following information was requested (in this order) from the manufacturers during the project design:

- Product specifications to include the chemical composition of the material.
- Material Safety Data Sheets (MSDSs).
- Environmental chamber test reports that included a test description; test conditions; a TVOC emission profile with time; an identification of individual VOC emissions; and, in some instances, the manufacturer was requested to identify the emissions of known hazardous chemicals as listed in any one of four regulatory or guidance lists — IARC (6), NTP (7), CARB (8), California Prop. 65 (9).

This information was collected and reviewed, and an evaluation was made, resulting in material and product classifications as shown in Table 1.

Table 1: Classification of materials and products according to review of product data

Class	Description
1	Acceptable as is.
2	Acceptable with specific installation procedures (e.g., temporary ventilation).
3	Acceptable in small quantities or at specific locations.
4	Acceptable with preconditioning.
5	Acceptable with modification (e.g., encapsulation).
6	Unacceptable. Manufacturer was requested to reformulate and re-test product.

It quickly became apparent that adequate information would not be received for all products. Therefore, a more detailed method of research and product specification was used, as indicated in Table 2.

4. Building Flush-Out:
While a number of product manufacturers were forthcoming with information, many were not. With the uncertainty about numerous product emissions and decay rates, and with the limited effectiveness of temporary ventilation during construction, it was decided to implement a building flush-out. Project scheduling allowed for a flush-out for 2.5 months prior to occupancy (10). During this period, the building's mechanical system was run with 100% outside air, for 24 hours per day.

5. Building Commissioning:
A Building Commissioning program was implemented in the Schematic Design Phase and specified in the Construction Documents Phase (11, 12). This was done as a quality assurance program during design and construction, and included a "fine tuning" commissioning after the building was occupied and operational.

Table 2: Materials & Product Selection Method

	Design Phase	Construction Document Phase	Construction Phase
Group 1: Adequate Product Data			
Carpet A [2] Carpet Tile [1] Carpet Adhesives A+B [2]	•Request & Review: -Product Data -MSDS -Emissions Test Data •Classify per Table 1	•For Class 1-4 Materials: -Specify Emissions, Test Requirements & Criteria	•Review Product Submittals: -Confirm Emission Test Data meets Requirements •Confirm Classification per Table 1
Group 2: Limited Product Data			
Custom Carpet B [2] Medium Density Fiberboard [1]	•Request & Review: -Product Data -MSDS -Emissions Test Data	•Specify Product: -Performance Specifications for Emissions	•Review Product Submittals: -MSDS -Emission Test Data •Classify per Table 1
Group 3: Minimal Product Data			
Ceiling Tiles [5] Fibrous Duct Liner [5] VAV Box Acoustical Insulation [5] Air Handling Unit Acoustical Insulation [5] Sheet Floor Material [6] Cementitious Floor Finish [2/3] Built-in Casework [4] Movable Furniture [4]	•Request & Review: -Product Data -MSDS -Emissions Test Data •Classify per Table 1	•Specify Special Procedures -Encapsulation -Temporary Ventilation -Preconditioning -Off-site Fabrication	•Review Product Submittals: -Check Special Procedures •Confirm Classification per Table 1

[#] Material Classification per Table 1

6. Microbial Contamination:
Although microbial growth is not generally considered a major contamination source in the San Francisco climate, during construction mold growth did occur on gypsum board during and after the winter rains due to water intrusion before the atrium skylight (glazed roof) was installed. The affected gypsum board was tested and all contaminated gypsum board was removed.

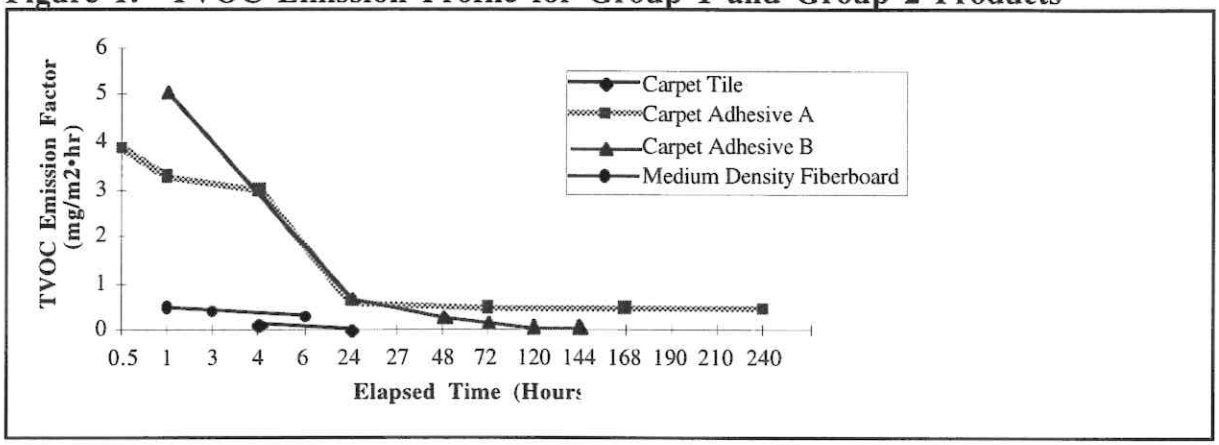
RESULTS

The results are summarized for each product group as follows:

