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AUGUST-NEWSLETTER -HIGH RISE FIRES

There is a deadly trend in high-rise fires. In the 1970s, New York City experienced a two-floor fire in a high rise; in the 1980s, Los Angeles had a five-floor fire in a high-rise; and in the 1990s, Philadelphia suffered a nine-floor high-rise fire. What can we expect in the next decade? All three of these fires had one thing in common: They all occurred beyond the reach of fire department ladders. Outside aerial master streams could not be used.

The New York fire, at I New York Plaza, was on the 33rd and 34th floors; the Los Angeles First Interstate Bank fire burned out the 12th to 16th floors; and the Philadelphia One Meridian Plaza fire burned the 22nd to 30th floors to a crisp. These high-rise fires killed three building employees and three firefighters. The fires were fought using an interior attack. Aerial master streams were not an option available. (In the Meridian Plaza fire, portable deluge guns were operated from nearby and adjacent buildings, with no effect on the fire.) At a low-rise building fire, after 30 or 40 minutes of fast and furious firefighting, the fire usually is extinguished. If it is not, firefighters may be withdrawn to safer outside positions and the fire is fought using an outside attack. Not so at a high-rise building fire. Here, if the fire is not controlled within the first 30 to 40 minutes, the next two or three hours of firefighting are also spent inside the burning building. It took six hours to extinguish two floors of fire in New York in 1970, eight hours to extinguish the Los Angeles five-floor high-rise fire, and more than 16 hours to extinguish-with nine sprinkler heads on the 30th floor-the Philadelphia nine-floor fire. That's roughly two hours of firefighting per floor. Will the next great high-rise fire require the fire department to operate with interior hand lines for two or three days?

HIGH-RISE DEFINED

What is a high-rise building? How does a high-rise building fire differ from a low-rise building fire? Why can't the fire service extinguish fires in high-rise buildings? Some reasons follow.

A high-rise building can be defined as a structure more than 75 feet high if your aerial ladder reaches only 75 feet or as a structure more than 40 feet high if your highest ladder is a 40-foot extension ladder. People trapped in a burning high-rise building who cannot be reached by your highest ladder will leap to their deaths, attempt to climb down knotted bedsheets and fall, scribble notes telling where they are trapped and drop them from smoky windows, or have their last cries for help recorded on fire dispatchers' telephones.

When buildings are constructed beyond the reach of a fire department's highest ladder, two important firefighting strategies are taken away from firefighters. First, life-saving victim removals using ladders are eliminated. Searches and rescues can be accomplished only from inside stairways. People trapped at windows, when flames are between them and a stairway will have to jump or bum to death. The second firefighting strategy a high-rise building takes away in many cases is the ability to extinguish a fire with an outside master stream.

The only strategy for a high-rise fire beyond the reach of an aerial ladder is an interior attack. Firefighters must extinguish the fire using handheld hose streams advanced through heat and smoke from an inside stairway. If this method fails, there is no alternate plan. An outside attack is not an option.



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FIREFIGHTING EXTINGUISHMENT The best-kept secret in America's fire service is that firefighters cannot extinguish a fire in a 20- or 30-thousand-square-foot open floor area in a high-rise building. A fire company advancing a 2 1/2-inch hoseline with a 1 1/4-inch nozzle discharges only 300 gallons per minute and can extinguish only about 2,500 square feet of fire. The reach of the streams is only 50 feet. A modern open-floor office design, with cubicle work stations and dwarf partitions that do not extend to the ceiling, allows fire to spread throughout an entire 100- x 200-foot floor area. A fully involved, free burning 20,000-square-foot floor area cannot be extinguished by a couple of firefighters spraying a hose stream from a stairway. City managers and department chiefs will not admit this to the public if they want to keep their jobs. But every fireground commander knows this is a fact. What really happens at a serious

high-rise fire involving an entire floor or more of the building is what we call "controlled burning." Firefighters operating the hose stream maintain a defensive position in the stairway for as long as it takes for all the combustible contents to be consumed by flames.

To successfully contain a high-rise fire to one floor and not kill large numbers of occupants attempting to escape, it takes 40 to 50 firefighters using a rapid-response, blitz attack. If this fails, it will take another 100 to 200 additional firefighters to control the fire and keep it from spreading to adjoining buildings. If a community does not have such a large number of firefighters available, then every high-rise building must be fully protected with an automatic sprinkler system.

