#6675

was above 10 µg/g. All but 1 of the moderate to high levels were of Der f-I allergen.

For Fel d-I, levels less that 1 µg/g of dust present a low risk, while levels between 1 and 8 µg/g of dust may be a risk factor for sensitization to cats. Levels above 8 µg/g of dust present a risk factor for acute asthma.

Researchers reported that high levels of cat dander allergen were detected in samples collected from every building. Of 75 samples taken, 24 fell in the moderate risk range and 7 were in the high range.

While researchers theorize that some Fel d-I allergens came in with employees who owned cats, the levels detected didn't correlate with the number of cats owned by employees in the area sampled. This led to the further hypothesis that some allergens may have come in on visitors and that other factors, such as types of cats and grooming practices, may have contributed to the discrepancy.

The research seems to show that dust mites and cat dander allergens can — and do — exist in office buildings, sometimes in concentrations sufficient to cause allergic reactions in sensitive individuals. This means they can't be ruled out as a cause of some symptoms attributed to IAQ problems.

For further information, contact Dr. Hung, Office of Federal Occupational Health, 3535 Market Street, Philadelphia, PA 19104, USA; (215) 596-1888, Fax: (215) 596-5024.

TOOLS AND TECHNIQUES

"Personal Environments" Show Productivity Gains in Office Study

The concept of giving each employee control over office environmental conditions has been around for a while, but now a study of "environmentally responsive workstations" in an actual office environment has shown definite gains in productivity.

The workstations, called Personal Environments modules (PEMs), from Johnson Controls, Inc. of Milwaukee, Wisconsin, USA, give each worker control over temperature, lighting, background sound, and air flow (see ***IAQU***, October 1989). After a Wisconsin insurance company installed the modules, researchers from Rensselaer Polytechnic Institute (RPI), Troy, New York, USA, recorded a 2% gain in worker productivity, and feel the actual gain might have been even higher.

First Actual-Use Study

Officials at Johnson Controls say this is the first time an actual-use study has linked worker comfort and productivity. Instead of using simulated working conditions with volunteers, the data comes from actual workers in a real environment.

West Bend Mutual Insurance Company of West Bend, Wisconsin, installed the workstations in a new building and envisioned the PEMs as the answer to an ongoing problem faced by facility managers.

"No two human beings feel the same need for a particular temperature at a particular time of the day," says Ron Lauret, a West Bend senior vice president. "One person might be cold and another hot, even though they're sitting only 10 feet apart."

Attempts to pare down the heating and cooling zones were unsuccessful, Lauret says, because as long as there was more than one person in the zone, opinions on comfort differed.

After testing a few prototype PEMs and getting favorable response, West Bend installed about 370 in a new facility. Fortunately, the company had been monitoring employee productivity since 1989, a factor that allowed researchers to make meaningful comparisons.

Researchers tracked 118 of the workers in the underwriter and accounting departments during the one-year study. Data was gathered for six months before the move into the building and for six months afterward. Measurements included the volume of paperwork produced by each employee, as well as absence rates.

Increase in Productivity

After discounting for productivity loss that would normally be expected in a move to a new facility, the RPI researchers determined that there was a net gain in productivity of about 2%. Company officials felt this should have been higher — probably in the range of 6% to 8%.

The discrepancy comes from the researchers' attempts to provide a control group for the re-

Building occupants received questionnaires shortly after the recarpeting was completed. These sought information on any symptoms that the respondents experienced during the installation, including how long the symptoms lasted.

Of the 244 persons surveyed, about half responded, and of these 75 reported that they had suffered symptoms including headaches; tiredness; eye, nose, and throat problems; and nausea. The incidence of symptoms correlated with the emission levels that researchers had measured in the building.

Most people experienced symptoms for between one and three days, while some reported the symptoms for three to five days. The number of people experiencing symptoms remained constant over the first three days, decreased by the fifth day, and was small after seven days.

The researchers concluded that because building occupants in this study experienced symptoms, despite the fact that the building received constant ventilation during and after the recarpeting, it is advisable to use continuous ventilation any time carpet is installed.

They noted, however, that VOC emissions in other buildings could vary, depending on the type of adhesive used, the method of installation, and the amount of outside air being brought into the building.

For more information, contact G. Kerr, Public Works Canada, Ottawa, ON K1A 0M2, Canada.

Some Dry Eye Complaints May Come from VDT Use, Not from IAQ

Many complaints about office environments include references to dry or irritated eyes and workers unable to tolerate wearing contact lenses for any length of time. While this has often been attributed to indoor air quality, two Japanese researchers have recently raised the question of whether the phenomenon can also be attributed to using video display terminals (VDTs).

In a letter to the *New England Journal of Medicine* (February 25, 1993), Kazuo Tsubota and Katsu Nakamori reported on studies they have conducted on 104 healthy office workers. They noted that the subjects blinked 22 (±9) times per minute under relaxed conditions, 10 (±6) times per minute while reading, and 7 (±7) times per minute while looking at text on a VDT.

