Incident Command for High-Rise Operations

ICHO-Student Manual

4th Edition, 2nd Printing-April 2014

FEMA/USFA/NFA
ICHO-SM
April 2014
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U.S. DEPARTMENT OF HOMELAND SECURITY

UNITED STATES FIRE ADMINISTRATION

NATIONAL FIRE ACADEMY

FOREWORD

The U.S. Fire Administration (USFA), an important component of the Department of Homeland Security (DHS), serves the leadership of this nation as the DHS's fire protection and emergency response expert. The USFA is located at the National Emergency Training Center (NETC) in Emmitsburg, Md., and includes the National Fire Academy (NFA), National Fire Data Center (NFDC), and the National Fire Programs (NFP). The USFA also provides oversight and management of the Noble Training Center in Anniston, Ala. The mission of the USFA is to save lives and reduce economic losses due to fire and related emergencies through training, research, data collection and analysis, public education, and coordination with other federal agencies and fire protection and emergency service personnel.

The USFA's National Fire Academy offers a diverse course delivery system, combining resident courses, off-campus deliveries in cooperation with state training organizations, weekend instruction, and online courses. The USFA maintains a blended learning approach to its course selections and course development. Resident courses are delivered at both the Emmitsburg campus and the Noble facility. Off-campus courses are delivered in cooperation with state and local fire training organizations to ensure this nation's firefighters are prepared for the hazards they face.

The "Incident Command for High-Rise Operations" (ICHO) course is designed to meet the needs of Command Officers responsible for commanding and operating at high-rise incidents.

The USFA's National Fire Academy is proud to join with state and local fire agencies in providing educational opportunities to the members of the nation's fire services.

The ICHO course is National Incident Management System (NIMS) compliant.

ACKNOWLEDGMENTS

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The 2008 Revision Workgroup appreciates the contributions of the following organizations and individuals:

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Unit 5	Basic Organizational Approach

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FIREFIGHTER CODE OF ETHICS

Background

The Fire Service is a noble calling, one which is founded on mutual respect and trust between firefighters and the citizens they serve. To ensure the continuing integrity of the Fire Service, the highest standards of ethical conduct must be maintained at all times.

Developed in response to the publication of the Fire Service Reputation Management White Paper, the purpose of this National Firefighter Code of Ethics is to establish criteria that encourages fire service personnel to promote a culture of ethical integrity and high standards of professionalism in our field. The broad scope of this recommended Code of Ethics is intended to mitigate and negate situations that may result in embarrassment and waning of public support for what has historically been a highly respected profession.

Ethics comes from the Greek word ethos, meaning character. Character is not necessarily defined by how a person behaves when conditions are optimal and life is good. It is easy to take the high road when the path is paved and obstacles are few or non-existent. Character is also defined by decisions made under pressure, when no one is looking, when the road contains land mines, and the way is obscured. As members of the Fire Service, we share a responsibility to project an ethical character of professionalism, integrity, compassion, loyalty and honesty in all that we do, all of the time.

We need to accept this ethics challenge and be truly willing to maintain a culture that is consistent with the expectations outlined in this document. By doing so, we can create a legacy that validates and sustains the distinguished Fire Service institution, and at the same time ensure that we leave the Fire Service in better condition than when we arrived.

FIREFIGHTER CODE OF ETHICS

I understand that I have the responsibility to conduct myself in a manner that reflects proper ethical behavior and integrity. In so doing, I will help foster a continuing positive public perception of the fire service. Therefore, I pledge the following…

- Always conduct myself, on and off duty, in a manner that reflects positively on myself, my department and the fire service in general.
- Accept responsibility for my actions and for the consequences of my actions.
- Support the concept of fairness and the value of diverse thoughts and opinions.
- Avoid situations that would adversely affect the credibility or public perception of the fire service profession.
- Be truthful and honest at all times and report instances of cheating or other dishonest acts that compromise the integrity of the fire service.
- Conduct my personal affairs in a manner that does not improperly influence the performance of my duties, or bring discredit to my organization.
- Be respectful and conscious of each member's safety and welfare.
- Recognize that I serve in a position of public trust that requires stewardship in the honest and efficient use of publicly owned resources, including uniforms, facilities, vehicles and equipment and that these are protected from misuse and theft.
- Exercise professionalism, competence, respect and loyalty in the performance of my duties and use information, confidential or otherwise, gained by virtue of my position, only to benefit those I am entrusted to serve.
- Avoid financial investments, outside employment, outside business interests or activities that conflict with or are enhanced by my official position or have the potential to create the perception of impropriety.
- Never propose or accept personal rewards, special privileges, benefits, advancement, honors or gifts that may create a conflict of interest, or the appearance thereof.
- Never engage in activities involving alcohol or other substance use or abuse that can impair my mental state or the performance of my duties and compromise safety.
- Never discriminate on the basis of race, religion, color, creed, age, marital status, national origin, ancestry, gender, sexual preference, medical condition or handicap.
- Never harass, intimidate or threaten fellow members of the service or the public and stop or report the actions of other firefighters who engage in such behaviors.
- Responsibly use social networking, electronic communications, or other media technology opportunities in a manner that does not discredit, dishonor or embarrass my organization, the fire service and the public. I also understand that failure to resolve or report inappropriate use of this media equates to condoning this behavior.