RESPONSE The long response time (the duration of time from receipt of the alarm until the first hose team discharges water on the fire) in a high-rise building allows the flames to spread beyond firefighters' control. The response time in a high-rise building fire may be 15 minutes or more. At a high-rise building, unlike a low-rise building, firefighters, after they arrive they, may have to walk 100 to 200 feet through an open space or large lobby. They then have to question building employees about the fire location, check an alarm panel, locate the stairs, and order air-conditioning systems to be shut down. They also have to wait for elevators when the fire is above stair-walking distance. Firefighters using the elevators also must use a complex key system to control elevators and stop the elevator during its ascent to ensure it is working properly and will not take them up to the floor where the fire is raging. Then firefighters must get off the elevator two or more floors below the fire and walk up stairs. At the floor below, the fire hose and nozzles must be connected to a standpipe outlet valve. At the street level, supply hose from the pumper must be connected to the siamese inlet to the building. After all this, the door to the large high-rise office may have to be forced open by breaking the lock, and a search for the exact location of the fire is started. In a typical large office high-rise, some 150 rooms and cubicles within a 20,000-square-foot smoke-filled office floor must be searched before the fire is discovered. After this, the hose is stretched to this point and the fire is finally extinguished.

None of this delay exists at a fire in a low-rise building. After 15 minutes of response time for a fire in a high-rise building, firefighters may discover the fire is too large to extinguish. The fire spreads out of the room along the ceiling and forces them to withdraw off the floor out into the stair enclosure.

ELEVATOR USE. Firefighter's battling a fire in a high-rise building depend on the building systems for success in extinguishment. The elevator system must take them, tools, and equipment up to the fire. The standpipe system must provide water pressure and volume to the upper floors. A building communication system must allow fire department firefighting radio transmission in these steel skyscrapers. If any of these building systems fail or are not present, firefighters will be unable to extinguish the fire. Today, many building systems have been discovered to be defective or nonexistent.

For example, in New York City, an eight-year study of 179 major fires revealed elevators failed at 59 fires-at one-third of the major fires. Fire, heat, or water caused electrical malfunctions in elevators. At some fires, elevators took firefighters up to the fire floor instead of the floor two or more levels below the fire. At other fires, the elevators stalled, trapping firefighters inside stuck cars. Also, some elevator cages would not recall to the lobby for searching.



STANDPIPE SYSTEMS

The standpipe system at the Los Angeles First Interstate building was shut down for repairs at the time of the fire. There was insufficient water pressure for the first 40 minutes of the fire because the building fire pumps were not operating and the standpipe hose lines were cut by falling glass. Another serious design defect at this high-rise fire was the installation of standpipe aluminum outlet valves inside the occupancies. The flames melted the aluminum valves, allowing water to drain from the standpipe system.

At the Philadelphia One Meridian Plaza high-rise fire, pressure regulating valves on the standpipe outlet were set at low pressures and were non-field-adjustable without a special tool, unavailable at the time of the fire. This prevented the firefighters from extinguishing the fire and allowed it to spread.

PORTABLE RADIOS Communication is necessary to command and coordinate a high-rise fire. Fire officers working to extinguish the fire must communicate with fire officers conducting search and rescue. Everyone on the upper floors must communicate with the command post in the lobby or street. The structural steel framework of a high-rise building interferes with fire department radios. Tests conducted on the 110-story World Trade Center and the 102-story Empire State Building revealed fire department radios transmit only up to the 65th floor. There can be no command control and coordination at a high-rise fire without fire department radio transmission. Rockefeller Center and other high-rise buildings are installing communication antenna systems. A radio antenna installed throughout all floors allows local fire department handheld radios to transmit throughout the high-rise building on all floors. All new high-rise buildings constructed should be tested to determine if fire department radios can transmit to all floors. If not, antennas must be installed.

VENTING High-rise buildings have sealed or locked windows that require keys to open them. High-rise buildings may be considered windowless buildings. Venting by breaking thick glass windows is extremely dangerous. Failing glass can injure people on the sidewalk and cut supply hose lines. Firefighters must fight high-rise fires like cellar fires that cannot be vented. Because these buildings are sealed, large volumes of heat and smoke generated by the fire become trapped in the structure. This giant smoke cloud, which often darkens the sky after being vented at a low-rise building fire, is trapped inside and spreads throughout the sealed high-rise building. The so-called "stack effect" (the result of the temperature difference between the inside and outside of a sealed high-rise building) causes smoke to spread up or down many floors during a fire in a high-rise. This temperature difference creates within the

sealed structure pressure differences capable of moving large volumes of smoke and heat uncontrollably during a high-rise fire. The uncontrollable smoke movement caused by the stack effect is another reason window venting is ineffective during a high-rise fire.

