

# Fire & Smoke

By TIM BAKER, Managing Editor, and  
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On Feb. 10, HPAC Engineering co-hosted a round-table discussion on fire and smoke control at the Hyatt Regency Reunion Hotel in Dallas. Sponsored by Ruskin, a manufacturer of dampers and louvers, the event brought together eight of the industry's leading experts.

Over the course of three hours, the discussion took many turns—some planned and some spontaneous—as the group wrestled with issues such as the purpose of fire codes, prescriptive versus performance-based codes, benchmarks for success, and the current state of code enforcement and inspection. This report—the first of three—focuses on the group's discussion of the topic of active versus passive fire and smoke control.

## A BALANCED APPROACH

With the then-upcoming *2000 International Building Code*™ (the code was published in March—see “News & Analysis,” May 2000) allowing more trade-offs to offset the costs of active fire protection, talk turned to the appropriate balance between passive and active forms of fire and smoke control.

“If you have a fully sprinklered building compared to one that isn't, it's common sense to say that other life-safety features in the building wouldn't have to be the same,” John H. Klote, DSc, PE, a fire- and smoke-control consultant from McLean, Va., said. “You could have some level of trade-offs .... I think where a lot of people get very uncomfortable is that there is no organized plan, no organized approach or scheme, for making these trade-offs. I don't think anyone really keeps track of it.”

At the end of this patchwork process of swapping one safety feature for another, Klote continued, one is left wondering, “How much has been removed from the basic safety of a building?”

Although sprinklers are important, James S. Buckley, PE, a consulting engineer with ccrd partners in Houston, said, they are not a “cure-all.”

“Most code officials say if you put in sprinklers, you don't need to pressurize the stairwells,” Buckley said. “I disagree with that. As an exit path, it's very important for people to get out safely. But when you have an owner who says, ‘Oh well, I don't have to spend the money to pressurize the stairs,’ then it be-

# Control

Codes and standards are a hot topic as experts weigh in on issues surrounding active and passive fire protection during round-table discussion in Dallas

comes very difficult.”

According to Kathleen H. Almand, PE, executive director of the Society of Fire Protection Engineers, at the heart of the trade-off issue is the question of reliability.

“People have a sense that there are some reliability issues for active systems and perhaps maybe there aren’t for passive systems,” she said. “But there hasn’t been a good, thorough look at the whole issue of reliability. In a design approach, you look at a system’s probability of failure. You look at a passive system of compartmentation and you need to look at whether the doors are opening or closing as part of that system. I think that’s what this really is all about. In a code framework, you are looking at trading off X against Y,

where X is a very specific requirement and Y is not.”

## THE IMPORTANCE OF MAINTENANCE

Buckley told the panel that installing appropriate systems—active, passive, or both—is the lesser part of the equation.

“You can put all the systems in you want—stair pressurization and smoke exhaust, passive systems with compartmentalization—but if these systems are not maintained, are not tested and regularly checked, then all the dollars you spent on them, including the sprinkler systems, is money down the drain.”

One should not assume that a well-designed and installed sprinkler system can handle any fire,

Buckley cautioned.

“You can design a system all you want, but people can affect it by either not maintaining it or doing something like storing papers under their desks,” he said.

Bruce W. Hisley, an instructor at the National Fire Academy in Emmitsburg, Md., said that no system is a panacea.

“Passive has its own problems—for example, where somebody violates a (compartment) wall,” he said. “There have been many cases in which shafts have been violated or walls penetrated because people were careless. On the active part, fire alarms and sprinklers are only as good as they’re maintained. It’s scary to realize what is happening regarding the maintenance of these systems.”

Douglas H. Evans, PE, a fire-protection engineer with the Clark County Building Dept. in Las Vegas, said that one of the first fire-resistant aspects of a building to be damaged after the building is completed are passive barriers.

“The owners, maintenance people, the contractors who are brought in

## The Participants



**Kathleen H. Almand, PE**, is the executive director of the Society of Fire Protection

Engineers, which represents over 4000 fire-safety engineering professionals in more than 20 countries. Previously, she was director of research applications for the Civil Engineering Research Foundation. She has a master’s degree in civil engineering from the University of Ottawa, Canada.



**James S. Buckley, PE**, is a consulting engineer with ccrd partners in Houston. Since

1981, he has been designing systems for high-rise office buildings as well as specialized facilities such as data centers, network rooms, and satellite transmission facilities. He has been heavily involved in ASHRAE Technical Committee 5.6, *Control of Fire and Smoke*.



