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PRACTICAL RESEARCH BRIEFS

Moisture Problems Plague Hotel/Motel Industry

Plagued by problems of odor, staining, and structural degradation, the lodging industry is promoting research on moisture with the aim of solving a nationwide problem of moisture infiltration and condensation. Last year, the Association of Hotels and Motels (AHM) conducted a survey of establishments across the United States in an effort to determine the extent, seriousness, and potential causes of high mold concentrations and other moisture-related problems. The findings from this survey, which the AHM has assembled into a report, have prompted both the lodging industry and the US Department of Energy (DOE) to study the problem.

According to John Salmen, director of technology and information for the AHM, the surveys reveal moisture and mold problems occurring in hotels and motels across the country. Faulty building shell design and climate control system design are largely responsible for the problems.

One of the design problems, which is unique to the lodging industry, is the negative pressure resulting from wall-mounted bathroom fans and induction units. The bathroom fans often run continuously, whether or not the rooms are occupied. The induction units draw air from the wall against which they are built. Since most commercially built walls use perforated metal studs, the entire interstitial space becomes negatively pressurized. The negative pressure then draws moisture in through the exterior walls.

In addition, hotel rooms are frequently cooled individually on demand. When guests check in, the desk clerk will switch on the room cooling unit to cool the room immediately, causing rapid chilling of the room air and condensation of any moisture in the air. Compounding the problem is the frequent use of waterproof vinyl wallcovering, which traps the migrating water, resulting in a disintegrating plaster wallboard and an effective reservoir for fungal accumulation.

Another problem, according to Salmen, is that package air-conditioning terminals (PACTs) are often overspecified for the rooms. These units not only chill the air to the point of causing moisture condensation, but the oversized fans increase the pressure in the room and drive moisture into cavities inside the wall.

Regional Variation

Part of the problem, according to Joseph Lstiburek, a building scientist with a specialty in moisture control and IAQ problems, is that the lodging industry is unwilling to recognize important regional climate differences when designing buildings. [Lstiburek, with John Carmody of the University of Minnesota's Underground Space Center, has produced a moisture control manual that discusses these issues. See related story in the Information Exchange.] Though climate factors might seem an obvious consideration, the standard formula approach to building design rarely takes regional variation into account. The bottom-line advantages of across-the board design standardization — known quantities, schedule prediction, and so on — frequently override attempts to address specific environmental circumstances.

Research — Reasons and Solutions

The DOE's Oak Ridge National Laboratory (ORNL) is in the process of developing a study of the moisture penetration problem. According to Jeff Christian, a scientist at ORNL, Oak Ridge is about to embark on a research project using the AHM data as a base for examining the problems of moisture control. According to Christian, the first step is to develop an investigative protocol for looking at the buildings. The protocol might require such measurements as air pressure differences across exterior walls, and pressure and air flows in individual rooms.

Christian anticipates that this first phase of research will both lead to options for correcting some of the problems and prove the effectiveness of the investigation protocol.

For More Information

The American Hotel and Motel Association will be sponsoring a symposium on moisture problems on October 11, 1991, in Orlando, Florida, USA. For more information on the conference, or further details regarding the national survey on moisture problems, contact: John Salmen, American Hotel and Motel Association, 1201 New York Avenue NW, Washington, DC 20005-3931, USA; (202) 289-3100.

Ventilation and Infectious Diseases — Tuberculosis

Tuberculosis (TB), which is caused by *Mycobacterium* species, is an ideal example of airborne infection. Unlike viruses, such as colds and influenza, which may be transferred in the air *or* by surface contact, *Mycobacteria* may only be transferred by water droplets inhaled deeply into the lungs. Early studies during the TB epidemics illustrated a direct relationship between shared air supply and infection: in addition to individual susceptibility, exposure to an infected air stream was a factor in the spread of the disease. Subsequent developments in treatment significantly diminished the public threat of TB.

Recently, however, the number of TB cases has been on the rise, particularly in institutions such as hospitals, shelters, and prisons. Public health officials attribute this in large part to the growing population of HIV-infected individuals. The resurgence of TB has health officials once again looking at environmental conditions as a factor in public health.

Case Study — Increased Ventilation Can Reduce Risk

Dr. Edward Nardell, TB Control Officer for the Massachusetts Department of Public Health, has utilized an existing model to predict the impact of outdoor air supply rates on the infection rate of tuberculosis. Nardell's analysis of a specific case study of an office space appeared recently in the *American Review of Respiratory Diseases*.

About four years ago, public health officials in Massachusetts reported a case of TB that infected 27 out of 67 building occupants, or 40%, over a four-week time period. Public health officials traced the spread of the disease to a single individual who had contracted the illness.

The extremely high rate of infection in the building prompted investigation of the air quality. Two years prior to the outbreak, the office building had been the subject of indoor air complaints, leading to several investigations.

During those investigations, independent consultants measured CO_2 levels between 1,000 and 1,500 ppm. Based on those CO_2 measurements, Nardell and his coauthors estimated outside air rates of approximately 15 cfm per person.

Knowing the number of workers infected over a fixed time period, Nardell used a model to relate the quantity of outside air to infection rate. According to Nardell, who spoke with ***IAQU***, the relationship is logarithmic. The chart in Figure 2, which appeared in the article, is a projection of infection at different ventilation rates, at the estimated dosage rate generated by the original index case. The "strength" of the dose in this case was quite high.

According to Nardell's findings, reducing the outside air rate to 5 cfm/person would have doubled the rate of infection, whereas increasing it to 25 cfm/person would have would reduced it by a third. Raising the ventilation rate to 35 cfm/person would reduce the rate of infection by a half. Increasing ventilation thus reduces the chance of infection, but does not eliminate it. After about 20-30 cfm/person, increasing the outdoor air rate yields decreasing returns. Other factors, such as duration of exposure and the susceptibility of the population become more important.

The TB case study is exceptional in certain respects. The spread of TB in an office is rare, as are such high infection rates. Doubling the outside air rate would cut in half the number of infected occupants, but 20% is still very serious. Nevertheless, Nardell's analysis of the Massachusetts case study suggests that increasing the outside ventilation rate could have a significant effect in reducing TB infection rates.

The article by Nardell, along with coauthors Joann Keegan, Sally A. Cheney, and Sue C. Etkind, appeared in the August issue of the *American Review of Respiratory Diseases*.

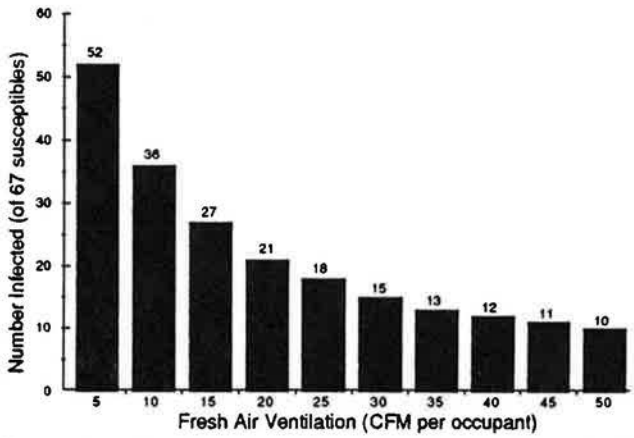

Figure 2 — Predicted number of workers infected with tuberculosis at various levels of outdoor air ventilation. Exposure conditions: 67 susceptible subjects exposed for 160 h to one source case generating 13 infectious quanta per hour (dose rate).