Multi-Objective Design – Economy, Sustainability, Aesthetics and Fire Safety

Background

People use buildings every day, and want to do so comfortably in a building that is attractive and inviting. Sustainability has immediate and lasting impacts, and lifecycle design of a building should consider impacts on the environment while serving needs of the occupants. Fire is a rare event, but consequences can be considerable if not properly mitigated, and in some cases, mitigation may be contrary to openness, sustainability and other such objectives. This set of widely varied and sometimes competing objectives raises several questions for building fire safety design. A number of different issues relating to this were discussed at the workshop including but not limited to:

- Do we need a comprehensive, holistic and integrated 'building performance model' for building performance analysis and design across multiple objectives?
- If so, which discipline should take the lead, how do we identify and engage the 'right' stakeholders to address the breadth of needs, and what must be done to develop and implement such a model?
- Are all societal objectives of equal weight, and if not, how should they be weighted?
- How far should we be going in trying to 'assure' safe buildings, given the low frequency of fires, relative to the daily use and sustainability impact objectives of buildings?
- Would we approach future building fire safety analysis and design differently than we do today if we have a holistic, risk-informed and performance-based approach?
- What is an appropriate role for benefit-cost analysis, and how do we measure associated benefits and costs?

Findings

To open discussion, perspectives were provided by Margaret S. McNamee, David Barber and Brian Meacham which can be downloaded from the program contained at the end of this report. Can we balance fire safety and health effects? Can fire safety be sustainable? Can architecturally interesting buildings be fire safe?

Three break-out groups discussed these issues and more from a variety of professional and cultural backgrounds. The main findings of each group are outlined below:

Group 1:
This group started their discussion based on relative fire problems in different countries and differing building regulations. Specific questions or ideas which were discussed (not solved) included:

- Can we agree on how to estimate the carbon foot-printing from fires in buildings? Do we need several categories, e.g. commercial and industrial?
- to develop action items needed to move us towards a more holistic, multi-objective analysis and design framework, and the role the fire science and engineering community can play in the process. We will then come together and produce a list of key action items to be addressed within our community.
- One problem with introduction of fire safety into green building schemes is whether a fire event in a building is sufficiently common to include in a sustainability rating system, bearing in mind that the face of fires in buildings changes over time as building practices change.
- There may not even be a significant benefit environmentally from the inclusion of fire protection in green building codes. There is simply not enough information to state with any certainty whether or not there is an inherent environmental advantage to fire safety in buildings. MORE RESEARCH IS NEEDED!

Workshop Program

10:00	Welcome and introduction	Margaret S. McNamee, SP
10:05	Good building design means good looking, well-functioning and sustainable buildings	David Barber, Arup, and Brian Meacham, WPI
10:20	Fire safety and sustainability (building fire safety objectives, potential fire challenges with sustainable practices (competing objectives) and how good fire safety delivers sustainability)	Brian Meacham, WPI
10:35	Buildings are not risk-free – balancing sustainability with fire and health effects	Margaret S. McNamee, SP
10:50	Breakout groups on the three topic areas: • good-looking/well-performing buildings • fire safety and sustainability • and buildings are not risk-free	All
11:30	Break-out groups report	Group Leaders
11:45	Key outcomes & summary comments	Margaret S. McNamee, SP and Brian Meacham, WPI

Group 2:
This group presented a summary of their focus on building code changes rather than on green building tools. Questions which were raised included:

- How can building codes be better designed to take into account the sustainability drivers to avoid unforeseen repercussions of building changes to sustainability
- Should fire scientist participate in writing green building codes? There is a general feeling that the interest from these groups for participation from fire scientists is low. Similarly, the feeling in the fire community is that there is very little possibility to obtain support for inclusion of fire safety in these systems which means that they are reticent about participating. A traditional Catch 22 situation.
- Should we organize a Building Code Workshop?

Group 3:
Group 3 had similar discussions to those expressed by the previous groups. They also felt there was a need for an open dialogue between green building codes and fire safety specialists to foster a discussion of possible trade-offs. How to evaluate these? How to incorporate countervailing objectives into performance based design.

Clearly there is a need for a multi-objective framework. There needs to be a dialogue both at a high level as part of high level decision making, e.g. political decisions concerning performance objectives, and at a low level as part of low level decision making, e.g. as part of peer review.