The Need for Balanced Fire Protection in Buildings

by the Alliance for Fire Safety

A steady erosion of building code provisions concerning fire-resistant construction in commercial and institutional facilities has placed firefighters and the general public at greater risk than ever before. This trend has caused fire protection in buildings to be out of balance. And things are getting worse.

Over the past 30 years, the three national model building codes have called for increased use of sprinklers, while steadily reducing requirements for fire and smoke resistant components such as:

- Fire walls and fire barriers
- Fire-rated reinforced concrete construction
- Concrete and masonry exterior walls
- Fireproofing for steel columns, beams and floor decks
- Fire and smoke dampers, doors and windows
- Firestopping
- Fire and smoke sealants and gaskets
- Smoke control systems

Reductions in fire and smoke-resistant construction and materials, generally referred to as "sprinkler trade-offs," are designed to pay for the installation of automatic sprinklers. However, these structural components, materials and systems have a proven track record of containing and controlling the spread of fire and smoke and limiting the damage to a burning building and surrounding structures. In addition, they maintain structural stability, enabling building occupants to escape safely, and permitting firefighters to do their jobs with minimum risk.

Fire- and smoke-resistant construction also provides compartmentation (subdivision of large building areas to contain the spread of fire and smoke), protects holes in floors and walls such as shafts and ducts where fire and smoke can rapidly spread, and affords safe passage through exit corridors and stairways during a fire emergency.

Despite the inherent benefits of fire- and smoke-resistant construction, the new model codes continue to be receptive to "sprinkler trade-offs" that create potentially dangerous imbalances in fire protection. This trend has been

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supported, in part, by building owners and developers who seek to reduce construction costs. Unfortunately, those who favor more sprinklers at the expense of fire-resistant construction insist that sprinklers are virtually foolproof and that built-in fire protection measures are, therefore, unnecessary.

While it is clear that sprinklers are important in protecting property and lives, there is ample evidence to show that they do not always perform as intended. In fact, recent data obtained from the National Fire Protection Association shows that *sprinklers failed to operate in one out of every six fires*.* Since sprinkler systems can and do fail to operate, there is still cause for concern when fire- and smoke-resistant construction continues to be traded-off. So why place all of our fire protection eggs in one basket?

The cited sprinkler failure rate takes into account actual fires in which sprinklers failed to perform as designed, as well as malfunctions due to inadequate inspection and maintenance practices, willful shut-off of the sprinkler system, or a loss of water supply. Even when deficiencies are found through inspections, they often go uncorrected. The *San Francisco Chronicle* recently reported that only 14 percent of that city's more than 2,200 fire safety violations from the previous year—including sprinkler system deficiencies—had been corrected.

Those needing further evidence that sprinklers may not always function as intended need only examine the product recall record of sprinklers between 1999 and 2001. During that period, the U.S. Consumer Product Safety Commission sought to recall some 67 defective sprinkler models because of their potential to fail during a fire. The defective sprinkler models represented more than 37 million sprinklers manufactured between 1961 and 2001. Last year, Underwriters Laboratories asked building owners and fire sprinkler contractors to submit samples of yet another popular sprinkler model, which were taken from actual installations for laboratory testing. Recent inspections revealed that some of those sprinklers also had the potential to fail.

Equally alarming is the fact that sprinkler system failures can occur even if the systems are otherwise functioning properly. Reported incidents of Microbial Induced Corrosion (MIC) –corrosion that results from bacterial attack of the interior surfaces of the sprinkler's water supply pipes– are increasing. MIC initially restricts, then blocks the flow of water to the sprinkler head. Eventually, the MIC is discovered when pinhole leaks develop in the pipes. However, in the

absence of such leaks, MIC may go undetected until fire activates the sprinklers. At that point, the corrosion may not only restrict water flow, but clog the sprinkler heads as well.

Even if a sprinkler system functions properly, a fire involving a larger than anticipated quantity of combustibles or fast-burning materials has the potential to overwhelm it. For example, earlier this year, fire destroyed a St. Louis warehouse packed full of highly flammable foam rubber. The sprinklers activated properly, but apparently were no match for the speed and size of the blaze.