Developed by the National Society of Executive Fire Officers

A Student Guide to End-of-course Evaluations

Say What You Mean ...

Ten Things You Can Do to Improve the National Fire Academy

The National Fire Academy takes its course evaluations very seriously. Your comments and suggestions enable us to improve your learning experience.

Unfortunately, we often get end-of-course comments like these that are vague and, therefore, not actionable. We know you are trying to keep your answers short, but the more specific you can be, the better we can respond.

Actual quotes from student evaluations:	Examples of specific, actionable comments that would help us improve the course:
1 "Update the materials."	• The (ABC) fire video is out-of-date because of the dangerous tactics it demonstrates. The available (XYZ) video shows current practices. • The student manual references building codes that are 12 years old.
2 "We want an advanced class in (fill in the blank)."	• We would like a class that enables us to calculate energy transfer rates resulting from exposure fires. • We would like a class that provides one-on-one workplace harassment counseling practice exercises.
3 "More activities."	• An activity where students can physically measure the area of sprinkler coverage would improve understanding of the concept. • Not all students were able to fill all ICS positions in the exercises. Add more exercises so all students can participate.
4 "A longer course."	• The class should be increased by one hour per day to enable all students to participate in exercises. • The class should be increased by two days so that all group presentations can be peer evaluated and have written abstracts.
5 "Readable plans."	• The plans should be enlarged to 11 by 17 and provided with an accurate scale. • My plan set was blurry, which caused the dotted lines to be interpreted as solid lines.
6 "Better student guide organization," "manual did not coincide with slides."	• The slide sequence in Unit 4 did not align with the content in the student manual from slides 4-16 through 4-21. • The instructor added slides in Unit 4 that were not in my student manual.
7 "Dry in spots."	• The instructor/activity should have used student group activities rather than lecture to explain Maslow's Hierarchy. • Create a pre-course reading on symbiotic personal relationships rather than trying to lecture on them in class.
8 "More visual aids."	• The text description of V-patterns did not provide three-dimensional views. More photographs or drawings would help me imagine the pattern. • There was a video clip on NBC News (date) that summarized the topic very well.
9 "Re-evaluate pre-course assignments."	• The pre-course assignments were not discussed or referenced in class. Either connect them to the course content or delete them. • The pre-course assignments on ICS could be reduced to a one-page job aid rather than a 25-page reading.
10 "A better understanding of NIMS."	• The instructor did not explain the connection between NIMS and ICS. • The student manual needs an illustrated guide to NIMS.

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UNIT 1: INTRODUCTION

TERMINAL OBJECTIVE

The students will be able to identify basic principles of the "Incident Command for High-Rise Operations" (ICHO) course.

ENABLING OBJECTIVES

The students will:

1. *Explain the course goal.*
2. *Explain the general characteristics of the instructional units of this course.*
3. *Explain basic concepts of the National Incident Management System (NIMS) and the National Response Framework (NRF).*
4. *Explain how their performance will be evaluated.*
5. *Describe administrative issues relevant to the classroom.*

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COURSE OVERVIEW

Course Goal

To assist emergency response officers in organizing high-rise incidents by organizing resources, developing strategies, and managing tactical operations and interagency coordination to protect life and minimize damage at high-rise incidents.

Course Units

The following units comprise the course:

- Unit 1: Introduction;
- Unit 2: High-Rise Construction;
- Unit 3: High-Rise Building Systems;
- Unit 4: Strategy and Tactics; and
- Unit 5: Basic Organizational Approach.

Student Performance Evaluation

Student performance will be evaluated through two means:

1. Daily instructor/student feedback and participation in lectures and activities.

2. Students will be required to take and pass a written test at the conclusion of this course.

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NOTE-TAKING GUIDE

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NOTE-TAKING GUIDE

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INCIDENT COMMAND FOR HIGH-RISE OPERATIONS

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TERMINAL OBJECTIVE

The students will be able to identify basic principles of the "Incident Command for High-Rise Operations" (ICHO) course.

