



ADDRESSING IAQ WITH VENTILATION

An office-warehouse owner virtually eliminated tobacco smoke and controlled other contaminants by retrofitting his building's ventilation system. Here's what he did – and why.

BY BECKY BUSBY

As a nonsmoker, Peter Brookner, president of Redi-Floors, Inc., Marietta, GA, had a personal desire to improve his building's air quality. Nearly two-thirds of Redi-Floors' 27 employees smoke cigarettes, and tobacco smoke odors were causing intense complaints from nonsmoking employees. The odor was noticeable to outsiders as well. And Brookner himself noticed that his clothes smelled of cigarette smoke.

Like many other business owners in his position, Brookner tried a no-smoking policy. But many of the smokers were key employees, and their productivity decreased when the smoking ban took effect. "I found that my employees became less productive due to the increased breaks outdoors to smoke," says Brookner.

On top of the tobacco problem, Redi-Floors handles new carpeting and other flooring materials, which emit a variety of volatile organic compounds (VOCs) considered to be indoor air contaminants. Two of Brookner's employees are hypersensitive not only to smoke, but also to chemicals in general.

It was time for action.

RETROFITTING A/C UNITS

Most new commercial buildings in the U.S. are constructed to house small businesses such as Redi-Floors, which has a 30,000-sq-ft warehouse with an enclosed office space of 4,800 sq ft.

Typically, the heating and air conditioning systems used by these small companies are packaged rooftop or residential-type units that rely on infiltration for their outside air intake.

To improve indoor air quality for the majority of America's workers, cost-effective solutions must be found to help



Peter Brookner, president of Redi-Floors, Inc., notices the indoor air quality changes in his building. Says Brookner, "My employees are happier and more productive. Based on this alone, the system has paid for itself."

these facilities, both in new construction and in retrofits of existing buildings.

One answer is a total energy-recovery system designed to cool and dehumidify (precondition) outside air. To reduce operating costs, the system makes use of the heat present in the building's return air.

Unlike conventional air-to-air heat exchangers, many of these units are designed to bring in more outside air without increasing the humidity level

indoors. Most units are compact and can be installed in new or existing unitary hvac systems. As one engineer pointed out, "Today's equipment can be readily retrofitted to packaged air conditioning units without a major change to the building. That's a big improvement."

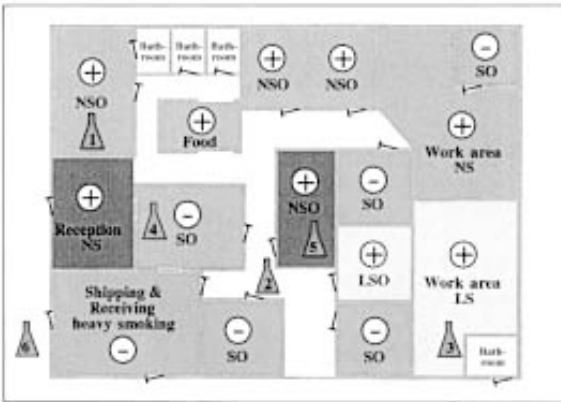
In Redi-Floors' case, two 500-cfm energy-recovery systems from SEMCO, Inc. (Columbia, MO), were added to the building's two 3-ton, electric air conditioning-gas heating units. Preconditioned outside air was supplied to occupied zones through the existing hvac system.

John Fischer, SEMCO technology consultant, designed the system for strategic ventilation, in which nonsmoking areas are under positive pressure in relation to smoking areas. With this pressure-balanced system, smoke is designed not to drift backward into nonsmoking areas.

DOCUMENTING RESULTS

To measure the effect of increased ventilation and pressure balancing on Redi-Floors' indoor air quality, Georgia Tech Research Institute collected air samples during three test phases:

1. Using the original ventilation system (an average of 14 cfm of outside air per person via infiltration), with no smoking allowed;
2. Using the original ventilation system (same cfm rate) with smoking allowed; and



Floor plan of Redi-Floors Inc.'s headquarters shows air pressures used (plus or minus), test sampling locations (symbolized by numbered beakers), and smoking areas (NSO = nonsmoking office; NS = nonsmoking; LSO = light-smoking office; and SO = smoking office).

