High-Rise Fire Protection
Standpipe and Sprinkler Systems

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Introduction

Why talk about high-rise buildings?

Focus on the Building Code application

Purpose of the presentation

My experience

Question
First Interstate Bank

- 62 Stories – process of sprinkler retrofit
- Started on 12th floor
- Delayed call to Fire Department
- Sprinkler System disabled
- Fire Pumps shut down
- Fire Damage – 12th-16th
- 1 Dead (Building Engineer)
Agenda

- Overview of High-Rise Buildings
- Standpipe Systems
- Sprinkler Systems
- Water Supply
- Design Issues
- Key Points
Overview of High-Rise Buildings
Building Occupancy Characteristics

- Residential
- Commercial
- Mixed occupancy
Residential buildings may contain senior citizens or people with special needs.

Residential buildings often have similar floor plans.

Commercial building floor plans often differ from floor to floor.

Building core usually remains consistent.
High-Rise Characteristic Features

- Occupants above reach of rescue ladders.
- The only effective means of fire control is by internal attack.
- A fire fighting team working from a riser are unlikely to control a fully involved 100 ft x 200 ft floor area.
High-Rise Characteristic Features Continued

Fire Department response times will be increased in inner city areas.

High-rises are closed buildings – causing a rapid build up of heat and smoke.
High-Rise Building Code Sections

Chapter 4 – Special Detailed Requirements Based on Use and Occupancy

Sprinkler Protection - §903.2.10.3 Buildings over 30 feet in height.

Standpipe Protection - §905.3.1 Building height. Class III standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet...
High-Rise Building Code provisions applies to

Buildings having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access

Some exceptions such as air traffic control towers.
High-Rise Building Code
Chapter 4

Standby and Emergency Power Required

There is a difference!

Standby required for fire pumps, fire command center …

Emergency is for egress lighting, fire alarm…
Standpipe Systems
High-Rise Standpipe System

Purpose – installed to provide adequate water flow for hose streams used to **extinguish** the fire.
High-Rise Standpipe System

Design Basis

Building Code and Fire Code

NFPA 14
High-Rise Standpipe System
Building Code

Chapter 9 requires that standpipes be installed per NFPA 14

Required installations
Class III standpipe systems shall be installed throughout buildings where the floor level of the highest story is located more than 30 feet above the lowest level of the fire department vehicle access …

But wait there is an Exception
Building Code Exception!!!

Class I standpipes are allowed in buildings equipped throughout with an automatic sprinkler system installed in accordance with §903.3.1.1 or §903.3.1.2.

Note throughout
Types of High-Rise Standpipe Systems

- Wet Automatic – most common
- Wet Manual – parking garages <150 ft
- Dry Automatic - areas subject to freezing
- Dry Manual - open parking garages
High-Rise Standpipe System

NFPA 14 Overview

- Standpipes located in **required** stairwell.

- At least 4” for Class III.

- 6” risers required for combined system – 4” if full sprinkler protection.

- Determine hose valve locations – max travel distance have to be in compliance.
High-Rise Standpipe System
NFPA 14 Overview

Class I Standpipe

100 psi at the outlet of the hydraulically most remote 2½ in. hose connection

Generally 500 gpm at hydraulically most remote standpipe + 250 gpm for each additional (max 1250 gpm)
High-Rise Standpipe System
NFPA 14 Overview

Class I Standpipe
Remote standpipe 100 psi requirement
Generally all new buildings.
Possible pressure problem.
3 in. drain rise for PRV’s
Sprinkler Systems
General Sprinkler Facts

Usually 1 or 2 sprinklers will control a fire:

- 85% of the time in a wet pipe system.
- 67% of the time in a dry pipe system.
Why Sprinkler System Fail

Reasons When Sprinklers Fail to Operate 2002-2004

- System shut off before fire: 66%
- Manual intervention defeated system: 16%
- Lack of maintenance: 10%
- Inappropriate system for fire: 6%
- Damaged component: 2%
High-Rise Sprinkler System

Purpose – installed to provide adequate property protection to **control** the fire.
High-Rise Sprinkler System

Design Basis

Building Code and Fire Code

NFPA 13
High-Rise Sprinkler System
Building Code Requirements

Section §403.2 Automatic sprinkler system.
 Buildings shall be equipped throughout with an automatic sprinkler system in accordance with NFPA 13.