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ENABLING OBJECTIVES

The students will:

- **Explain the course goal.**
- **Explain the general characteristics of the instructional units of this course.**
- **Explain basic concepts of the National Incident Management System (NIMS) and the National Response Framework (NRF).**
- **Explain how their performance will be evaluated.**
- **Describe administrative issues relevant to the classroom.**

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COURSE GOAL

To assist emergency response officers in organizing high-rise incidents by organizing resources, developing strategies, and managing tactical operations and interagency coordination to protect life and minimize damage at high-rise incidents.

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COURSE UNITS

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- **Unit 3: High-Rise Building Systems**
- **Unit 4: Strategy and Tactics**
- **Unit 5: Basic Organizational Approach**

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APPENDIX
NATIONAL INCIDENT MANAGEMENT SYSTEM/NATIONAL RESPONSE FRAMEWORK FACT SHEET

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National Incident Management System/National Response Framework Fact Sheet

As required by the Department of Homeland Security (DHS), every new and existing DHS training course will include an appropriate amount of information explaining the National Incident Management System (NIMS) and the National Response Framework (NRF). For this level course, the NIMS/NRF video, along with this fact sheet, will meet the intent and obligation for this training and education update.

NIMS is more than the Incident Command System (ICS). The NIMS is comprised of the following four components:

- Compliance;
- Training;
- Standards and Technology; and
- Resource Management/Mutual Aid — Standardized procedures for resource management processes.

Command and Management envisions the most familiar (and easily implemented) part of NIMS — the ICS. Organizations must, as a condition of federal preparedness assistance, take steps to begin institutionalizing the use of ICS during prevention and response efforts. Actions to institutionalize the use of ICS take place at two levels — policy and organizational/operational.

- At the policy level, institutionalizing the ICS means government officials, i.e., governors, mayors, county and city managers, tribal leaders and others:

  - Adopt the ICS through executive order, proclamation or legislation for the jurisdiction; and
  - Direct that incident managers and response organizations in their jurisdictions train, exercise and use the ICS in their response operations.

- At the organizational/operational level, evidence that incident managers and emergency response organizations are institutionalizing the ICS would include the following:

  - ICS is being integrated into functional and systemwide emergency operations policies, plans and procedures;
  - ICS training is planned or under way for responders, supervisors and command level officers; and
  - Responders at all levels are participating in and/or coordinating ICS-oriented exercises that involve responders from multidisciplines and jurisdictions.

Additional information, requirements and guidelines for fulfilling an organization's NIMS compliance can be found on the NIMS Integration Center's website: http://www.fema.gov/nims/. Of particular interest to fire service organizations is NIMCAST (National Incident Management Compliance Assessment Tool) a Web-based self-assessment system that will allow evaluation of an organization's preparedness and response capabilities against the requirements of the NIMS.

The NRF specifies how the resources of the federal government will work in concert with state, local, tribal governments and the private sector in response to Incidents of National Significance. The NRF is predicated on the NIMS. Together the NRF and the NIMS provide a nationwide template for working together to prevent or respond to threats and incidents regardless of cause, size or complexity.

Two online, self-study courses developed by the Emergency Management Institute are available to learn more about the NIMS and the NRF:

- IS700 NIMS: An introduction to the NIMS and is a Web-based awareness level course that explains NIMS components, concepts and principles.

- IS800 NRF: An introduction to the NRF, including the concept of operations upon which the plan is built, roles and responsibilities of the key players, the organizational structures for NRF coordination, the field-level organizations and teams activated under the NRF, and the incident management activities addressed by the NRF. The course is designed for DHS and other federal department/agency staff responsible for implementing the NRF, as well as state, local and private sector emergency management professionals.

Both of these courses, as well as other NIMS-related training, can be accessed at the National Emergency Training Center (NETC) Virtual Campus at www.training.fema.gov.

UNIT 2: HIGH-RISE CONSTRUCTION

TERMINAL OBJECTIVE

The students will be able to identify the various high-rise construction systems, fire behavior problems, and their impact on strategy, tactics and life safety.

ENABLING OBJECTIVES

The students will:

1. *Define the term "high-rise."*
2. *List building construction features.*
3. *Explain the characteristics of building construction, design features, and fire behavior that affect strategy, tactics and life safety.*

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HIGH-RISE CONSTRUCTION

High-Rise Definition

A high-rise building is a structure that has a height of 75 feet or more above the ground. However, some buildings that are less than 75 feet present the same problems as ones over that height. It is likely that buildings constructed just short of code requirements for a high-rise do not have all the fire protection and life safety features of a building that meets a high-rise code.

Formal definition from National Fire Protection Association (NFPA) 101, *Life Safety Code*® 3.3.27.7 High-Rise Building. “Any building greater than 23 meters (75.5 feet) in height, where the building height is measured from the lowest level of fire department’s vehicle access to the floor of the highest occupiable story.”