1. Group 1: Adequate Product Data
The manufacturers for Group 1 products had previously tested their products and were able to provide detailed information and Environmental Chamber Test Reports during the design phases. These reports included TVOC emission profiles (Figure 1) as well as emission rates for the identified VOCs. For Carpet A, the manufacturer provided the requested Environmental Chamber Test Report (prepared in accordance with the EPA Policy Dialogue and Carpet and Rug Institute's recommendations) that showed there were

no detectable levels of 4-Phenylcyclohexene (4-PC) at the 24-hour elapsed exposure. This information was used to screen the products for acceptance (Class 1 or 2), and once accepted, the manufacturers certified that the installed products were the same as those tested. In some cases, temporary ventilation was specified during the installation.

Figure 1: TVOC Emission Profile for Group 1 and Group 2 Products



2. Group 2: Limited Product Data

• Custom Carpet B

An Environmental Chamber Test Report (prepared in accordance with the EPA Carpet Policy Dialogue and Carpet and Rug Institute recommendations) was provided by the manufacturer in response to performance specifications. Initial tests on the sample obtained from the manufacturer showed significant emissions of 2-ethyl-1-hexanol as the carpet backing was not correctly cured. The product was then re-manufactured, cured correctly and re-tested. The information was evaluated and the product was accepted (Class 2) as the test data indicated that no emissions 4-Phenylcyclohexene were detected at 24 hours from the newly formulated carpet backing.

• Medium Density Fiberboard

The MSDS provided insufficient information for selection. The Environmental Chamber Test Report was provided by the manufacturer in response to a performance specification, and included the TVOC (Figure 1) and formaldehyde emission factors, and a GC-MS analysis of individual VOCs using a screening test developed by the IAQ Consultant and the test laboratory (4). The product information was evaluated and the product was found to be acceptable (Class 1).

3. Group 3: Minimal Product Data

No Environmental Chamber Test Reports were available for the Group 3 products. Therefore each product required special fabrication and/or installation procedures. Examples of such products include:

1. Fabric-wrapped acoustic fiberglass ceiling panels were encapsulated with a polyester (top) and polyvinylflouride film (bottom), less than 1 mil. thick (Class 5).
2. Where fibrous acoustical insulation was needed in the mechanical system, it was encapsulated with perforated metal in the ducts, with foil in the VAV boxes, and with mylar in the air handling units (Class 5).
3. The sheet floor material was found to be unacceptable (Class 6) for use in a 330m^2 auditorium with an air volume of 2080m^3. Instead, a 3/16" thick cementitious durable floor material was installed with temporary ventilation at 12,000 CFM for the first 96 hours and at 2,000 CFM for the following 160 hours after installation was completed (Class 2/3).

4. All built-in casework was fabricated off-site to allow adhesives and finishes to dry prior to installation (Class 4).
5. Custom-designed, movable furniture was preconditioned by storage in a ventilated warehouse for 30 days prior to installation (Class 4).

Building construction is not an exact science, thus, not all construction problems can be foreseen. It was very effective to flush out the building to purge remaining vapors and dust. The Building Commissioning also contributed to the successful project start up by ensuring that the mechanical system performed as designed.

No damp or mold-infected products were allowed to remain on the project. All such damaged materials were removed.

The library opened to the public in April 1996 with favorable anecdotal reports by the library staff on the Indoor Air Quality.

Where minor IAQ concerns were raised, they were quickly resolved through the post occupancy Building Commissioning process.

DISCUSSION

There are no widely accepted, standardized procedures for evaluating and screening products for use in buildings although practical procedures have been recommended by Levin (1, 5) and Levin and Hodgson (4). Each group of products requires specific screening information prior to evaluation and specification.

Product manufacturers will provide product specifications and MSDSs with very quick turn around. However, this information may lack important IAQ data when such information is considered proprietary, and some MSDSs are inaccurate. Many product manufacturers now provide Environmental Chamber Test Reports, which are useful for screening products provided the Architect is aware of the differences between the test and the actual site conditions (e.g. air changes per hour may be inconsistent; manufactured product may differ from the installed product, aged materials are generally weaker emitters).

Product screening is further aided when manufacturers obtain the Environmental Chamber Tests at the request of the Architect and where the test criteria are developed specifically for the project. Testing should be performed during the design phases for greater control of the project results.

Interpretations of the data must be done carefully with an understanding of the test limitations and sources of inaccuracies. To provide added insurance, especially where few product data are provided, other project procedures, such as flush-out and Building Commissioning, can be effective.

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Key Words:

Environmental Chamber Testing
Emissions
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Odor
Public Building
Source Control
TVOC
VOC