The growing acceptance of sprinklers as a reliable, primary weapon in fighting and containing fires is having a profound impact on how new buildings are constructed. The International Code Council (ICC) – created through the merger of the three regional model code groups: the Building Officials and Code Administrators International (BOCA), the Southern Building Code Congress International (SBCCI) and the International Conference of Building Officials (ICBO) – has developed the International Building Code (IBC). The new model code has ushered in an era of fire safety that is far less stringent than that provided by any previous model code. This new trend—a result of trading-off built-in fire- and smoke-resistant construction for sprinklers—is also reflected in the new National Fire Protection Association's NFPA 5000 Building Construction and Safety Code.

Following are three examples of the ways in which fire protection through fire- and smoke-resistant construction has eroded under the newly published model building codes:

- The BOCA National Building Code allowed certain buildings with sprinklers to be constructed with no building area limits and no “fire ratings” (i.e. construction rated for its ability to resist fire for a specific period of time) as long as they were only one-story high. Under the IBC and NFPA 5000, these "unlimited-area" buildings can now be two stories high and still need not be fire-rated.

- The SBCCI Standard Building Code required fire walls separating buildings to have a four-hour fire resistance rating. The new codes have reduced the ratings to as little as two or three hours in most cases, depending on the building's use.

- The ICBO Uniform Building Code allowed sprinklers to be used to increase

either the allowable height or the allowable floor area of buildings, but not both. However, the IBC and NFPA 5000 allow both increases for the same building, while not requiring increased fire-resistant construction.

In truth, both the IBC and NFPA 5000 permit the use of significant sprinkler trade-offs that could lead to greater destruction of property and less safety for building occupants and firefighters over the life of the building. Furthermore, other sprinkler trade-offs have resulted in the following situations:

- Fire resistance ratings have been reduced or eliminated for structural components such as columns, beams, floors and bearing walls, as well as fire doors, fire dampers and firestopping.
- The maximum distance allowed for people to escape from a work area to the nearest exit has been increased.
- The required fire-resistance ratings for exit corridors has been reduced or eliminated.
- Smoke control systems are no longer required in high-rise buildings, even though sprinklers cannot eliminate smoke.

Efforts to reduce requirements relating to fire- and smoke-resistant construction make little sense given the fact that fires originating in fire-resistant compartments seldom migrate, according to a recent study by the National Fire Protection Research Foundation. While only one in 10 fires extend to adjacent areas in fire-resistant buildings, more than 20 percent of fires that started in rooms built with unprotected wood frame spread to adjacent areas. At the same time, fires involving fire-resistant construction result in lower dollar loss—$4,000 on average, as opposed to $11,000 for fires involving unprotected, wood-frame construction—according to the NFPRF study.

More importantly, the NFPRF study suggests that the risk of death from fire in buildings up to six stories high that are built using fire-resistant construction and materials is 35 percent lower than for comparable buildings with unprotected wood framing.

The value of fire-resistant construction was clearly demonstrated in a fire that gutted four floors of the 62-story, First Interstate Tower office complex in downtown Los Angeles in 1987. The blaze blew out windows and destroyed office furnishings on each of the four floors, but resulted in no loss of life. This was attributed, in part, to the performance of fireproofing that had been applied to

the building's steel framing 16 years earlier. While the fireproofing was burned and blackened, it provided an effective protective shield, preventing key structural assemblies from warping and collapsing from the intense heat. Four months later, the building was re-opened and was totally functional.

When viewed collectively, sprinkler trade-offs have the potential to place building occupants and firefighters in great danger should sprinkler systems fail to function properly during a fire. Without adequate fire-resistant construction, compartmentation, and other forms of built-in fire protection, building occupants may not have enough time to evacuate, and firefighters may be unduly hampered when attempting to suppress the fire and carry out their rescue mission.

Although sprinklers are an important fire-protection tool, proponents are often tempted to ignore their shortcomings. Given what is now known about the performance of sprinkler systems and fire-resistant components and materials, it seems prudent to require that new buildings incorporate *both* forms of fire protection in a manner consistent with previous, more conservative building codes. **As a start, this will require a reassessment of the new allowable height and area requirements, including Table 503 and related Sections 504, 506 and 507 of the IBC and Table 7.4.1 and related Sections 7.5 and 7.6 of NFPA 5000.**

Just as seat belts and airbags work together to provide even greater safety in automobiles, built-in fire- and smoke-resistant construction, working together with sprinklers, can achieve even greater fire safety in buildings. With lives at stake, nothing less should be acceptable.

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*Failure rate statistic is based on a 1989-1998 NFPA survey of more than 8,000 fires.