Wallpaper: Brewster Wallcovering, 67 Pacella Park Drive, Randolph, MA 02368. Tel: (800) 366-1700 (toll free in US) or (781) 963-4800 (outside US).

Bamboo wall panels: Mintec Corporation, 100 East Pennsylvania Avenue, Towson, MD 21286. Tel: (888) 964-6832 (toll free in US) or (410) 296-6688 (outside US).

Window treatments: Fabtex, Inc., 111 Woodbine Lane, Danville, PA 17821. Tel: (800) 778-2791 (in US and Canada) or (570) 275-7500; Web site: www.fabtex.com.

Room carpeting: Mannington Commercial, 200 Lexington Avenue, New York, NY 10016. Tel: (800) 241-2262 (in US and Canada) or (212) 251-0290; Web site: www.mannington.com.

Hallway carpeting: Shaw Contract Group, 900 South Harris Street, 072-42, P.O. Drawer 2128, Dalton, GA 30722-2128. Tel: (706) 278-3812. (Commercial contact: Steve Bradfield.)

Carpet padding: Norman D. Lifton Co., 315 East 3rd Street, Mount Vernon, NY 10553. Tel: (800) 431-1808 (toll free in US) or (914) 667-7400 (outside US).

Cleaning products: Envirosafe Cleaning Products, P.O. Box 620356, Woodside, CA 94062. Tel: (650) 369-3711.

Hotel industry Natural Beginnings personal care products: The Hewitt Soap Company, Inc., 333 Linden Avenue, Dayton, OH 45403. Tel: (800) 543-2245 (US and Canada) or (937) 253-1151. Web site: www.hewittsoap.com.

Environmental interior design: Floss Barber, Inc., Architects Building Penthouse, 117 South 17th Street, Philadelphia, PA 19103. Tel: (215) 557-0700; Web site: www.flossbarber.com.

PRACTICAL RESEARCH BRIEFS

CEN Used Results from European Studies to Set Realistic Target Value for Low-Polluting Buildings

Four research studies of more than 80 schools, kindergartens, and office buildings in nine countries produced data that CEN (European Committee for Standardization) used to establish requirements for low-polluting buildings in terms of maximum indoor emissions from materials. Pawel Wargocki and P. Ole Fanger were involved in the studies, and they discuss their findings in *European Data for Building Related Pollution Load and Building-Related Required Ventilation.*

Wargocki and Fanger write that in three of the studies, researchers visited buildings when the occupants were absent during a weekend with the mechanical ventilation system operating normally. A panel of 54 people judged the quality of room air immediately after entering the office buildings, following the procedure specified by the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Standard 62.1 *Ventilation for Acceptable Indoor Air Quality*, Appendix C. Meanwhile, a panel of 13-15 trained judges rated perceived air quality immediately after entering classrooms at several schools and spaces in kindergartens using procedures specified by Bluyssen et al. (1989). Researchers used tracer gas to measure outdoor ventilation rates in these spaces. Based on these measurements, the researchers calculated the sensory pollution load from the building including the HVAC system as "the equivalent number of standard persons which would cause the same percentage acceptance of indoor air as the pollution caused by the actual unoccupied building." When they calculated pollution loads, they converted the judgments of trained panels to ratings by untrained panels using the transfer function established by Wargocki and Fanger (1999). Table 1 shows the pollution loads they determined.

The fourth study took place in 56 office buildings. A trained panel of 12-15 people visited each building once when occupants were there and measured the outdoor supply rate using tracer gas. They again converted the judgments by the trained panel to those of an untrained panel using the same materials are a source of indoor pollution in addition to building occupants. Second, responsible parties should encourage reductions in the building-related sources of indoor pollutants.

For more information, contact Pawel Wargocki and P. Ole Fanger, International Centre for Indoor Environment and Energy, Technical University of Denmark, Building 402, DK-2800 Kgs. Lyngby, Denmark. Tel: +45 4525 4300; Fax: +45 4593 2166; E-mail: pw@et.dtu.dk (for Wargocki) and fanger@et.dtu.dk (for Fanger); Web site: www.ie.dtu.dk.

CASE STUDY

[In each issue, IEQS *presents a case study on an indoor air investigation in a particular building. The information in the cases comes from various sources, including published material, reports in the public record, and, in some cases, reports supplied by the consultants involved in the case.* IEQS *presents a variety of approaches to investigation and mitigation implemented by consultants with a broad range of experience, philosophies, and expertise. Inclusion of a particular case study in the newsletter does not imply* IEQS*'s endorsement of the investigative procedures, analysis, or mitigation techniques employed in the case.* IEQS *invites readers to submit comments, suggestions, and questions concerning the case. At the discretion of the editors, correspondence may be presented in a future issue.]*

When to Search for Hidden Mold in Office Buildings

In January 1998, a major ice storm struck southeastern Canada and the northeastern US, leaving hundreds of thousands of people without power for days or weeks. The storm also caused extensive water damage to many buildings. Afterward, the administrators of an office building in Montréal, Quebec, Canada, hired consultants with expertise in microbial contamination and indoor environments from Group Natur'Åir-Kiwatin to evaluate their building for possible microbial contamination. The Natur'Air-Kiwatin team included Claude Mainville, professional senior engineer and company president; Louis Gagnon, M.Sc., aerobiology; Robert Kelly, B. Sp., geography; and Alain Beaudet, junior engineer, mechanical engineering. For all laboratory testing, the team used the principal of an associate company, Marie-France Pinard, Ph.D., molecular biology, of Laboratoire Microvital. What Natur'Air-Kiwatin found is a textbook study in the need to investigate further when crucial evidence seems to warrant it, despite other evidence or circumstances that may weigh against additional probing. In this case study, the consultants also emphasize the importance of clearly explaining remediation recommendations and of providing clients with a straightforward, cost-effective remediation plan which protects the clients' and tenants' interests.

