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Assessment Tools

Canadian researchers developed a software tool to predict the impact of building materials and ventilation strategies on indoor air quality.

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Many building materials and furnishings emit chemicals called volatile organic compounds (VOCs), which can adversely affect the health of building occupants. These VOCs are present in varying degrees in building products and materials like coatings, sealants, carpets and adhesives. They are also emitted from many consumer products such as cleaning solvents, aerosols, and dry cleaning compounds. There is a wide variance in how human react to VOCs.

As awareness of VOCs increased in recent decades, there were two problems facing designers. The first was a lack of standards for consistently quantifying the nature and concentrations of these compounds, of which there are hundreds. The second was the difficulty in linking them to health effects. And although it was known that VOCs could adversely affect air quality, there was little guidance to help designers select materials that would reduce harmful emissions.

A consortium organized by the NRC Institute for Research in Construction in the late 1990s sought to address this lack. The first phase of the work saw the research team develop test standards so that emissions could be measured consistently. They used the new testing protocols to determine the quantity and composition of emissions for 48 commonly used building materials. This information became the starting point for a database. The team then turned their efforts to developing a software package called MEDB-IAQ, a tool designed to predict the chemical concentrations in a room for given materials and ventilation conditions.

There was clearly more to be done, and a second phase of the work was begun in 2000. IRC and its partners now set out to expand the database and refine the software tool. They also sought to advance the development of indoor air quality guidelines for office and residential buildings. Other aims were to help investigators diagnose air quality problems, and to help designers assess trade-offs between ventilation and control of emissions at the source.

The years of work in Phase II are now yielding several design aids.

The MEDB-IAQ software database has been greatly expanded and contains more than 2,600 combinations of materials and chemicals. Also, the functionality of the software has been improved and it is now capable of predicting the impacts of material selections and ventilation strategies on indoor air quality. For instance, it can be used to determine whether the designer's choice of materials and ventilation strategies can meet a specific air quality guideline such as that of the World Health Organization. It can also be used to find out how long it will take for the emission concentration to fall below the guideline. The software should be ready for downloading from the IRC web site in late 2005.

The researchers have identified 90 VOCs emitted from building materials, about half of which are known to be potentially harmful to human health. Additional chemicals will be identified for the database as new building products are introduced and as more is learned about the health effects of VOC concentrations. Much more research is needed to determine safe exposure levels for each type of VOC, taking into account the variations in human sensitivity. In the meantime, it is generally accepted that it is good practice to keep VOC emissions in buildings as low as possible.

One of the other key outcomes of the consortium project is the *Practice Guide for Managing VOCs and IAQ in Office Buildings.* This guide is intended to help designers and building owners avoid or rectify indoor air quality problems. It will also serve as a reference for daily duties and for training building staff. It includes information on VOCs and their sources, diagnostic techniques for identifying problems, causes of occupant complaints, strategies for improving indoor air quality, and suggestions on how to balance ventilation and energy use. The guide should be available in a manual format in the first half of 2006.

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