

# **Life Safety Laws: Sprinklers in High-Rise Buildings**

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## Background

Sprinklers are proven to save lives and property. According to the National Fire Protection Association (NFPA), buildings equipped with fire sprinklers lowered the risk of death and property damage by 50% to 66%. Between 1996 and 2001, the average cost of fire damage in buildings with a working sprinkler system was less than \$400,000, while the loss incurred in buildings without sprinkler systems averaged \$2.2 million. Sprinklers have a 95% to 99% success rate in extinguishing fires.

To protect his factory, an American piano manufacturer invented automatic fire sprinklers in 1874. Through the 1950's sprinklers were installed primarily in factories and warehouses. Now they can be found in almost all new commercial and apartment construction. The majority of older buildings that have been renovated have been retrofitted with sprinklers.

In 2001, the total number of sprinklers sold was 40 million, which was double the number sold in the early 1990's. The National Fire Sprinkler Association (NFSA) estimates there are over 800 million sprinkler heads installed in the United States and Canada. Ordinances and building code sprinkler requirements have led to an increase in the number of sprinklers sold.

Properly installed and maintained sprinklers in good working condition can effectively fight the spread of fires in their early stages before they can cause severe injury to people and property damage. Newer sprinkler systems are built to allow one sprinkler head to activate to fight a fire without the entire sprinkler system activating. Sprinkler heads are designed to react to temperatures in individual rooms. The chances of a fire sprinkler accidentally going off are unlikely. NFPA has no record of a fire killing more than two people in a building completely equipped with sprinklers where the system was properly operating, except in an explosion or flash fire or where industrial fire brigade members or employees were killed during fire suppression operations.

Smoke is the main cause of death to building occupants who experience a fire. Although smoke is produced as sprinklers extinguish a fire, the quantities of smoke produced are less than those which would be produced by a growing fire not controlled by sprinklers.

## High-rise Building Fires

Fire is always a serious threat to high-rise buildings. It is difficult for fire fighters to reach upper floors since most fire truck ladders only reach to the sixth or seventh floor. High-rise buildings are also difficult to evacuate. Hundreds of people may be forced to exit down crowded stairs since elevators are not to be used during a fire.

Certain stairwells and electrical and plumbing chases may allow smoke to travel to several floors above the fire. Building materials in high-rises built since 1960 create a further danger when a fire generates poisonous smoke from thousands of miles of wiring, plastics, furniture, flooring, and carpeting. The longer a fire burns the more toxic and dangerous it becomes. Windows may be blown out as a high-rise fire intensifies allowing flames to leap to the exterior, spreading to other floors through open or broken windows.

High-rise fire deaths are at an all-time low. High-rise buildings are among the safest types of buildings in the event of a fire since they are being constructed with fire resistant materials. Commercial high-rise office buildings also tend to be safer due to intensified education and safety efforts. Residential buildings, however, tend to be more dangerous because of how they're used. Three major risk factors for fire include cooking, smoking, and dangerous play by children. Relevant statistics:

- **Only 1% of all fire deaths, nationwide, occur in high-rise buildings.**
- 80% of fires occur in the home.
- 82% of high-rise fires originate in non-office areas (restrooms, kitchens, storerooms, and copy rooms).

- 94% of high-rise fires are confined to the room of origin (due to such safety measures as compartmentalization).
- 98% of fires in buildings equipped with sprinkler systems are extinguished prior to the arrival of the fire department.

### **Sprinkler Recall Raised Major Concerns**

On July 19, 2001 the U.S. Consumer Product Safety Commission and the Central Sprinkler Company, an affiliate of Tyco Fire Products LP, announced a voluntary replacement program. Central Sprinkler Company provided free parts and labor to replace 35 million Central fire sprinklers with O-ring seals. Central initiated the recall after it discovered the performance of the O-ring sprinklers degrade over time. The sprinkler heads can corrode or minerals, salts, and other contaminants in water can affect the O-ring rubber seals, causing heads not to activate in a fire. Central provided newer fire sprinklers that do not use O-ring seals. The recall was the third largest replacement program in the U.S. Consumer Product Safety Commission's history.

The recall raised concern of fire safety officials that there is an over-reliance on sprinklers. In recent years building code officials and fire-safety inspectors throughout the country relaxed long-standing requirements that call for passive fire protection in buildings equipped with sprinklers. Passive fire protection systems may include fire and smoke resistance rated assemblies, sealed with fire-stopping systems, fire and smoke dampers, fire doors, and sprinkler suppression systems. Simultaneously many building code officials are permitting builders to construct taller and wider high-rises with more open space, more narrow stairwells, fewer exits, less fire doors and walls, and less extensive fire protection in the roofs.

Upon a change in property management, the potential or newly hired management group should research the type of sprinklers in the building and check to see if a recall was previously issued on the equipment.