PREFIRE PLANNING CONSIDERATIONS

An important point to remember is that all high-rise buildings are not of the same design or construction nor do they all have the same types of fire protection features. Construction methods and code requirements have changed through the years and can be a factor in fire behavior within a building. These changes also can affect the built-in protection features that help to mitigate or control fires within the building. Because high-rise buildings can be so different, it is critical that firefighting personnel be familiar with each building and the operation of the life safety and fire protection systems that it contains.

The Incident Commander (IC) needs the following information (which would be provided on a preplan):

- floor plans;
- stair shaft types — exits/termination above grade;
- location of mechanical equipment rooms (MERs);
- heating, ventilating, and air conditioning (HVAC) zones/return airshafts; and
- standpipe locations.

KNOWLEDGE OF THE BUILDING

Strategy and tactics for high-rise fires are affected greatly by the fire personnel’s knowledge of the building’s construction and design features. Some of the questions that fire personnel need to have answered in the prefire plan include

- Is the building of “old-style” or “new-style” construction?

- Are there built-in life safety or fire protection features? What are they? Where are they? How do they operate?

- What is the current occupancy and layout of those parts of the building affected by the fire?
- Is the fire floor compartmented?
- Is the fire floor an open space area that will allow the fire to spread quickly?

This critical information must be gathered ahead of time through effective prefire/preincident planning. The degree of firefighting success may be measured not only by the presence of fire safety features but also by the ability of firefighting personnel to take advantage of these features.

OLD-STYLE VERSUS NEW-STYLE HIGH-RISE CONSTRUCTION

Old-Style High-Rise Construction

Class 1 fire-resistive high-rise construction has changed drastically since the early 1900s. This type of construction has evolved into what should be divided properly into three distinct categories: Class 1 heavyweight, Class 1 medium weight, and Class 1 lightweight. Although there is no formal reference in any code pertaining to these classifications, distinct differences do exist.

The old-style high-rises would fall into the heavyweight category. Old-style high-rise buildings were constructed with bearing walls made of masonry. Most of these buildings were constructed of reinforced concrete. Due to the weight of the construction materials, the walls at the bottom were many feet thick, so the lower floors have thicker walls. As the building rose and the upper levels supported less weight, the walls were tapered, so the upper floors have thinner walls. These buildings are really the epitome of what fire-resistive construction means.

Old-style high-rises have more mass due to their concrete construction. Buildings of this construction type generally have operable windows. The old-style high-rise is least likely to collapse under fire conditions because of both the mass of the bearing materials and the supporting nature of the exterior walls. One of the most important features regarding fire and smoke spread in these types of buildings is the absence of a central air conditioning (A/C) system that serves more than one floor.

The symbol of old-style construction is New York City's Empire State Building. In 1945, a B-25 bomber once crashed into the building — the structure suffered some minor structural damage and content loss (due to running gasoline fires) but no major problems.

Many high-rise buildings have unreinforced masonry wall construction. The contents of these buildings are prone to destruction during fires as well as in earthquakes.

While we don't have specific dates for old-style high-rise buildings, when we refer to them, we refer to buildings built during the prewar era. Buildings that were built during this time in history generally reflected the uncertainty of the engineers as to just how much of a load the supports could carry. The theme remained constant in the construction of these buildings — reinforce everything.

A perfect example of the durability of an old-style high-rise building under severe fire conditions is the 90 West St. building in New York City. The building was built in 1912 and was ignited by falling debris from Tower 2 of the World Trade Center (WTC) the morning of Sept. 11, 2001. The fires burned uncontrolled on several floors for more than 24 hours, yet the building remained structurally intact and is back in operation today after extensive renovation.

This clearly demonstrates the ability to build high-rise buildings that can resist fire spread and the threat of collapse. This type of building today would be labeled as not cost effective. By comparison, the 47-story WTC Building 7 was a new-style high-rise building completed in 1987. Because of its steel-framed construction, it would be classified as a medium-weight high-rise building. It, too, was ignited on several floors by flaming debris when Tower 1 of the WTC collapsed. Due to lack of water supply, WTC 7 burned uncontrolled for seven hours when it suddenly collapsed pancake style.

New-Style High-Rise Construction

New-style high-rise construction would fall into the medium weight and lightweight categories. Most medium weight high-rise buildings are constructed of, but not limited to, skeletal steel and concrete, while most of the lightweight buildings are constructed of, but not limited to, lightweight concrete poured over metal decking and supported by lightweight steel bar joists. Examples of lightweight high-rise construction are the WTC Towers and Chicago's Aon building.