VDTs could cause workers to blink less, causing dry eyes.

The researchers also noted that those subjects who were reading from a book could look down, partly offsetting the effects of decreased frequency of blinking. While looking at a VDT, however, they tended to keep their eyes wide open.

The larger exposed surface area contributed to a greater rate of tear evaporation from the eyes of the workers using VDTs. This and the reduced blinking rate can both contribute to dry eyes.

To combat the problem, the researchers suggested artificial tears and, in severe cases, special spectacles. Another suggestion was to place the VDT at a lower height with the screen tilted upward.

In many offices where furniture is not designed for computer use, VDTs are placed wherever there is room for them. Often, the VDTs for microcomputers are placed on top of the computers themselves, raising them to eye level or above. This has been blamed for many ailments, including neck and back strain.

While adjusting computer screens may not solve every complaint of dry eyes, it may answer some questions in what appear to be IAQ complaints.

For more information, contact Kazuo Tsubota, MD, Tokyo Dental College, Chiba 272, Japan.

Computer Simulation Measures Energy Cost of Ventilation Increase

The city of Montreal, Quebec, Canada, is considering a by-law that would increase the required outdoor air ventilation rate from the present 3.5 liters per second per person (l/s/p) to the ASHRAE standard of 10 l/s/p. A group of Canadian researchers has conducted a computer simulation that indicates the move could increase energy costs even more than previously estimated.

The group from the Center for Building Studies at Concordia University in Montreal reported

search. Originally, they intended to disable some of the PEMs on a random basis during the trial without telling the workstation occupants. However, when they did this, the affected employees noticed the difference immediately and demanded that the units be reconnected.

The study team would have preferred that the units remain disconnected to get the statistical base they needed for more accurate figures. However, company officials had agreed that if people demanded the units be turned back on, they would do it. "None of us really anticipated that they would have demanded it 15 or 20 minutes into the first day," Lauret commented.

Systems Offer Individual Control

Each PEM has a desktop controller that allows a worker to control such things as temperature, air movement, lighting, and noise levels. Each employee can control the temperature, direction, and velocity of air in his or her workspace. Adjustable panels on either side of the desk deliver the air. A radiant heat panel under the desk controls temperature on the legs and feet.

Both electrostatic and charcoal filters remove particulate and gaseous material.

Task lighting is also adjustable, while lighting in the corridors is indirect, reflected off the white ceiling. A white noise generator masks external sounds and is designed to enhance the sense of privacy.

When an employee leaves his or her workspace, a motion sensor sets air temperature and volume and the radiant heat panel temperature to an energy-saving level. When the employee returns, those parameters return to the previous levels.

A PC-based system monitors air temperature and volume levels in each workspace and directs the central HVAC system to provide sufficient volumes at the right temperature to keep all the employees in that section of the floor supplied, while maintaining energy efficiency levels.

Setting up an office with PEMs means a new approach to delivering supply air. Rather than using ceiling ducts, the system delivers air through partitions between workstations or through a raised floor. In the latter case, the entire raised floor can serve as a supply air plenum.

West Bend officials calculated the payback on the system at about 18 months. Much of the savings came from modifications to the HVAC system for the new building. The increased productivity would add even more.

For more information on the Personal Environments, contact: John Bernaden, Johnson Controls, Inc., P.O. Box 423, Milwaukee, WI 53201, USA; (414) 274-4128, Fax: (414) 274-5135.

For more information on the RPI study, contact: Dr. Walter Kroner, Center for Services Research and Education, Rensselaer Polytechnic Institute, 105 Green Building, 110 8th Street, Troy, NY 12180, USA; (518) 276-6000.

Knowledge-Based Systems: How Computers Can Diagnose Buildings

Knowledge-based systems (KBSs), computer programs that capture and use expert experience, may someday help IAQ consultants evaluate and diagnose buildings. Widely used in a variety of other applications — from medical diagnosis to industrial maintenance — these systems are only now in the early development stages for IAQ.

James E. Woods, professor of building construction at Virginia Polytechnic Institute, Blacksburg, Virginia, USA, explained the current state of building diagnostic programs in a paper delivered at *IAQ '92*, the ASHRAE symposium held in October in San Francisco, California, USA.

Also called expert systems, these KBSs rely on a knowledge base — a database of domain-specific knowledge gathered from experts in the field. Usually, a person called a knowledge engineer determines the parameters of the domain, or area of knowledge, and after collecting the data from human experts, transforms the information into a form that the appropriate program can use.

Building Diagnostics

Woods explained how building diagnostics works. Defined as a process in which a skilled expert draws on available knowledge, techniques, and instruments in order to predict a building's likely performance over a period of time, building diagnostics is similar to the process used in the medical profession, and contains the same four essential steps:

- Knowledge of what to measure;