3. Using the new energy-recovery system (a controlled outside air supply averaging 33 cfm/person) with smoking allowed.

Samples were collected from six sites:

1. The office of a nonsmoker;
2. An area occupied by a hypersensitive nonsmoker;
3. An area of light smoking with intermittent occupancy by seven employees;
4. The shipping and receiving area, with five employees smoking heavily throughout the day;
5. A transition area in a hallway between nonsmoking and smoking areas, with a nonsmoker's desk in the hallway; and
6. An outside air control sample.

Georgia Tech measured not only tobacco-related contaminants, but also several VOCs generated by the flooring materials handled in the space and an additional chemical that comes from cleaning products. Carbon monoxide and carbon dioxide levels were also monitored, as were temperature and relative humidity.

According to the test results, operation of the energy-recovery system more than doubled the air exchange rate, to 2.1 changes per hour compared to 0.8 changes in the original (infiltration) mode. "This two-fold increase in outdoor air supply was achieved without increasing the heating and/or air conditioning capacity, or compromising indoor comfort conditions," says Fischer.

Data on nicotine and pyrrole indicate that the energy-recovery system minimizes the exposure of nonsmokers to tobacco-related

contaminants. During the two smoking-allowed test phases, nicotine levels were 60% lower with the new system versus infiltration alone, and nicotine exposure was more concentrated in the smoking areas.

According to the report, carbon monoxide levels never exceeded 2.25 parts per million by volume (ppmv) when the energy-recovery system was operating, even in the heavy smoking area, compared with 16.3 ppmv in the nonsmoking area using infiltrated ventilation air.

The energy-recovery system also reduced the average concentrations of total VOC compounds by 30% to 36%. The general trend in VOC reduction was more closely related to the ventilation mode than to the presence or absence of smoking. In fact, the nonsmoking employees reported that they preferred the indoor environment with smoking allowed while the energy-recovery system was operating, compared to the original system with smoking banned.

The engineers interpreted this to mean that the reduction of all indoor air pollutants, rather than just tobacco smoke, contributed to a more comfortable environment.

"Although this began as an environmental tobacco smoke study," says Fischer, "the levels of other indoor air contaminants highlighted the need for continuous, effective ventilation even if smoking was not permitted."

BACK TO WORK, YOU

According to RediFloors' Brookner, the complaints from nonsmokers have disappeared, and even the two hypersensitive employees have been pleased with the difference in air quality. In his estimation, employee productivity has increased because smokers need not leave the building for a cigarette break.

"My employees are happier

and more productive," he says. "Based on this alone, the system has paid for itself."

Brookner also believes that with better ventilation, illnesses are not as easily spread. Previously, he had noticed that when one employee became ill, other workers came down with the same symptoms within a week or two.

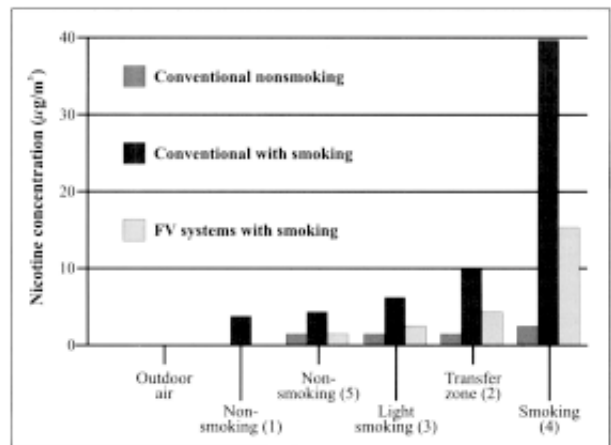
"We've seen a decrease in that type of absenteeism," he says. "Temperature and humidity have remained comfortable, and odors in general have been reduced. The space seems more fresh than before, and when I go home at night, my clothes no longer smell of cigarette smoke."

Brookner tells a story that highlights the effectiveness of the energy-recovery system. Redi-Floors was interviewing for a receptionist position, found the ideal candidate, and made her an offer. However, the person turned it down because she noticed the high level of smoke and other odors during her interview and decided that it would aggravate her allergies.

Then Brookner was reminded that on the day of the interview, Georgia Tech was testing the space with smoking allowed and with the energy-recovery system turned off. He explained the situation to the receptionist candidate, and she revisited the building when the system was operating.

"She noticed a dramatic difference and accepted the job that day," says Brookner. **ES**

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Bar chart shows nicotine levels at six test sites in Redi-Floor's headquarters. Green shows how much was recorded using original ventilation system, when nonsmoking was allowed; red shows how much was recorded with original system, when smoking was allowed; and yellow shows newest system, with smoking allowed.