One modern method of constructing high-rise buildings is called "core construction." This method involves erecting a steel skeleton by using a column, girder and beam system or constructing the building using poured reinforced concrete. The elevators, stair shafts, utility shafts, etc., are placed in a core area. Most commonly, this core is found in the center of the building; this is referred to as "center-core" construction. It should be noted that in **some** buildings this core will be found on the side. When this occurs, the construction is referred to as "side-core." In the case of side-core construction, stairways and elevators are located on exterior walls.

Core construction has less mass than old-style construction and is more vulnerable to heat from a fire. In buildings constructed of steel, floors have been known to sag nearly two feet under intense fire conditions; this has caused, in at least one case, several portions of the exterior wall assembly to fall. Some of these buildings have a sprayed-on coating on support members that assists in maintaining strength when subjected to heat or flames.

Some modern high-rise buildings are constructed without cores. In these buildings, stair, elevator and utility shafts may be throughout the structure, but usually they are located on exterior walls.

The year the high-rise was built does not determine old- or new-style construction; it is materials used and how the building is constructed. Table 2-1 lists high-rise structural features and components. This table provides a comparison of features found in old- and new-style high-rise buildings.

Table 2-1
High-Rise Structural Features/Qualities

Feature/Component	Found in Old-Style	Found in New-Style	Found in Both Styles
Structural framing systems			
Reinforced concrete	✓		
Structural steel		✓	
Exterior walls			
Part of bearing member	✓		
Prefabricated/Curtain		✓	
Roofs			
Concrete			✓
Shingled/Other	✓		
Shafts			
Stair			✓
Conventional			✓
Pressurized		✓	
Scissor		✓	
Elevator			✓
HVAC			✓
Electrical			✓
Mail			✓
Dumbwaiter			✓
Floors			
Concrete poured over metal deck		✓	
Poured concrete	✓		
Interior walls			
Poured concrete	✓		
Concrete block			✓
Drywall on wood or metal studs		✓	
Compartmentation			
Concrete with walls running floor to floor	✓		
Large open areas		✓	
Ceiling assemblies			
Plaster or drywall	✓		
Steel wire attached to grid of metal channels (with plenum area)			✓
Electrical systems			
Standard system			✓
Emergency generator(s)			✓

Table 2-1 (cont'd)
High-Rise Structural Features/Qualities

Feature/Component	Found in Old-Style	Found in New-Style	Found in Both Styles
Elevators			
Multiple			✓
Low, medium, high-rise banks			✓
Firefighter Service			✓
Active smoke-control systems			
Stairway pressurization		✓	
Building smoke control		✓	
Zone smoke control		✓	
Corridor smoke control		✓	
Elevator smoke control		✓	
Atrium smoke control		✓	
HVAC systems			
Individual floor or office units	✓		
Standard system		✓	
Water supply			
1 1/2-inch wet standpipe	✓		
2 1/2-inch dry standpipe			✓
2 1/2-inch wet standpipe			✓
*Sprinkler system	✓*	✓	
Emergency communication systems			
Hardwired, jacks at every floor		✓	
Fire control room/station			
No fire control room	✓		
Varies according to design and code		✓	

* Partial sprinklerization may be found in some old-style buildings.

STRUCTURAL FEATURES

Structural Framing Systems

The structural frame of a high-rise building is the skeleton of the structure that supports not only the dead load of the building but also live loads (such as occupants and building contents). The most common systems in high-rise buildings use one of the following as the basis for forming the building skeleton:

- reinforced concrete (old-style) or
- structural steel (new-style).

Both types of construction use vertical interior and exterior columns to which lateral girders are attached. The girders span the horizontal distance between the columns and structural support beams. In a lightweight building, steel-bar joists are used to span the horizontal distance between the columns and structural support beams. Although there is a difference in materials used for structural elements in a concrete versus a steel structural frame, they both serve the same function.

The construction design for high-rise buildings is based on the concept that structural integrity of the building must be maintained sufficiently in any potential fire. Principal structural components have a high degree of heat resistance. However, a number of structural stability concerns for fire personnel exist during fire conditions. This is especially true in a lightweight building.

- Component failure (possible under prolonged exposure to sufficient heat).

- Floor beam failure (somewhat serious but is also a localized occurrence).

- Girder failure (far more critical than floor beam failure because it would affect a significantly larger area).

- The failure of one or two connecting girders could cause column instability (potentially leading to a progressive collapse of the framing system).

- Column failure could result in serious structural instability. (Depending on the location of the column, it conceivably could trigger extensive collapse damage to the structure.)

- Failure of the steel-bar joist system leading to a progressive and catastrophic collapse of the framing system.

To achieve the fire protection required by building codes for Type I (fire-resistive) construction, steel-frame members in high-rise buildings are fireproofed by encasing them in concrete or sheetrock or by spraying them with a protective coating. Concrete has the advantage of being the most permanent type of fireproofing, but its use is limited due to the affect that it has on the dead weight of a building. Improperly applied sprayed-on protective coatings can spall during a fire. This may leave the steel structural member exposed and subject to failure from excessive heat.