### **Sprinkler Maintenance and Inspection Issues**

Fires can be very damaging in buildings with malfunctioning sprinkler systems. In February 2000, a sprinkler failure in a nursing home near Philadelphia killed an elderly woman and injured another woman. The pipes were clogged due to corrosion from the bacteria in the water supply. The full water pressure could not reach the sprinkler heads because the pipes were so badly clogged.

In July 2001, a fire destroyed a storage facility at the National Severe Storms Laboratory in Norman, Oklahoma, destroying important research equipment and a new Doppler Radar System. The damage to the facility was estimated at \$1.8 million. The only fire control system was the sprinkler system. The piping system had been cut four years before the fire occurred. Since the system was not checked annually the building managers did not know it was not operational.

Human errors are sometimes to blame when sprinklers do not work properly. According to an Association of Walls and Ceilings article titled "Making the Case for Balanced Design: Why Sprinklers Are Not Enough" people have been known to make some basic mistakes. They leave water valves closed, paint over sprinkler heads, increase the fuel load beyond the design capacity of the sprinklers, move walls creating unsprinklered areas, and place objects on top of furniture, such as filing cabinets, blocking sprinklers.

Sprinklers are beneficial, but they are not perfect. If a building does not have any other life-saving devices in addition to a sprinkler system, the building tenants and property could still be in danger, especially if the system is not properly maintained. Routine inspection and maintenance of sprinkler systems is essential.

## City Ordinances

Many U.S. cities have quickly drafted legislation regarding life safety quickly after a major fire when emotions are running high. Los Angeles, Philadelphia, Atlanta, Las Vegas, and the State of Massachusetts have enacted legislation requiring commercial high-rise buildings be retrofitted with sprinklers. Las Vegas passed a city ordinance after a 1980 fire at the MGM Grande Hotel killed 85 people. City governments rush to pass sprinkler ordinances in response to the public's demands. Consequently, building owners and property managers are burdened with unrealistic compliance timetables and other burdensome provisions.

The Chicago City Council has a history of amending its municipal code to require sprinklers in specified buildings after fatal fires, according to a 1999 Chicago High-Rise Commission Report. After the 1958 Our Lady of the Angels fire killed 95, mostly students, Chicago began requiring sprinklers in schools. The 1967 McCormick Place fire that killed one person and ruined the building led Chicago to require sprinklers in exhibition halls. The Hawthorne House fire that killed four residents in the early 1970's was the catalyst for Chicago's ordinance requiring either a sprinkler system or compartmentation in new construction of high-rises. Proposals requiring high-rises built *prior* to 1975 to be retrofitted with sprinklers have been considered by the Chicago City Council in recent years.

## Case Study

The City of Chicago experienced two commercial high-rise building fires within fourteen months. On October 17, 2003, a fire at the Cook County Administration Building killed six employees who attempted to escape the building by exiting down the stairs. The stairwell doors locked and were unequipped with an automatic unlocking device; consequently once the employees were in the stairwell, they could not escape. Firefighters on the twelfth floor reportedly told them they could not go down and had to go back up. The Chicago Office of Emergency Management and Communications (OEMC) investigated the fire and released a report of its findings. OEMC identified several elements that contributed to the fatal fire, including:

- The lack of a specific protocol for top-to-bottom searches of high-rise buildings prior to a fire being extinguished;
- The lack of effective control over the building's communications system;
- The lack of safety measures at the Cook County Administration Building;
- A lack of coordination and clear instruction between building management, tenants, and the Fire Department;
- And the lack of building information providing 911 dispatchers with stairwell locations.

Two reports, including the OEMC report, stated lives could have been saved if the building had been equipped with sprinklers and stairwell doors that automatically unlocked during emergencies.

The failures of the *building management* of the Cook County Administration Building were recently studied by the James Lee Witt Associates Fire Review Team. The Review Team's key findings, highlighted in "Building Operating Management" in January 2005, included:

- Building management failed to develop, publish, and implement a full evacuation plan, to determine the roles for security personnel, building personnel, and building occupants.
- Building management failed to name a deputy fire safety director with current and valid certification or other life-safety leader to share responsibilities with the fire safety director.
- Building management failed to organize quarterly evacuation drills to ensure all parties were aware of emergency procedures.
- Building management failed to properly maintain fire and life-safety systems through scheduled service and repair.

Property managers should routinely evaluate and update their properties' emergency procedures.

The second commercial high-rise fire occurred at the LaSalle Bank headquarters on Monday, December 6, 2004. The fire was contained to the floor twenty-nine and thirty of the forty-five-story LaSalle Bank Building. Thirty-seven people were injured that night in the five alarm fire, mostly firefighters; however no one died as a result of the fire. The cause of the fire is believed to be accidental; investigators have not released an official report yet.

