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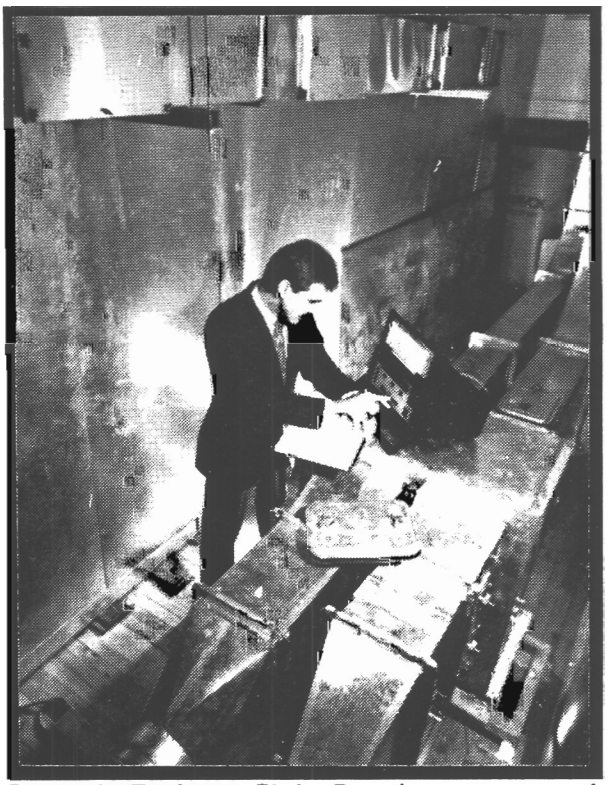
A BETTER INDOOR ENVIRONMENT: STUDIES FIND THAT INSIDE AIR CAN BE IMPROVED WITHOUT RAISING ENERGY COSTS

New research suggests that the quality of air inside office buildings can be significantly improved without producing higher energy bills.

The improvement results from increased amounts of fresh air and an energy recovery system that uses a unique material able to separate compounds according to their molecular size. Microscopic pores in the material -- known as a molecular sieve -- permit the system to reclaim energy from building exhaust air without bringing pollutants back into the building. The recovered energy allows building ventilation systems to bring in more fresh air -- and dilute pollutants -- without raising energy costs.

SEVEN RULES FOR BETTER INDOOR AIR, SEE PAGE 3 OF THIS RELEASE.

Scientists at the Georgia Institute of Technology recently confirmed that energy recovery systems using the molecular sieve material do not transfer pollutants. At the same time, they also found that new standards requiring more fresh air in buildings can significantly improve indoor air quality.



Research Engineer Chris Downing measures air quality in a laboratory-scale total energy recovery system (TERS). (Color/B&W Available)

Concern about indoor air quality has grown in recent years because of increased recognition that indoor pollutants can cause a variety of health problems known as the "sick building syndrome."

FOR MORE INFORMATION:

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To help improve indoor air quality, new standards recommended by the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) -- and recently adopted as part of some building codes -- require four times as much outdoor air as older standards. Ventilation systems of new and renovated office buildings must now provide 20 cubic feet of outside air per minute per person, up from just five cubic feet (in buildings without tobacco smoking) under the old standards.

Recognizing the need for energy conservation and indoor air quality, Carter & Associates (owner), Sunlink Corporation (owner) and Rosser Fabrap International (engineer) incorporated the new ASHRAE ventilation requirements and the molecular sieve energy recovery design in a new Atlanta office building, the Eleven Hundred Peachtree Street Building.

"In areas where the outdoor air is of good quality, bringing more outdoor air into a building helps to remove and dilute indoor pollutants. In almost all cases, you will have lower levels of indoor pollutants."
-- Dr. Charlene Bayer

A recent study of air quality inside the building demonstrated the effectiveness of the new ASHRAE standard, reported Dr. Charlene Bayer, principal research scientist at the Georgia Tech Research Institute (GTRI). Increasing the amount of fresh air to meet the (ASHRAE 62-1989) standard reduced levels of volatile organic compounds in the building's air by 40 percent, while carbon dioxide declined by 33 percent and formaldehyde by 24 percent.

"In areas where the outdoor air is of good quality, bringing more outdoor air into a building helps to remove and dilute indoor air pollutants," said Bayer. "In almost all cases, you will have lower levels of indoor pollutants."

High levels of carbon dioxide can make building occupants lethargic, she said. Boosting the fresh air supply reduced carbon dioxide levels in the building studied from nearly 1,100 parts per million (ppm) -- a level higher than the recommended 1,000 ppm -- to about 700 ppm, Bayer said.

Volatile organic compounds and formaldehyde are irritants that may cause allergic reactions in sensitive persons. The compounds are released by office equipment, furnishings such as pressed-wood products, paints and other finishes, and by cleaning products.

But increasing the supply of fresh air can raise energy consumption because the outside air must be heated, cooled and dehumidified before it can be brought into the building. To overcome these energy penalties, engineers have developed recovery systems designed to capture energy from exhaust air leaving the building. This energy can then be used to pre-condition incoming fresh air, significantly reducing energy consumption.

