Using ASHRAE's New IAQ Guide

By Andrew Persily, Ph.D., Fellow ASHRAE; and **Martha Hewett,** Member ASHRAE

As was seen in the 1970s, ill-conceived approaches to increase energy efficiency can degrade indoor air quality (IAQ), and today's focus on net zero energy buildings must neither repeat the mistakes of the past nor create new ones. Many discussions of sustainable building focus primarily on energy use, but the quality of the indoor environment and its impact on occupant health, satisfaction and performance also must be considered for any building to be a sustainable contribution to the built environment over the long term.

IAQ has traditionally been addressed through minimum ventilation requirements in building codes, which have been based on industry consensus standards such as ASHRAE Standard 62.1. While this approach has helped to improve IAQ in buildings, good IAQ requires more than just the minimum ventilation rates.

Over the years many important contributions have been made directed toward improving IAQ in buildings, including Standard 62.1 and other publications.[1,2] In addition, ASHRAE, the International Society for Indoor Air Quality and Climate (ISIAQ) and other organizations have held conferences that have advanced knowledge and practice related to IAQ. While these efforts have been valuable, the building community still lacked a comprehensive and practical resource on achieving good IAQ for the building professionals who design, construct and commission buildings. To meet this long-standing need, ASHRAE teamed with several key organizations* to develop the newly published *Indoor Air Quality Guide: Best Practices for Design, Construction and Commissioning*. This article presents a short summary of the guide, including its development, format and content.

Background on the *Guide*'s Development

The initial idea for the *IAQ Guide* can be traced back to the development of Standard 62.1. The 62.1 committee was directed in 1997 to write the standard in mandatory and enforceable language to facilitate its adoption and reference by building codes. That direction implied that the standard would contain only minimum requirements. As a result, it could not contain a wide range of potentially useful material such as background information, case studies, or discussion of design approaches and technologies that could improve IAQ but which are not appropriate for minimum requirements for all buildings. The Standard 62.1 Project Committee proposed to provide that additional information through a companion guideline to the standard but the standard so fully consumed their time that they were unable to move the guideline forward quickly.

ASHRAE found a way to meet this need in 2006 for a comprehensive and practical IAQ resource. The Society entered into a cooperative agreement with the U.S. Environmental Protection Agency to develop a guidance document and educational program to assist building professionals in designing and constructing buildings with improved IAQ. Building on the positive experience with the Advanced Energy Design Guides, ASHRAE sought to bring other key organizations in the building community into the IAQ effort, and developed collaborative agreements with the American Institute of Architects, BOMA International, Sheet Metal and Air-Conditioning Contractors' National Association, and the U.S. Green Building Council in addition to the U.S. Environmental Protection Agency. These organizations first met in December 2006 to begin defining the scope of the guide and the process by which it would be developed.

One of the first steps in developing the guide was to assemble a project committee of experts in the field of IAQ and building design, construction, and commissioning to write the document. This group started meeting in spring 2007 and worked for more than two years to complete the document. Two focus groups of architects, engineers, building owners, and sustainable building specialists reviewed early outlines and provided input on what they have found most useful in other design guides. Two peer reviews of drafts of the guide also provided input from many reviewers that helped to shape the final document.

*American Institute of Architects, BOMA International, Sheet Metal and Air-Conditioning Contractors' National Association, U.S. Green Building Council, and U.S. Environmental Protection Agency

Scope

The *IAQ Guide* addresses the design and construction of commercial and institutional buildings, including but not limited to office, retail, education, lodging, and public assembly buildings, with no restrictions as to building size or system type. These buildings are the same as those covered by ASHRAE Standard 62.1 and are the focus of the bulk of the recommendations in the *Guide*. The scope was necessarily limited due to the resources available for its development and the practical need to bound the effort so that it could be completed in a reasonable amount of time.

Several space types and issues are not covered, although the *Guide* does attempt to address their interactions with the rest of the building and other systems. These include commercial kitchens, medical procedure rooms, natatoriums, cold buildings such as cold storage facilities and ice arenas, and laboratory, residential, and industrial spaces.

Content and Organization of the Guide

While building owners and building professionals recognize the importance of IAQ, they do not always appreciate how routine design and construction decisions can result in IAQ problems. The content of the *Guide* is informed by the IAQ problems that have been occurring in commercial and institutional buildings for several decades and the authors' experience in investigating, resolving and avoiding these problems. These problems relate to issues in several major categories, which are used to organize the information contained in the guide.

The summary guidance portion of the* IAQ Guide*, shown here for the strategy on pests, provides an* overview *(upper left) that describes why each strategy is important, how to determine whether it needs to be considered in a particular project, and the general nature of the solutions. It also provides a* case study *for each strategy (gray box) that illustrates how this strategy can be applied. In addition, it contains* tabular and graphical guides *(green box on upper left page and graphic on upper right page) which, on the companion CD, link to over 500 pages of more detailed guidance useful in later phases of design and construction. The pest control section of the CD, for example, contains 17 additional pages of specific design and construction guidance, including 15 additional photos, tables and graphics, and further references.

IAQ not considered during design and construction. Many IAQ problems occur because IAQ was not considered at the beginning of the design process. Basic design decisions related to site selection, building orientation, location of outdoor air intakes and how the building will be heated, cooled and ventilated are critical to good IAQ. Efforts to achieve high levels of building performance without diligent consideration of IAQ at the beginning of the design process can lead to IAQ problems and represent missed opportunities to ensure good IAQ.