Sprinklers were not required in either the LaSalle Bank or Cook County Administration Building since both high-rise buildings were built before 1975. Since 1975, sprinklers have been required in all buildings constructed in Chicago that are eighty feet and higher. LaSalle Bank had begun to retrofit the building with sprinklers. The only floors with sprinklers were the basement and concourse levels. The County building did not have a sprinkler system above the first floor.

*While commercial high-rise fires receive a great deal of press, most high-rise fire fatalities occur in residential buildings.* A study by BOMA Chicago concluded that since World War II, Chicago has suffered 77 high-rise fire deaths in hotels, 57 in residential structures, and 14 (including the six victims of the 2003 fire) in office structures. In 2003, there were forty-three fire deaths in one to four unit residential housing in Chicago according to the Chicagoland Apartment Association.

The Chicago City Council passed the High-Rise Safety Substitute Ordinance on December 15, 2004 after years of very deliberative and thoughtful debate. The ordinance, supported by Chicago Mayor Richard M. Daley, requires certain existing commercial high-rises to be equipped with a full, automatic sprinkler system by January 1, 2017. The timetable for sprinkler installation will be allowed in three phases: one-third of the building must be equipped with sprinklers by 2009, two-thirds by 2013, and the entire building by 2017. Landmark buildings, non-transient residential buildings, open-air parking facilities, open-air portions of stadiums, and certain portions of mixed-use occupancy buildings are exempt. Residential high-rises must submit thorough life safety evaluations, conducted by a licensed architect or engineer, of their buildings to the City.

The ordinance features other major requirements affecting commercial and residential high-rises:

- Commercial and residential high-rise owners or managers must file a Life Safety Data Sheet containing pertinent information such as the building owner and manager's contact info and the address of the building, with the Fire Department by April 1, 2005. Inspections are not required to be completed at that time.
- A licensed professional engineer or architect must evaluate residential high-rises for life safety by January 1, 2006 and certified evaluations must be filed with the Fire Department and the Department of Buildings. Buildings that initially fail the evaluation will be required to make modifications to pass the evaluation by 2012.
- Commercial and residential high-rises must be equipped with both one-way and two-way voice communications systems by January 1, 2012.
- Residential high-rises are required to have 1-hour fire-rated doors installed by 2012.

Issuance of new buildings permits for building owners who are not in compliance with the ordinance are prohibited.

In Chicago there are eighty-seven commercial high-rise buildings defined as structures more than seventy-five feet tall, built before sprinklers were required in 1975. There are more than 700 multifamily residential high-rise buildings that are not equipped with sprinkler systems. It is estimated retrofitting the eighty-seven commercial properties that would be affected by the ordinance could cost more than \$350 million. In addition, it could cost \$280 million for the accompanying asbestos abatement.

## **Impact on Commercial Brokers**

### **Illinois Association of REALTORS® Push for Incentives**

The CCIM Institute and the Illinois Association of REALTORS® support any and all incentives to make sprinkler installation a cost-effective option for building owners. The real estate industry, both commercial and residential, has developed a list of incentives to achieve the goal of fire safety, education, and protection.

Incentives that professionals in the industry recommend and support:

- Tax credits including deduction for the interest on a loan to finance installation of a sprinkler system, tax credits for major renovation of older buildings, exemption from state and local sales taxes on the purchase of related materials, and federal tax credits for commercial building owners.
- A special property tax assessment category deferring the cost of installing sprinkler systems by reducing the rate at which the property is assessed for a certain time period. The value of a sprinkler system can be exempted from assessment and taxation and not be deemed real property for as long as the building does not undergo a change in ownership after the system is installed.
- An assessment freeze period, for example ten years, for buildings that install sprinklers.
- Creation of a state fund via state legislation to guarantee loans for retrofitting buildings, thereby reducing installation costs on those loans.
- Government sponsored bonds to provide an additional source of loans at reduced rates for retrofitting.

Currently, there are relatively few incentives for property owners and managers to install sprinklers. Many professionals in the real estate industry support incentives versus mandates for installing sprinklers.

It is in the best interest of property managers to be knowledgeable of proposed and existing local, state, and federal laws affecting their properties. Members of the CCIM Institute may contact the Legislative Department Staff for information and resources.

### **Financial Impact**

The cost of installing fire sprinkler systems is a major concern of property managers. Many factors may affect the cost of retrofitting sprinklers in existing high-rise buildings including its location, height, and the ceiling structure. Businesses, trade associations, and sprinkler companies vary widely in their estimates. The National Fire Protection Association (NFPA) estimates it costs up to \$3.50 per square foot to retrofit sprinklers. However, that estimate includes additional expenses, such as asbestos removal if it is necessary. Spot asbestos abatement costs averaged \$1.00 to \$4.00 per square foot in recent years. Real estate interests estimate it costs up to \$10 or \$12 per square foot to retrofit commercial high-rise buildings and up to \$20 per square foot to retrofit residential high-rises. The estimates provided by real estate experts include the costs of sprinkler installation, standpipe installation, electrical work, drywall, asbestos abatement, and lead mitigation. Additional costs could include tenant relocation and the loss of tenants due to retrofitting.

