Shifting the IEQ Paradigm from Comfort Silos to Holistic Health and Performance

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ABSTRACT

Indoor environmental quality (IEQ) is generally taken to encompass four main factors: indoor air quality (IAQ), thermal conditions, visual quality, and acoustical quality. Although there is an implicit concern for safety, the predominant metrics all four in standards for design of buildings are based on perceived quality or comfort. For example, ASHRAE Standard 62.1-2013 *Ventilation for Acceptable Indoor Air Quality* (ASHRAE 2013a) strives to provide indoor air "in which there are no known contaminants at harmful concentrations as determined by cognizant authorities and with which a substantial majority (80% or more) of the people exposed do not express dissatisfaction." ASHRAE Standard 55-2013 *Thermal Environmental Conditions for Human Occupancy* (ASHRAE 2013b) defines thermal comfort as "that condition of mind that expresses satisfaction with the thermal environment and is assessed by subjective evaluation." Additionally, both the scientific and standards writing communities treat the main IEQ factors independently and lack metrics for overall quality. Within these areas, a large body of research has established criteria for ventilation, thermal conditions, light, and sound that are widely accepted and utilized.

An alternative view of IEQ is that it should be defined in a way that more directly addresses health and productivity rather than the subject perception of comfort. In other words, measures like differences in healthcare costs, absenteeism from work, quality of learning in school, and rate of production take the place, or are added to considerations of satisfaction. Research to establish connections between performance and IEQ have, to date, focused primarily on the effects of thermal conditions and air quality while little has been done to extend this approach to lighting and acoustics. Air quality studies predominantly consider the effects of varying ventilation rate or of interventions such as particulate filters or other air cleaners. Studies have examined data under laboratory and field conditions and have used simulation to predict various outcomes. Monetized benefit: cost ratios of improved IEQ predicted by these studies are as large as 10:1 and in some cases can be achieved with no additional energy cost or with a net reduction in energy use, for example, through the use of outside air economizer controls where feasible. These benefits are not purely economic, but also human, resulting from predicted reductions in morbidity and mortality. A more limited body of work has considered interactions among IEQ factors, again primarily IAQ and thermal environment, but this has not resulted in a widely accepted approach to integrating them.

While widely discussed and debated the impact of this body of work on policy, standards, and practice, has been relatively small and generally limited to credits in high performance building rating programs such as the US Green Building Council's *Leadership in Energy and Environmental Design* program (USGBC 2014. A promising recent development is the establishment by the US General Services Administration (GSA), which establishes design standards and criteria for government buildings, of a three-tiered system in its PBS-P100 *Facilities Standards for the Public Buildings Service* (GSA 2015) for high performance buildings that includes specifications for enhanced particulate filtration of outside and supply air and, at the highest level, ultraviolet germicidal irradiation of cooling coils. However, in the private sector, minimum standards based on acceptability criteria continue to predominate and IEQ is specified piecemeal without consideration for the relative importance of the various factors. The most significant advances in indoor air quality in recent times have been source

removal and control actions directed at asbestos, radon, indoor smoking, and carbon monoxide. Much remains to be done.

The slow, essentially organic, penetration of research findings on the costs and benefits of IEQ into building standards and policies stands in sharp contrast to aggressive programs for energy conservation, energy supply, and atmospheric protection that have been implemented worldwide by nations independently and as a result of international agreements. The ability to mobilize significant resources to address energy and environmental issues can be credited to an effective effort to explain the significance of research findings to professionals and the public, the ability to express the impacts of energy consumption and environmental damage in concrete and fiscal terms, and the consequent mobilization of political forces. Where IEQ is concerned, this effort has been less coordinated and less effective – but the opportunity exists for this community to take a positive example from the successes of others.

To this end, an alliance of international organizations, the Indoor Environmental Quality Global Alliance (IEQ-GA 2015) has been initiated with the goal of improving the actual, delivered indoor environmental quality in buildings through coordination, education, outreach, and advocacy. Founding members include organizations that broadly deal with indoor environments as well as those specialized primarily in IAQ. Discussions with potential member organizations representing lighting and acoustics are in progress. Although in its infancy, IEQ-GA has already begun work to collect and critique IEQ standards and is organizing and presenting programs at the conferences of member organizations and others. Such an organization can help to create the public and professional awareness and provide the advocacy needed to influence research funding and public policy by speaking with one voice across national boundaries. History clearly suggests that such an organization is needed and the key question at this point is whether the IEQ-GA will succeed in meeting that need. Regardless, organizations that believe in the need for a better approach to IEQ that must recognize the need for a more concerted effort on multiple fronts – research, education, standards, policy – to achieve their goals.

KEYWORDS

Indoor Environmental Quality, Standards, Health, Productivity

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