Concrete frame structures tend to resist the effects of fire better than steel-frame structures, but they are less resistant to the effects of earthquakes. The ability of properly designed and constructed steel-frame high-rise buildings to withstand moderate earthquakes has been proven in many parts of the world in recent years.

A new generation of high-rise building construction has begun to emerge in the post-9/11 era. With this type of construction, we are seeing, in some cases, a resurrection of many of the features typical in the heavyweight buildings of the prewar era, featuring a return of the use of reinforced concrete in the structural framing system. Though costly, this feature provides for a greater degree of heat resistance and provides for greater structural stability in the event of a catastrophic fire. Be aware, however, that some of these newer poured reinforced concrete buildings still have some lightweight features such as curtain walls.

Exterior Walls

As stated earlier, the exterior walls of an old-style high-rise are part of the bearing members. Wall construction is reinforced concrete; these walls are very thick at the bottom and become smaller as they rise. The walls are poured in place and, therefore, are self-protected.

The exterior walls of new-style (core-style) high-rise buildings commonly are prefabricated and typically are lighter in weight than those in older buildings. In many cases, these walls are nonload-bearing and may be referred to as “curtain walls.” A complete curtain wall consists of a panel with finished surfaces and a means for attaching it to the building frame.

The most common method for attaching curtain walls to the building is by bolting them to clips that are attached to the structural frame or floor slab. This method of attaching walls often leaves a space of several inches between the end of the floor and the exterior wall. Unless this space is sealed with an effective fire and smoke barrier, it can provide a ready path for fire and smoke to spread to floors above and allow water to penetrate to floors below.

The outside finish of a new-style high-rise building often is referred to as the “skin” and usually consists of decorative materials such as aluminum, stainless steel or lightweight concrete. Large window areas often are present in new-style construction. These windows may be made of plain, tempered or decorative glass. Metal alloy frames, backed up with conventional construction, hold the glass in place.

Roofs

Roofs on high-rise buildings are required to have at least a two-hour fire-resistive rating. In most cases, concrete construction exceeds this requirement. Careful consideration must be given to roof configuration during preincident planning. Pay particular attention to:

- stair shaft exits;
- other obstructions that would limit certain types of ventilation activities on the roof; and
- microwave antennas.

In many cases, not all stair shafts in the building will exit to the roof. Knowing which stair shafts exit to the roof can be critical when moving occupants to the roof for safe refuge or evacuation and when using stair shafts to exhaust smoke. It is also important to know if it is possible to land a helicopter on the roof for a top-down approach to firefighting, interior rescue, or to lift building occupants from the roof. Evacuation stairs should be vented (if possible) at roof level to make stairs tenable for occupants. Ventilation stair shafts must be open to the roof.

In most cases (unless the code under which the building was built required the provision of a helipad), it probably will be impossible to land a helicopter on the roof. Various obstructions such as machinery rooms, antennas or lack of adequate landing space will exist.

Shaft Enclosures

Shaft enclosures in high-rise buildings are required to have a minimum of a two-hour fire-resistive rating. Shafts in old-style buildings are reinforced concrete and more than satisfy code requirements. Examples of shaft enclosures are stair, elevator, utility, HVAC, supply/return and electrical shafts. Any vertical shaft in a high-rise building, under fire conditions, can transfer heat and smoke to other parts of the structure. Therefore, it is critical that shaft integrity be maintained. These shafts may be used as escape routes for building occupants or as access routes for firefighters. Failure to maintain the integrity of vertical shafts can

- transfer combustion products to remote parts of the building;
- impede safe exit of building occupants; and
- greatly restrict the ability of fire personnel to perform tactical operations.

Stair Shaft Systems

If there is one construction component of a high-rise building that firefighting personnel don’t know enough about, it is stair shaft systems.

Old-style construction provides stair shafts of reinforced concrete, often located on the building’s perimeter.

As a rule, new-style high-rise building stair shafts are built into the center core. Additional stair shafts **may** be on the structure’s outer perimeter (depending on the height and occupancy type of the building).

Stairs normally found in high-rise buildings are generally of two types, return stairs and scissor stairs. In return stairs, the entry and exit are usually from the same location on each floor. The stairs will rise approximately halfway up the floor to a landing and then “return” the remainder of the distance to the next floor.

Scissor stair shafts feature two sets of stairs in one common shaft. In some cases, each set of stairs may serve every floor, but entry points at alternate floors are on different sides of the center core. Others are designed so that one set of stairs serves odd-numbered floors while the other set serves even-numbered floors. While these subtle differences may not seem important, under fire conditions they can be responsible for firefighters approaching the fire from a less than desirable location, or they can result in fire personnel going to the wrong floor.