The most efficient of these systems, known as total energy recovery systems (TERS), use rotating "wheels" that transfer energy as they alternately pass through streams of exhaust and incoming fresh air. Since the cost associated with humidifying and dehumidifying a space is significant, these systems recover both temperature and moisture, making them far more effective than systems which recover only temperature.

In operation, some wheels can also transfer pollutants from the exhaust air into the fresh air supply, potentially negating the benefits of the increased ventilation.

To help solve the problem of pollutant transfer, SEMCO Manufacturing of Columbia, Missouri developed and patented a total energy recovery system that uses an aluminum media coated with a 3 angstrom (3A) molecular sieve dessicant material. Pore openings in the sieve allow only molecules smaller than three angstroms in diameter -- an opening 5,000 times smaller than the diameter of a human hair -- to pass into the fresh air supply, explained Research Engineer Chris Downing.

Water molecules (2.8 angstroms in diameter) can enter and exit the sieve, but because of their larger size, pollutants are excluded.

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Downing and other Georgia Tech scientists tested the wheel by introducing high levels of pollutants on the exhaust air side of a laboratory-scale TERS system. Tests with carbon dioxide, formaldehyde, volatile organic compounds, ozone and sulfur dioxide showed that the wheel did not transfer measurable amounts of those pollutants to the incoming air.

"This means you can increase the amount of fresh air ventilation to a building without significantly increasing the amount of energy used," said Downing. "If you tried to bring in enough fresh air to meet the standards without the energy recovery system, it would be very costly to maintain comfortable conditions."

Because recovering total energy allows builders to install a smaller heating and air conditioning system, the SEMCO recovery system normally does not add to the initial capital costs of a building. And because it is typically 75 to 90 percent efficient at recovering energy, operating costs should not show a significant increase either, he said.

Like many innovations, however, total energy recovery systems have been slow to gain acceptance among builders. But Downing believes the new ventilation standards will accelerate the use of such systems as the best way to improve indoor air quality without raising costs.

This research was sponsored by SEMCO Manufacturing, Inc., Rosser Fabrap International, and Carter & Associates. Results were published in the Proceedings of the ASHRAE Indoor Air Quality '91 Conference in September 1991, and presented at a conference "Measuring, Understanding and Predicting Exposures in the 21st Century," held in Atlanta, Georgia in November 1991.

HOW CAN YOU IMPROVE INDOOR AIR QUALITY? USE COMMON SENSE, SCIENTIST SAYS

Growing awareness of health problems which can result from the "sick building syndrome" has led to new concerns about indoor air quality -- at a time when many building operators face strict financial constraints. Are there ways to improve air quality without large capital investments?

Based on audits of more than 50 office buildings, indoor air experts at the Georgia Tech Research Institute say many problems can be solved through common sense -- or small building alterations. They suggest:

1) **Provide ventilation for office machines such as copiers.** "A common problem we see now is the non-exhausted, improperly-placed office machine," said Dr. Charlene Bayer, principal research scientist at the Georgia Tech Research Institute. Copying machines and laser printers emit pollutants into the air, and those chemicals should be directly removed from the building.

2) **Improve the supply of outdoor air.** Building operators may be tempted to shut off outdoor air supplies to cut energy costs, Bayer noted. But operating heating and air-conditioning systems without fresh air simply circulates and concentrates indoor pollutants, creating what Bayer calls a "false economy."

Annual salary costs for the average office building are approximately $200 per square foot, while annual energy costs run about $2 a square foot. "Lost productivity and increased health insurance costs are pretty high costs," she noted. "If you look at the two against one another, which one would you rather save?"

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3) **Provide proper maintenance for the heating & cooling systems.** Clogged air filters, moldy condensate pans and dirty duct work can be found in many office buildings, evidence of poor maintenance. Maintenance personnel are often not aware of how important equipment care can be to indoor air quality. Simply cleaning up the equipment can often solve indoor air problems, Bayer noted.

4) **Choose cleaning products carefully.** Highly perfumed products are often used to hide building odors, but Bayer suggests maintenance personnel should try to resolve the primary problem. "When you can detect an odor, that means you are releasing organic chemicals into the air," she said. "If you use something which is heavily perfumed to cover that up, you are just adding to the organic load that is already there."

5) **Schedule renovation and pest control work when the building is not occupied.** Painting, carpet installation and other renovation work releases harmful chemicals into the air. Such work should be done while the building is not occupied, and adequate ventilation should be provided to exhaust the pollutants, Bayer said. Likewise, pesticides should only be used when workers are not present.

6) **Use non-polluting products.** Choose furnishings and wall coverings that do not emit pollutants into the indoor air. Preventing problems is easier than cleaning them up once they occur.

7) **Call in professionals for an audit.** If common sense steps don't help, a professional building audit may be necessary to pinpoint problems. Inspectors talk with building owners, maintenance staff and occupants, then study the mechanical systems to look for common problems. In most cases, said Bayer, a day-long inspection can find the causes of indoor air problems without expensive air sampling or other tests.

"Most problems in buildings can be solved with are common sense," she said. "If somebody really sat down and reviewed the operation and maintenance procedures for the building, they would probably never have had a problem."

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