BUILDING CONSTRUCTION. Most high-rise buildings are classified as "fire-resistive" structures, but from an operational perspective, they are not. The goal of a fire-resistive building should be to confine fire to one floor, barring an explosion or collapse that would destroy part of the compartmentation. The walls, floors, and ceilings of a fire-resistive building are supposed to contain the fire. This is not true today. There is no fire-resistive building.

HEATING AND AIR CONDITIONING SYSTEMS (HVAC) One of the reasons modern skyscrapers are not fire-resistive is the central air-conditioning system installed in some of them. A central air system in a high-rise building interconnects 10 to 20 floors for the purpose of heating and cooling. Ducts, shafts, and poke-through holes penetrate fire-resistive floors, walls, and ceilings. These air-conditioning openings and holes allow fire and smoke to spread throughout the 10 or 20 air-conditioned floors of a high-rise building. A high-rise hotel fire in Las Vegas, Nevada, spread fire and smoke through the central air-conditioning system and killed 85 people in rooms on upper floors. The air system was not equipped with smoke detectors arranged to shut down the system during an emergency. In addition, the fire dampers-shutters designed to stop spread of fire in ducts and shafts of the air-conditioning system--did not close properly. Smoke, heat, and flame were pumped throughout the so-called fire-resistive hotel by the air-conditioning system.

EVACUATION STRATEGY Firefighters cannot order all the people in a high-rise building to leave during a fire. It is not possible for thousands of people to leave a burning building quickly. It would take several hours. High-rise firefighting strategy is supposed to "defend in place"--extinguish the fire while most of the occupants remain inside the building. So, at high-rise fires, we do not have another option that is available at low-rise building fires. At a low-rise building fire, strategy can be to extinguish the fire and evacuate the people at the same time.

A defend-in-place strategy depends on two factors: that the building has the ability to contain fire to a particular area and that the occupants will obey the fire chief's instruction to stay in place. Neither of these assumptions is necessarily true. High-rise buildings are not fire-resistive, and people leave the high-rise buildings during a fire regardless of instructions to do otherwise. At the World Trade Center terrorist explosion and fire in New York City (February 26, 1993), 50,000 people (25,000 in each tower) left the building without instructions because the building communication system was damaged and fire department radios would not transmit to the upper floors of the high-rise steel structure. One of the lessons learned at this fire, as stated in the chief of department's post-fire analysis, was that "the 'defend-in-place' strategy does not exist."

LESSONS LEARNED

After fighting high-rise fires in midtown Manhattan, New York City, for the past 15 years, it is my opinion that the fire service has been lucky. Despite the above limitations in fighting high-rise fires, we have not had a great loss of life or another multi-floor high-rise fire. The elevators fail even when in the Phase II fire service mode, the standpipe systems on older buildings fail, and there is no command and control when the fire department radios cannot transmit to the top floors of burning high-rise buildings. It is also my opinion that the only real fire protection for a commercial or residential high-rise building is an automatic sprinkler and a smoke-removal system to vent the smoke after the sprinkler system extinguishes the high-rise fire.



Discussion questions:

1. What is the definition of a high rise building in your fire department?
2. What is your fire department rapid response “blitz” attack strategy?
3. Can you department portable radios transmit messages from the lobby to the top floor of the high rise buildings in your community?
4. Are the air (HVAC)systems in your high rise buildings centralized systems with duct penetrating several floors or are they unit systems-systems that serve one floor without ducts penetrating floors?
5. Are the high rise buildings in your district protected with automatic sprinklers?

Test questions:

1. A fire company operating a 2 _ inch hose line can extinguish how many square feet of fire?

- A. 1000
- B. 2500
- C. 3000
- D. 5000

Answer_____

2. Response time (time from alarm receipt until first hose line discharges water on a high rise fire may be as long as?

- A. 5 minutes or more
- B. 10 minutes or more
- C. 15 minutes or more
- D. none of the above

Answer_____

3.Which one of the following is not one of the important firefighting systems in a high rise building?

- A. the communication system
- B. The standpipe system
- C. The elevator system
- D. The sanitation system

Answer_____

4.In the Las Vegas Nevada hotel fire and smoke spread through the central air-conditioning system (HVAC) and killed how many people?

- A. 25
- B. 45
- C. 65
- D. 85

Answer_____

5.A defend in place strategy a high rise fire depends on which two factors?

- A. The ability of the building to contain fire and that occupants will obey directions
- B. The command presence of the chief and the searching firefighters
- C. The building manager and the occupants
- D. None of above

Answer_____



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Answers to test questions

1-B; 2-C; 3-D; 4-D 5-A