The building may contain pressurized or smoke-proof stair shafts. Activation of special equipment can provide a smoke-free atmosphere within these stair shafts. In many cases, however, even though the building has multiple stair shafts, only one stair shaft may be designed to provide this smoke-free environment. Some high-rise buildings feature stair shafts referred to as smoke towers. These are either fully or partially open to the outside atmosphere to prevent smoke from filling the stair shaft.

When choosing a stair shaft for attack purposes, if possible, choose one that vents to the roof.

Doors that provide access to the stair shaft from individual floors often are locked from the stair shaft side. This requires firefighting personnel to have a key to provide immediate access to the floors from the stair shaft. A substantial amount of time can be wasted forcing entry if a key is unavailable. Forcing the door is often difficult, due to the metal construction of the door and jamb. Sometimes it is faster to breach through the wall and reach inside to open the door.

In many modern high-rise buildings, the stairwell entrance doors to individual floors are locked for security reasons by electronic locking mechanisms. Occupants leaving a particular floor during a high-rise incident may find themselves trapped in a stairwell unable to re-access a particular floor if necessary. These electronic locking mechanisms are equipped with devices which allow for these doors to be unlocked automatically due to the activation of a fire alarm, or manually via a switch, usually located in the fire Command center or near the fire alarm annunciator panel. This manual switch must be activated by the first-arriving fire companies upon entering the building as they prepare to make their initial investigation.

As a rule, stair shaft systems in high-rise buildings are not designed to handle the total occupant load of the building simultaneously. This is complicated further by the fact that the number of useable stair shafts may be reduced by heat, smoke or fire department operations. This is one of the main reasons why total evacuation of building occupants during a high-rise fire is often impractical.

During early fire stages, when there is a rapid spread of fire products to floors above the fire area, it may be best to relocate occupants from upper floors to safe refuge areas below the fire, rather than attempting to evacuate them from the building. When this is done, occupants must be placed in areas that will not be subject to smoke or heat. An escape route from the area must be maintained, and responsible personnel (i.e., police, floor wardens or building security) must remain along the route to prevent panic.

Stair shafts in high-rise buildings should be marked at each landing with signs that provide specific information about the shaft. Signs should identify the stair shaft by name or number (e.g., Stair 1, Stair 2). They should specify what floor you currently are on and list the lower and upper terminal points of that stair shaft (e.g., B-3 to 18). The sign also should indicate whether the stair shaft provides access to the roof of the building. This seemingly simple information can be critical to occupants who are using the stair shaft under fire conditions, and it can provide critical information for firefighters.

Another type of stair found in high-rise buildings is the access stair. These are stairways that supply access between floors owned by a single tenant.

Floors

Floors in high-rise buildings also are required to have a minimum of a two-hour fire-resistive rating. Floors in old-style construction usually are poured reinforced concrete. Floors in new-style construction normally are concrete poured over a metal deck that remains in place after the concrete has set. After the concrete has set, holes are bored in the concrete to allow for passage of various utility lines or equipment between floors. This procedure is called "poke-through" construction. Poke-through openings, if not sealed properly around the bored holes, can seriously diminish the floor's two-hour fire resistivity.

While most recent codes require that poke-through openings are sealed with a material that re-establishes two-hour fire resistivity, in many cases it is not done properly or is completely overlooked. In older buildings, poke-throughs may not be sealed due to a lack of code requirements when the building was built. Not sealing these poke-through spaces can allow fire and smoke to travel to upper floors and provide a path for water to travel to floors below. During a fire situation, a check must be made of the floors above and below the fire floor to ensure that poke-throughs are not causing a problem.

Interior Partition Construction and Compartmentation

In old-style construction, interior walls usually are poured concrete or concrete block. There is generally a high level of compartmentation. Walls usually run from floor to floor and provide a high degree of horizontal fire spread protection.

In new-style construction, the interior partitions and walls usually are constructed of drywall on a wood or metal stud. There may or may not be a high level of compartmentation. The office-type occupancy buildings may have large, open areas containing new modular furniture and cubicles. This may be combined with certain portions of the floors also having conventional offices. Another configuration is to have the entire floor consist of full-size offices.

The residential-type occupancy building usually has floor-to-ceiling drywall on wood or metal studs enclosing each individual living unit or apartment. There may be floor-to-ceiling partitions only on the interior of the living unit or apartment. This allows a common area above the entire living unit.

Floor Configuration

There are two general design concepts for horizontal floor separations in high-rise buildings. They are referred to as "compartmentation" and "open space." Compartmentation in high-rise buildings is based on the concept that small, protected areas separated from others will allow the fuel within them to burn out. This keeps the fire from spreading beyond the separated or protected area. An example of compartmentation would be a typical high-rise apartment building. These designs exist in both old-style and new-style construction.