**Thomas R. Edwards** is president of Ruskin, a U.S. manufacturer of dampers and

louvers and the sponsor of the Fire and Smoke Control Round Table. With a degree in engineering from the University of Wisconsin, he has 21 years of experience on the mechanical-supplier side of the business. He is a member of ASHRAE and AMCA’s board of directors.



**Douglas H. Evans, PE**, is a fire-protection engineer with the Clark County Building Dept. in

Las Vegas, where he is responsible for the coordination and review of fire-protection approaches for major structures, including malls, atria, arenas, resorts, and high-rises. Over the last several years, he has acquired considerable experience with smoke-management systems.

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afterward will do whatever they need to do to get their job done," he said. "If they need to run a telephone wire, they'll do it. If they get trash stuck in a trash chute, perhaps they knock a hole in the wall."

In many cases, Evans said, the integrity of those barriers is not reestablished.

Unfortunately, the inspection process does not offer much reassurance, Hisley said.

"I call it the old pencil-whipping inspection," he said. "They pull out the paperwork from last year and check everything they checked before."

**REDUNDANCY A MUST**

Stressing the importance of overlapping systems and redundancy, Hisley cited floods that have inundated parts of Iowa over the last five years.

"A local fire chief (in Iowa) said that because the water system is down, you can't occupy the high-rise building," Hisley recalled. "Buildings are too vulnerable to fire without sprinkler systems. There's no backup."

The Iowa case is an example of a failure to design redundant systems, Evans said.

"If you have to close down the building because there is no city water, then that wasn't thought out very clearly in the initial design phase," he said.

Sprinkler systems should be coupled with compartmentation for optimum protection, Evans argued.

**MAINTENANCE NOT CODIFIED**

Part of the reason that the maintenance of fire- and smoke-control systems is so spotty is that codes do not address all aspects of it, Evans said.

"The codes give you guidance on how to put these systems together and how they're supposed to work, but they fall short on maintenance," Evans said. "I understand ASHRAE is developing some guidelines on continued-maintenance testing of smoke-control systems."

Hisley confirmed that there is some momentum behind codifying maintenance and setting standards for inspectors. The *2000 International Fire Code™* includes qualifications for people who test smoke-control systems, he said.

"It actually says the kind of pedigree the third-party inspector should have," Hisley said. Also, "It even spells out what should be tested. Before, you could throw the switch and say, 'I tested it and it worked.' That was it. Now, it spells out what you're supposed to check and when you do the inspections. It's very detailed—about four pages of material in the fire code. It's a positive movement."

Gregory E. Harrington, PE, a fire-protection engineer with the National Fire Protection Association (NFPA),

said that, at least with respect to sprinklers, the NFPA's *Life Safety Code®* is "real clear" on the issue of testing and maintenance.

"It says if you have a required sprinkler system for life safety, it shall be tested and maintained in accordance with NFPA 25 (*Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*)," he said. "All that is spelled out real clearly. What NFPA codes don't attempt to do is specify who is qualified to do that testing or maintenance because it's licensed pretty much on a state-by-state basis."

Unfortunately, maintenance is an afterthought in the United States, Almand said. However, there are certain countries that have set a positive example to the contrary.

"I spent a little time in Australia during the time when they were beginning their thinking about performance-based codes," she said. "It was very clear to me that this idea of maintenance and follow-through certainly was in their thinking. There was a much greater expectation that there would be continuous inspection."

Evans said that maintenance cannot be codified in building codes because, "You will never sell this to the building officials who adopt the building code. They do not want to accept that responsibility and aren't set up for that type of financial com-

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**The Participants**



**Gregory E. Harrington, PE,** is a fire-protection engineer in the National Fire Protection Association's Building Fire Protection and Life Safety Dept. He is the staff liaison on the technical committees on Air Conditioning (NFPA 90A and 90B) and Smoke Management Systems (NFPA 92A, 92B, and 204) and is a regular instructor for the NFPA's Life Safety Code seminar.

of mechanical systems in structures. After retiring from the Anne Arundel County (Md.) Fire Dept. in 1984, he joined the National Fire Academy (NFA) in Emmitsburg, Md. He now is in charge of the NFA's fire-prevention technical courses, which cover inspection and testing.



**Bruce W. Hisley** has 17 years of experience in the plan review, inspection, and testing

Previously, he conducted research on fire and smoke control for NIST. He is the author of two books on smoke control, chapters for countless other books, and more than 85 technical papers and articles. He is a member of HPAC Engineering's Editorial Advisory Board.