Lack of commissioning. While a good design is critical to providing good IAQ, improper installation can seriously compromise it. Therefore, a key factor in achieving good IAQ is a serious commitment to comprehensive commissioning that starts in the design phase and continues well into occupancy. This effort should include a focus on commissioning systems and assemblies critical to good IAQ.

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Moisture in building assemblies. Many notable cases of IAQ problems have been associated with excessive moisture in building assemblies, particularly in the building envelope. Such situations can lead to mold growth that can be difficult to fix without major renovation efforts and costs. Moisture problems arise for a variety of reasons, including roof leaks; rain penetration through leaky windows; envelope design and construction defects, such as low permeability wall coverings in hot and humid climates; and poor building pressure control. These problems are largely avoidable, but require an understanding of building moisture movement and attention to detail in envelope design and construction and in mechanical system selection, installation and operation.

How to Get the Guide

The *Indoor Air Quality Guide* (summary guidance book *and* detailed guidance CD) is available for $29 ($29 Member). A pdf file of only the summary guidance book may be downloaded for free. Visit www.ashrae.org/iaq.

Poor outdoor air quality. The traditional means of dealing with IAQ is through ventilation with outdoor air, but this approach assumes that the outdoor air is cleaner than the indoor air. In many locations and for many contaminants, this is not the case, and insufficiently treated ventilation air can actually make IAQ worse. Poor outdoor air quality includes regionally elevated outdoor contaminant levels, as well as local sources such as motor vehicle exhaust from nearby roadways and contaminants generated by activities in adjacent buildings. Some green building programs recommend across-the-board increases in ventilation rates, but such recommendations may be counterproductive in areas with poor outdoor air quality unless accompanied by appropriate and effective increases in filtration and air cleaning.

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Moisture and dirt in ventilation systems. Dirt accumulation in ventilation systems, combined with poor management of water, can lead to biological growth and serious IAQ problems. These conditions generally result from inadequate levels of particle filtration, poor filter maintenance, and problems with cooling coil condensate, humidifiers or other sources of moisture.

Indoor contaminant sources. Many IAQ problems are associated with indoor contaminant sources that are unusually strong or for some other reason cannot be handled by typical or code-compliant levels of outdoor air ventilation. Many contaminants are released by normal building materials and furnishings, especially when new, and also by materials and substances brought into the building during occupancy. Unusual, unexpected or high contaminant emissions from indoor sources are associated with many IAQ problems, and the guide addresses the issues of material selection, cleaning and other indoor source concerns.

Contaminants from indoor equipment and activities. The wide range of occupancies and activities in commercial and institutional buildings can generate a variety of pollutants. Many IAQ problems can be avoided through proper equipment operation, adequate exhaust ventilation and careful choices of materials used in these activities.

Inadequate ventilation rates. While building codes and standards have addressed outdoor air ventilation for decades, many buildings and spaces are poorly ventilated, which increases the likelihood of IAQ problems. Reasons for inadequate ventilation may include: lack of compliance with applicable codes and standards; installation or maintenance problems that lead to the design ventilation rate not being achieved in practice; and, space use changes without an assessment of the need to modify ventilation rates. Also, system level outdoor air intake rates may be adequate, but air-distribution problems can lead to certain areas in the building being poorly ventilated.

Ineffective filtration and air cleaning. Filtration and air cleaning are effective means of controlling many indoor air pollutants, particularly those associated with poor outdoor air quality. Air filtration or air cleaning can provide an important adjunct to, and in some cases a partial substitute for, outdoor air ventilation. The guide provides a detailed treatment of filtration and air cleaning alternatives which, when properly administered and maintained, can improve IAQ and energy performance.

Based on these common categories of IAQ problems and proven approaches to avoid them, the guide is organized around these eight objectives:

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1. Manage the Design and Construction Process to Achieve Good IAQ;
2. Control Moisture in Building Assemblies;
3. Limit Entry of Outdoor Contaminants;
4. Control Moisture and Contaminants Related to Mechanical Systems;
5. Limit Contaminants from Indoor Sources;
6. Capture and Exhaust Contaminants from Building Equipment and Activities;
7. Reduce Contaminant Concentrations through Ventilation, Filtration, and Air Cleaning; and
8. Apply More Advanced Ventilation Approaches.

Each of these eight sections contains strategies intended to achieve the objective, with a total of 40 strategies presented in the *Guide*.

One of the key features to emerge from the focus group input was an emphasis on succinct and richly illustrated material. The guide contains hundreds of drawings, photos and case studies that convey key points quickly to busy professionals. Another outcome of the focus group discussion was the division of the *Guide* into a summary document that can serve as a reference during conceptual design, and a companion CD with extensive additional information that can be used in later project phases. The summary guidance is available as a pdf file for free download at www.ashrae.org/iaq. The detailed design and construction guidance on the CD is available at a reduced price during the first year of distribution.

Conclusions

The new *IAQ Guide* represents a major step forward in achieving good IAQ by presenting comprehensive and practical guidance for building professionals. Hopefully it will contribute to improved IAQ for many years into the future, beginning by having a major impact on today's efforts to promote sustainable buildings.

References

1. EPA and NIOSH. 1991. *Introduction to Indoor Air Quality. A Reference Manual*. EPA/400/3-91/003, U.S. Environmental Protection Agency, U.S. Public Health Service, National Environmental Health Association.

2. SMACNA. 2007. ANSI/SMACNA 008-2008, *IAQ Guidelines for Occupied Buildings Under Construction*. Sheet Metal and Air Conditioning Contractors' National Association.

Andrew Persily, Ph.D., is group leader, Building and Fire Research Laboratory, National Institute of Standards and Technology, Gaithersburg, Md. Martha Hewett is director of research, Center for Energy and Environment, Minneapolis.