A secondary water supply where required.
High-Rise Sprinkler System “equipped throughout”

§903.3.1.1 NFPA 13 sprinkler systems. - provisions of this code require that a building or portion thereof be equipped throughout …

Important wording – why?

Exempt locations – where water is bad

Alternate protection allowed?
High-Rise Sprinkler System

Alternative protection

Section §903.1.1 states alternate protection is permitted in lieu of automatic sprinkler protection where:

1. recognized by the applicable standard and

2. Such installations shall be approved by the code enforcement official.
High-Rise Sprinkler System
Building Code Chapter 9

Floor control valves need to be supervised at point of connection to riser.

Rubbish chutes need to have sprinkler protection.

NFPA 13D and NFPA 13R do NOT apply.
High-Rise Sprinkler System
NFPA 13 Overview

Floor control valves shall be supervised by constantly attended signaling service

Additional alarm apparatus

- Waterflow device per floor for the sprinkler systems
- Central station service is required if a constant supervision by qualified personnel is not provided
- Distinct trouble signal to indicate impairment of the sprinkler system
Water Supply
High-Rise Water Supply Characteristics

- Primary Water Supply
- Secondary Water Supply
- Fire Pump
High-Rise Secondary Water Supply

- On-site water supply
- Equal to the hydraulically calculated sprinkler demand, including the hose stream requirement
- In Seismic Design Category C, D, E or F areas
- Duration of not less than 30 minutes

Exception for existing buildings
High-Rise Fire Pump

- Series and Parallel Pumps
- Zoning - Pressure
- Break Tanks
Series and Parallel Fire Pumps

Series Fire Pumps
- Meant to boost the pressure from a lower zone.
- The design is dependent on both operating

Parallel Fire Pumps
- Primary and secondary
- Meant to boost flow volume
## High-Rise Zoning

<table>
<thead>
<tr>
<th>Residual Pressure</th>
<th>Building Height (feet)</th>
<th>Zones</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 psi</td>
<td>200</td>
<td>1</td>
<td>max 175 psi rating</td>
</tr>
<tr>
<td>100 psi</td>
<td>120</td>
<td>1</td>
<td>PRV’s required</td>
</tr>
<tr>
<td>65 psi</td>
<td>350</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>100 psi</td>
<td>270</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>65 psi</td>
<td>580</td>
<td>2</td>
<td>Design limit of 350 psi</td>
</tr>
<tr>
<td>100 psi</td>
<td>500</td>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>
Break Tanks

- No NFPA standards for sizing break tanks
- Generally the size for 3 to 5 minutes of full flow
- Monitoring of the water level is recommended
Design Issues
Design Issues

What is the biggest issue?

Pressure
Design Issues

Standpipe system pressure limit is 350 psi

*Generally* (product specific, safety factor of 8)
- Schedule 10 maxes at 300 psi
- Schedule 40 minimum at 350 psi
- Schedule 80 minimum at 650 psi

Reduction to 65 psi may be allowed by the Authority Having Jurisdiction. Generally used for existing buildings.
Design Issues

- When system pressure exceeds 175 psi there may be listing problems.

- Sprinkler listing are limited to 175 psi unless a special listing.
Design Issues

Make sure that water supply will meet system demand.

Combined Standpipe/Sprinkler systems required additional coordination between NFPA 13 and 14.

Generally the standpipe will be the most demanding on the water supply. NOT ALWAYS THE CASE.
Design Issues

If building is existing need to watch out for applying current code sections directly to the building.

Due Diligence is required to identify the required level of protection.
Design Issues

- Existing building
- Adding new preaction systems
- Jockey pump setting
Design Issues

- Existing building and systems
- Upgrading to meet current code requirements.
- Listing pressure ratings
Design Issues

- New Construction
- Water Supply
- Greatest Demand
Design Issues

🔥 Existing building

🔥 Gut Rehabilitation

🔥 Preparing for the future tenant renovation.
Questions

What is the most effective means of fire control in high-rise buildings?

What is the pressure requirement for the hydraulically most remote hose connection for a Class I standpipe system?

What is one of the most critical design issues for high-rise building standpipe systems?
Key Points To Remember

- Analyze the Code
- Plan early – communicate with CEO
- Address existing buildings uniquely
- Address exceptions
- PRESSURE!
Key Points To Remember
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