**John H. Klote, DSc, PE,** is a fire- and smoke-control consultant from McLean, Va.

Margate, Fla. For over 12 years, she has been representing individual companies and trade associations at hearings to develop model building codes, where over 90 percent of the changes she has submitted have been approved by model-code organizations.



**Vickie J. Lovell** is president of InterCode Inc., a building-code consulting firm based in

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pensation. Maintenance is codified in the fire codes. The tendency that I'm seeing in the fire-protection community is to move toward special inspectors, qualified individuals who work in private practice and go in and recommission different aspects of the system. This is already being done with fire alarms and sprinklers."

Hisley agreed. The recommissioning—including maintenance—of fire- and smoke-control systems is going to become a lucrative industry for highly trained professionals working in private practice, he said.

#### CLEARER CODE LANGUAGE NEEDED FOR SMOKE

Vickie J. Lovell, president of Inter-Code Inc., a building-code consulting firm in Margate, Fla., said that codes historically have been preoccupied with the containment of fire, that any resistance to the free passage of smoke that they offered was more by default than design. She expressed concern that many fire-resistance features that offer protection from smoke, such as combination fire/smoke dampers, smoke- and draft-control doors, and sealed penetrations and joints, are permitted to be traded off in the new *International Building Code (IBC)*.

"Some are very concerned that there are fewer provisions for the control of smoke in the *IBC* than in any previously published model code," she said. "Yet smoke-related injuries and deaths outnumber fire-related injuries and deaths four to one ...."

A lack of direction in codes regarding smoke reflects the fact that two smoke-control systems can have two entirely different performance objectives, Harrington said.

"We (the NFPA) provide guidance in the 92A (*Guide on Smoke Management Systems*) and 92B (*Guide for Smoke Management Systems in Malls, Atria, and Large Areas*) guides, but, again, they're recommendations—they're not mandatory requirements because every smoke-control system is different," he said. "You have to

look at what the performance objectives of that smoke-control system are. What is the life-safety dependency on that smoke-management system? Is it there for helping to clear out the smoke after the fire department arrives so that they can do their mop-up operations? Or is it there to provide a tenable means of egress for the building population during fire emergency?"

To Klote, the problem is a lack of a consistent philosophy running through the various codes when it comes to smoke control. For instance, the ICC recently voted against requiring closed elevator lobbies. To Klote, this indicates a fundamental lack of commitment to smoke control.

"Now you have some very good barriers in a number of places, but smoke can just flow into the elevator shafts and go up wherever it wishes," he said. "Maybe there's some hidden protection that I missed in the (ICC) document, but that's something that, to me, seems to be terribly inconsistent. A typical elevator door has a leakage area of between half and three-quarters of a square foot. Smoke can flow into these doors and up and around—and it has. There have been an awful lot of building fires in which smoke moved through the elevator hoistways.

"So here we are," Klote continued. "You've just described what I think are some good barrier protections. But the new code that's coming down the road that we're all going to be relying on has just grossly failed in one of the areas."

Klote said that this lack of a common philosophy between and, sometimes, within codes can lead to major oversights, as systems are viewed by components rather than as a whole.

#### A FLAW IN THE CODE-APPROVAL PROCESS?

Evans agreed with Klote.

"If you think of fire protection in terms of systems, then you can spot these types of inconsistencies," he said. "If you think of it in terms of components, then some aspects are going to be missed."

This problem goes back to the code-approval process, which suffers from too much compromise, Thomas R. Edwards, president of Ruskin, said.

"Everybody throws in their code change ... and it can change the whole goal of the system," he said. "It's a line-item veto system, but it's the best we have."

Buckley said compromises and concessions often become evident during testing.

"If you test (smoke-control elements) correctly with hot smoke and other things, you see, all of a sudden, that your smoke isn't going where it's supposed to

go. It's supposed to go to that fan right there, (but) it's going out through the elevator shaft over here."

#### SUMMARY

The panel was in agreement that active controls alone do not an effective fire- and smoke-protection system make, that passive measures, such as compartmentation, also are needed. Further, the panel agreed that a well-designed system is only as good as it is maintained and that more guidance on maintenance is needed in codes. Finally, the panelists agreed that a greater commitment to smoke control also is needed in codes.

*In the second installment of this series, the panelists will discuss the advent of performance-based fire codes.*

**"You can put all the systems in you want, but if these systems are not maintained, then all the dollars you spent on them is money down the drain."**

—James S. Buckley, PE