Background

As is true elsewhere in the world, during the past 25 years Canadian building owners and contractors have made their commercial and other buildings more airtight to conserve energy. During the same period, many organizations reduced their building-maintenance budgets. In numerous cases, these changes have produced problems ranging from "stale" air with higher levels of carbon dioxide and indoor pollutants to severe microbial contamination that reduces human productivity and makes the building occupants ill. In many cases, water leaks through building envelopes and from HVAC systems have produced considerable mold and other microbial contamination. In fact, a Canadian government survey of 95 office buildings from 1987 to 1994 revealed that microbial contamination was the major factor that caused poor indoor air quality in 21% of such airtight but "water-leaky" buildings.

The 1998 ice storm caused already extensive leaks at the 20,000-square-foot Montréal office building to worsen significantly. The three-story structure built in the 1950s has a brick facade, flat roof, and concrete basement. Water leaked in primarily from the roof but also through foundation cracks. After 5 of 33 third-floor occupants complained of asthma, flu-like symptoms, and severe headaches, local health officials evacuated the floor.

Investigation

Natur'Air-Kiwatin called in a family physician with expertise in identifying microbial illnesses to meet with the 33 people working on the third floor of the suspect office building. After the doctor questioned transfer function as before. They calculated the total pollution load as before and found the contribution from the building by subtracting the person-related contribution based on CO_2 measurements (see Table 1).

As shown in Table 1, there is considerable variation among the buildings. The mean values for offices are high — elevated by spaces where people are allowed to smoke. Interestingly, the 25% of buildings with the lowest pollution had a pollution load less than approximately 0.1 equivalent number of standard persons (olf) per square meter of floor (m^2floor), and the median value (50%) was about 0.2 olf/m^2floor for all building categories. This is why CEN chose the value of 0.1 olf/m^2floor as the realistic target value for "low-polluting buildings" in CR 1752 *Ventilation for Buildings — Design Criteria for the Indoor Environment* (1998), Wargocki and Fanger note. You'll find the requirements for low-polluting buildings in terms of maximum emissions for materials and so on listed in Annex to CR 1752. Buildings that do not meet these criteria are in CR 1752 as "non-low-polluting buildings" with a sensory pollution load of 0.2 olf/m^2floor (see Table 2), which is close to the median of existing buildings.

In addition to the load produced by the building, CR 1752 prescribes a load from the persons present that translates into a person-related ventilation rate to be added to the building-related rate. CR 1752 strongly encourages the design of low-polluting buildings, and in Northern Europe today, designers, building managers and owners, and others commonly screen building materials to ensure they use materials that will produce a low-polluting building. They have access to a database of more than 400 building materials (Clausen et al., 1996). The background for this effort also includes the results of many field studies in Europe and North America that showed high rates of dissatisfaction and complaints of sick building syndrome (SBS) symptoms in many buildings. These include: Sundell et al., 1994; Jaakkola and Miettinen, 1995; Bluyssen et al., 1996; Groes et al., 1996; Sieber et al., 1996; Pejtersen et al., 1999; and Apte et al., 2000. Wargocki and Fanger report that SBS occurred in these buildings even though they met the existing ventilation standards included ASHRAE 62.1. According to the researchers, there is a consensus that pollutants from buildings and HVAC systems are a major reason for the SBS symptoms. It therefore is fundamental, they write, that the HVAC engineers acknowledge the building and HVAC system as a potential pollution source and that they make every effort to minimize and control these sources. Recent studies in two countries that documented a significant positive effect on office productivity and SBS symptoms due to decreasing building-related pollution sources (Wargocki et al., 1999; Lagercrantz et al., 2000; Wargocki et al., 2000) underscore the importance of using low-polluting building materials, they report.

Conclusions

The authors reached two conclusions. First, it is essential to acknowledge that building systems and

Table 1 — Sensory Pollution Loads (olf/m^2floor) in Different Types of European Buildings

Building Type	Number of Buildings	25th Percentile	Median	Mean ±SD*
Schools[1]	6	0.03	0.06	0.06+0.04
Kindergartens[2]	15	0.07	0.10	0.12+0.09
Offices[3]	18	0.12	0.32	0.40+0.35
Offices[4]	49	0.07	0.18	0.28+0.34

[1]Thorstensen et al. (1990); [2]Pejtersen et al. (1991); [3]Fanger et al. (1988); [4]Bluyssen et al. (1996).
*SD = standard deviation

Table 2 — Sensory Pollution Loads from the Building Specified by CEN CR 1752 (1998) and the Corresponding Ventilation Required to Handle the Building Load and Obtain 80% Acceptability in Indoor Air Quality

Building Type	Sensory Pollution Load (olf/m^2floor)	Required Building-Related Ventilation (L/s times m^2floor)
Low-polluting building	0.1	0.7
Non-low-polluting building	0.2	1.4