

High-Rise Fire Protection: *A Tall Order*

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This is a familiar pattern: fire protection codes are strengthened after a devastating fire. Following the MGM Grand Hotel and Las Vegas Hilton fires, the state of Nevada enacted some of the most stringent fire protection standards in the U.S. Eighty-five persons lost their lives in the MGM Grand fire and eight were killed in the Hilton.

The Hotel and Motel Fire Safety Act (now Public Law 101-391) was a direct response by the U.S. government to the Dupont Plaza Hotel and Casino fire in which 97 persons died. The law steers the \$1.5 billion federal travel business to sprinklered hotels. It prohibits federally funded conferences from being held at unsprinklered hotels and requires that 90 percent of federal travel nights be spent at sprinklered hotels by 1997. Puerto Rico also enacted legislation after that fire, requiring increased fire protection in high-rise buildings (residential and commercial), industrial properties, government buildings, and hotels.

As indicated above, high-rise fire protection in the U.S. is legislated by a patchwork quilt of city, state, and federal laws, many of them directly adopted or adapted from model code-making organizations such as the International Conference of Building Officials (ICBO), the Building Officials and Code Administrators International (BOCA), and the Southern Building Code Congress International (SBCCI). Most local codes currently require complete sprinkler protection in new high-rises, but local authorities are often reluctant to require a complete retrofit of existing high-rises because of the expense and inconvenience to the business community.

The cost of installing sprinklers in a new building is comparable to the cost of installing wall-to-wall carpeting. Retrofitting a sprinkler system can cost almost 50 percent more than a new installation (or even more if asbestos has to be removed from the building). In addition, high-rise owners feel they cannot afford to disrupt their or their tenants' day-to-day business operations to accommodate a retrofit. Unfortunately, it sometimes takes a catastrophic loss to overcome the reluctance of both lawmakers and high-rise owners.

Obviously, high-rise owners must comply with the fire codes that govern their area; however, considering the potential severity and recent history of high-rise fires, they may want to reevaluate fire protection and, if necessary, protect beyond the requirements of local codes.

Factory Mutual Research Recommendations

Factory Mutual Research believes that adequate sprinkler coverage is the key to providing the best possible physical protection in high-rise buildings and so recommends automatic sprinkler protection for all new high-rise buildings and for all areas of significant combustible loading in existing high-rise buildings of fire-resistive construction. (For other recommended fire protection features, see following page.)

In today's high-rise office buildings, a significant combustible loading may be more the rule than the exception. Office furnishings such as wooden desks, chairs, and bookcases, upholstered furniture, plastic cushions, and office machinery all provide fuel for fire. Interior finish and construction can also contribute to the combustible loading. Some areas may have plywood, hardboard, or solid lumber wall paneling, vinyl wall covering, wooden doors, carpeting on floors and walls, built-in wooden cabinets, wooden area dividers or movable partitions between work areas. Multiply these contents times 10 or even 100 floors, and the potential for a severe fire is great.

Consider, too, that modern high-rises often house more than offices; many are a mix of offices, retail stores, restaurants, and even small manufacturing and commercial operations. These contribute such items such as merchandise, decor, furnishings, gas-and electric-fired cooking appliances, and packaging material to the combustible loading. Residential occupancies such as apartments, hotels, and dormitories also have combustible furnishings and kitchens with cooking appliances.

Some would argue that fire-resistive construction or the use of compartmentation in these buildings would negate the need for sprinkler protection. Factory Mutual Research sees these elements as only a starting point for protection.

Fire-resistive construction generally consists of protected steel and concrete structural frame, glass or metal curtain walls, interior partitions of noncombustible gypsum board on steel and suspended ceilings of mineral tile. This type of construction can help preserve a building's structural integrity during a fire, but it won't prevent the interior from being destroyed.

Compartmentation involves subdividing a building of fire-resistive construction into smaller spaces or compartments. Building codes usually define compartmentation as areas less than or equal to 15,000 ft² (1,395 m²) cut off by two-hour fire walls. Theoretically, a fire starting in one room or area will be confined to that area, will be easily approachable by fire fighters, and may even self-extinguish once oxygen or fuel is consumed. This approach has worked in some apartment buildings, but it has a major drawback: confining fire damage to one area may satisfy the high-rise owner, but it is little consolation to a tenant who could suffer extensive property damage and business interruption.

Both fire-resistive construction and compartmentation can help limit the size of a fire, but they can't extinguish it. More practical for a modern high-rise is fire-resistive construction and compartmentation combined with an active fire suppression system.

Fire protection features

In addition to sprinkler protection, the following features are needed in high-rises to aid in fire extinguishment.

Provide hose stations for manual fire fighting on every floor. The number of hose stations in each section of the building subdivided by fire walls should be such that all portions of each story are within 30 ft (9 m) of a nozzle attached to not more than 100 ft (30 m) of hose (longer hose can be cumbersome).

Both 2½-in. (64 mm) and 1½-in. (38 mm) hose connections are needed on every floor. The connections may be through one 2½-in. (64 mm) hose valve with an easily removable 2½-by-1½-in. (64-by-38 mm) adapter. Provide a 2½-in. (64 mm) roof hose outlet for those high-rises with combustible roofs, or where structures on the roof are of combustible construction or have combustible contents.

The minimum water supply to any given floor should be able to fulfill the demand of the sprinkler system or hose requirements, whichever is larger. The most desirable supply of water is through a public water system that can meet pressure and discharge capacity requirements. Generally, high-rises of more than

15 stories will require automatic fire pumps, which can be supplied by public water mains or tanks to meet water supply requirements on the upper floors. In some cases, pressure tanks and gravity tanks can also be arranged to satisfy fire protection needs.

Alarm protection is particularly important in high-rise buildings as fire control depends on detection in its early stages. Even after detection, there is an inherent delay as fire fighters will not only have to travel to the fire, but often will have to load their gear onto elevators, unload one or two floors below the fire, and carry equipment up the stairs to the hose stations. Meanwhile, the fire is growing.

This delay can be offset by a sprinkler system, which can both detect a fire and begin fighting it promptly. To achieve this, a properly designed alarm system is imperative. Install sprinkler water flow alarms on each floor to serve not only as constant alarm protection but also to aid in finding the seat of a fire; finding a fire can be difficult because smoke spread often results in fires being reported on several floors.

Ensure that the water flow device will actuate the alarm system at the operation of a single sprinkler. The operation of the flow device should indicate on an annunciator and /or register in the high-rise's emergency communications center or at grade level at the point of fire department access.

A supervisory signal, separate and distinct from any other building supervisory signals, can be used to monitor the sprinkler system, fire pump power supplies and operating condition, water tank level and temperature, and pressure on all pressure tanks. Monitoring sprinkler control valves is particularly important; if they are shut off for any reason, sprinkler protection is impaired.

The human element also comes into play in high-rise protection. An Emergency Organization (EO) should be established and trained in the proper actions in the event of a fire. Building owners and tenants need to come up with an emergency plan, train EO members to carry out that plan and make sure trained members are available at all times to handle emergencies.



◀ The charred exterior of One Meridian Plaza in Philadelphia following the March 23, 1991 fire.