The cost of installing fire sprinkler systems in new construction is much less, averaging \$1 to \$2 per square foot in smaller communities. In cities such as Chicago, the cost is higher, averaging \$2 to \$5 per square foot due to stricter requirements of the city.

Property managers should be cautious in regards to the percentage of the building they remodel as remodeling may cause the building to fall within the category of those that need to be retrofitted.

### **Reductions in Insurance Premiums**

Installation of fire sprinklers can provide discounts on insurance premiums. After September 11, 2001, insurance companies raised the rates for high rise buildings and certain incentives were withdrawn. According to the Northern Illinois Fire Insurance Board, when a building is retrofitted with a fire sprinkler

system, the fire insurance savings can range from 20% or higher for common areas. Across the country, tenant space or homeowner area savings can range from 5% to 20%. Discounts vary depending on the insurance company and the city, metropolitan area, or region. Property managers may want to contact their insurance companies to learn if they offer such a discount.

### **Reducing Liability**

Catastrophic fires result in significant liability for business owners. In 1991, One Meridian Plaza in Philadelphia, a thirty-eight story building, burned down to the first floor. The first floor was the only floor equipped with sprinklers which finally extinguished the fire when it reached the first floor. Three firefighters died in attempting to put out the fire. Claims totaled over one billion dollars. Hundreds of millions of dollars in damages were awarded in lawsuits, including the significant lawsuit between the building owner and his or her insurer. Sprinklers minimize liability.

### **Tax Deductions**

Building owners can obtain a depreciation allowance for the value of the sprinkler system, in addition to a deduction for the interest on a loan, if they finance the cost of installation. Building owners may qualify for a federal Rehabilitation Tax Credit for renovations of historic buildings.

Property owners or managers may want to contact their local or municipal governments to find out if there is property tax relief available for retrofitting high-rise buildings with sprinklers. They also may want to ask if the state, county, or city provides sales tax exemptions on the purchase of sprinkler installation materials.

### **Maintenance**

Fires can be very damaging to buildings with sprinkler systems that are not working properly. Building managers could be giving themselves a false sense of security if the building's only life-safety feature in the building is a sprinkler system and it is not working properly. Sprinkler heads can be faulty, pipes can be clogged, or water lines can be damaged preventing sprinklers from activating in the case of a fire. Routine inspection and maintenance of sprinkler systems are essential.

### **Conclusion**

In the last twenty years, local governments have increasingly been amending their building codes to require sprinklers be installed in buildings, particularly high-rises. Cities have reacted to catastrophic fires by passing sprinkler ordinances. The Chicago City Council passed a High-Rise Safety Substitute Ordinance after two major fires occurred in commercial-high rises in a fourteen month time period. Changes in local and state law regarding life safety requirements can cost real estate managers and owners a great deal of time and money. It is in the best interest of property managers to be up-to-date on municipal building code requirements, local ordinances, and state laws. Sprinklers have proven to be effective in saving human life and property. Though costly to install sprinklers in new construction or retrofit in existing buildings, managers and owners can benefit from reduced insurance premiums, reduced liability, tax deductions, and increased life safety. The CCIM Institute and the Illinois Association of REALTORS® argue there should be additional incentives to make sprinkler installation a cost effective option for building owners. It is important to remember relying solely on sprinklers for fire protection can result in unnecessary death and property destruction; additional life-safety measures need to be taken. Property owners and managers need to stay informed on life-safety issues and laws and be pro-active in order to protect their businesses, lives of tenants, and the property.

## **Sources for Additional Information**

### **City of Chicago**

[www.cityofchicago.org](http://www.cityofchicago.org)

### **Federal Emergency Management Agency (FEMA)**

[www.fema.gov](http://www.fema.gov)

FEMA Index of State Agencies (to view an individual state's agency of emergency management):

<http://www.fema.gov/fema/statedr.shtm>

### **National Association of State Fire Marshals**

[www.firemarshals.org](http://www.firemarshals.org)

### **National Fire Protection Association**

[www.nfpa.org](http://www.nfpa.org)

### **Residential Fire Safety Institute (formerly Operation Life Safety)**

[www.firesafehome.org](http://www.firesafehome.org)

### **National Association of Realtors®**

For additional information you may research the National Association of Realtors®' library online:

[www.realtor.org](http://www.realtor.org)