IEQ: Improving the Performance and Health of Buildings

We all know that buildings are designed, operated, and constructed for a variety of purposes. At their most primary level, buildings provide their occupants shelter from the weather and natural hazards. At a higher level, they provide a protective setting for innumerable activities. For example, hospitals and medical facilities are built to enable healing and recovery from illness and injury; schools and universities are constructed to facilitate learning, and workplace structures allow for a myriad of products and services to be designed, built, and used.

At yet another level, buildings such as Rockefeller Center in New York City, are constructed to symbolize and convey status, values and empowerment, as well as to inspire and memorialize people. These facilities can help occupants and visitors formulate new ideas that can have a profound impact on our entire society.

These are just some of the findings recently published by the Federal Facilities Council based on its workshop, Implementing Health-Protective Features and Practices in Buildings. And, many items discussed in the Council's report are of particular and appropriate interest to those

Interesting Facts...

• Up to 30 percent of all buildings contain indoor air contamination.

• Indoor pollution costs more than $50 billion in the United States in healthcare expenses, absenteeism, lost production, and lost revenue.

• In the workplace, allergic reactions to unhealthy IEQ account for more than 10 million workdays missed by U.S. employees each year.

• In schools and universities, allergic reactions to harmful contaminants keep 10,000 American children out of school.

• According to a University of California study, adverse health effects have been identified in 222 traditional cleaning products.

• Nationwide, more than 32 million pounds of household cleaning products are poured down the drain each day.

• Many cleaning products used in households and offices contain more than 50 potentially harmful and possibly lethal chemicals. And, the U.S. Occupational Safety and Health Administration—OSHA—estimates:

• Poor indoor air quality, also known as Sick Building Syndrome,

of us who have the responsibility of improving the facilities we live, work, and learn in.

Such organizations as the US Green Building Council and Hospitals for a Healthy Environment envision a future in which buildings will be designed, constructed, and operated—from move-in to disposal—in such a way as to enhance health, security, comfort, and satisfaction for its occupants. They foresee facilities whose construction will actually influence wellness in our hospitals, student performance on standardized tests in our schools, and do these things cost effectively.

Machines for Living

Studies indicate that we spend as much as 85 percent of our time inside buildings such as homes, workplaces, and schools as well as health care, retail, recreational, and entertainment facilities. In fact, the famous French architect, Le Corbusier, believed buildings are so critical to our everyday lives that he suggested we recognize them as “machines for living.”

But buildings are composed of integrated systems. The actions—or the lack of action—in one area can have consequences that ripple through the entire facility, affecting other building systems and their occupants. Because of this, it might be more appropriate to view buildings as a living organism, and not a “machine” or an inanimate artifact.

The overall Indoor Environmental Quality (IEQ) of buildings can be affected by many external things, such as chemicals, bio-aerosols, mold spores, airborne bacteria, and pollens, as well as temperature, humidity, lighting, noise level, furniture, and equipment design. It can also be influenced by such things as:

- Building design of the structure, including walls, roof, windows, doors, and materials
- Heating, ventilation, and air-conditioning (HVAC) systems
- Construction materials used to build the facility
- Furnishings, fabrics, and materials installed in the structure

affects between 30 and 70 million U.S. workers.

• Approximately 37 percent of the U.S. population suffers from chemical sensitivities, skin rashes, or allergies.

- Lighting systems and design.

Additionally, building operations, maintenance, and cleaning products and procedures can have a profound influence on a facility's IEQ.

Environmental Conditions in Schools

During the 1990s the General Accounting Office (GAO) published a series of reports on the conditions of American schools. The GAO reported that about 58 percent of school facilities in the United States had at least one unsatisfactory environmental condition, and about 13 percent had five or more. The unacceptable conditions most frequently reported were:

- Acoustics for noise control (28 percent)
- Ventilation (27 percent)
- Physical security (24 percent)
- Heating (19 percent)
- Indoor air quality (19 percent)
- Lighting (16 percent).

Increasingly, evidence suggests that some adverse health conditions that afflict employees, students, hospital patients, and others are linked to the presence of indoor pollutants and other aspects of poor IEQ. Many buildings, even some of the best designed, can develop problems that affect the health of occupants if operations, maintenance, or cleaning practices are inadequate.

Although sufficient scientific evidence has not been collected to positively link all of the suspected ties between illness, diseases, and health problems to specific building features and practices, the FFC's Workshop mentioned earlier made one point perfectly clear: Building-related diseases and symptoms are "substantially preventable."

Improving IEQ

The U.S. National Institute for Occupational Safety and Health (NIOSH), a federal agency responsible for conducting research and making recommendations for the prevention of work-related injury and illness,

analyzed the potential benefits that might result from improved IEQ in U.S. work environments. NIOSH reported that:

- An estimated 6 million to 8 million respiratory infections could be prevented each year, at an annual savings of $3 billion to $5 billion.
- One million to 4 million episodes of asthma and allergies could be prevented, at a savings of $200 million to $600 million a year.
- “Other” building-related illnesses and health concerns could be prevented in 8 million to as many as 30 million people, resulting in a productivity benefit of $4 billion to $70 billion annually.

Some practical and immediate operations, cleaning, and maintenance actions that can be implemented to create a more healthful indoor environment include:

- Developing an IEQ management plan that identifies those accountable for implementation of policies to improve and protect IEQ.
- Create an IEQ checklist of some specific tasks to be performed to maintain good IEQ for operations and maintenance staff.
- Monitor buildings to ensure that they are clean, dry, well ventilated, well lit, acoustically sound, and comfortable in terms of temperature and vibration.
- Take measures to limit, control, or eliminate indoor sources of volatile organic compounds such as those in cleaning and maintenance products.
- Minimize the use of pesticide and other powerful chemicals within the facility.
- Implement a proactive program to prevent indoor dampness and mold and to alleviate existing moisture problems as quickly as possible.
- Prohibit smoking inside buildings. Restrict smoking to outside, physically isolated, or depressurized smoking rooms that exhaust air to the outside.
- Keep HVAC systems and other mechanical

equipment well maintained and in proper working condition; follow the manufacturer's installation and maintenance specifications, including proper cleaning, regularly changing filters, and cleaning coil drainage pans.
- Meet, at a minimum, ventilation rates in existing codes and maintain those over the life of the facility.
- Control the growth of Legionella in building water systems. (Legionella, the bacteria that causes Legionnaires' disease, is commonplace in cooling towers which should be monitored to prevent the risk of illness).
- Maintain temperatures within the comfort range specified in thermal comfort standards.
- Keep indoor relative humidity below 70 percent.
- Establish a reporting and feedback system for complaints related to IEQ. Complaints should be taken seriously and the concerns investigated. Corrective actions should be taken when and where necessary, and the actions taken recorded and communicated back to the occupants involved.

Improved IEQ starts with the design and construction of buildings—using materials that have minimal affect on the environment—and continues with good operations and maintenance practices throughout the life of the building. Some of these improvements are quite straightforward, easily implemented, and cost effective. Others may take more time and require more extensive changes in building operations and systems. However, the result can produce outstanding returns for building occupants, turning our "machines for living" into healthy and productive places to live, work, and learn.

By Stephen Askin