Compartmentation can be an essential design consideration in limiting the size of a high-rise fire. Compartment separations must offer adequate fire resistivity and must divide plenum areas above dropped ceilings. They also must prevent vertical fire travel by use of protective construction features around vertical shafts and above windows. Proper compartmentation also requires all poke-through openings between floors to be properly fire stopped.

Examples of the open space concept are high-rise office buildings where floors are virtually wide open. This openness is designed to allow unrestricted movement of employees throughout the floor. In a fire situation, however, the lack of physical barriers will allow the fire to spread quickly throughout the floor. High-rise floors often are divided by partitions that extend from the floor to the dropped ceiling. These conditions do not represent true compartmentation. Should the fire reach the open plenum area above the dropped ceiling, it will move through the plenum and extend into other areas of the floor.

Ceiling Assemblies

Ceiling assemblies in new-style high-rise buildings usually are suspended from the floor assembly by steel wires attached to a grid of metal channels. These channels hold acoustical tile (or other ceiling material) and, in most cases, they also hold lighting fixtures. The open space between the suspended ceiling and the floor above normally is used for horizontal distribution of utility services (air conditioning ducts, electrical conduits, plumbing lines, etc.). It often serves as a common exhaust plenum for the HVAC system.

Ceiling assemblies in old-style buildings may be plaster or drywall, unless the buildings have undergone renovation.

WARNING
Under prolonged exposure to sufficient heat, suspension wires will weaken, often causing ceiling assemblies to fall. When this occurs, it can greatly impede the progress of fire attack personnel or cause firefighters to become entangled in the wire or to become trapped.

NOTE-TAKING GUIDE

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NOTE-TAKING GUIDE

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UNIT 2:
HIGH-RISE CONSTRUCTION

Slide 2-1

Slide 2-2

TERMINAL OBJECTIVE

The students will be able to identify the various high-rise construction systems, fire behavior problems, and their impact on strategy, tactics and life safety.

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ENABLING OBJECTIVES

The students will:

- **Define the term "high-rise."**
- **List building construction features.**
- **Explain the characteristics of building construction, design features, and fire behavior that affect strategy, tactics and life safety.**

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WHAT IS A HIGH-RISE?

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DEFINITION OF A HIGH-RISE

A structure that is 75 feet or more above the ground.

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DEFINITION OF A HIGH-RISE (cont'd)

Buildings less than 75 feet high also may pose some of the same problems as a high-rise.

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PREFIRE PLANNING CONSIDERATIONS

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HIGH-RISE DESIGN

- **Buildings have varied design or construction.**
- **Fire protection features differ by building.**
- **Codes and construction methods have changed.**
- **A high-rise must have a prefire plan.**

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HIGH-RISE BUILDING PLANS

- **Floor plans**
- **Stair shaft types (exits/termination above grade)**
- **Mechanical equipment room (MER) locations**
- **Heating, ventilating, and air conditioning (HVAC) zones/return airshafts**
- **Standpipe locations**

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KNOWLEDGE OF THE BUILDING

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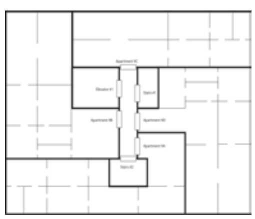
KNOWLEDGE OF THE BUILDING (cont'd)

Strategy and tactics for high-rise fires are affected greatly by fire personnel's knowledge of building construction and design features.



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PREFIRE PLAN

- **Building style (old or new)**
- **Built-in life safety or fire protection features**
- **Current occupancy and layout of building**
- **Floor compartmentation**
- **Open space areas**

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PREFIRE PLAN (cont'd)

- **Effective prefire/preincident planning is the key to success.**
- **Degree of firefighting success directly relates to:**
  - **Presence of fire safety features.**
  - **Ability to take advantage of these features.**

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How would you define an old-style high-rise building?

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OLD-STYLE HIGH-RISE

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OLD-STYLE HIGH-RISE CONSTRUCTION CHARACTERISTICS

- **Masonry bearing walls**
- **Most have reinforced concrete**
- **Lower floors, thicker walls**
- **Upper floors, thinner walls**
- **Large mass and operable windows**

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OLD-STYLE HIGH-RISE CONSTRUCTION CHARACTERISTICS (cont'd)

- **Less likely to collapse under fire conditions.**
- **Floors are reinforced concrete.**
- **High degree of compartmentation.**
- **Old-style look popular with new-style construction.**

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OLD-STYLE EXAMPLE

- **Masonry walls**
- **Large mass**
- **Operable windows**

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OLD-STYLE EXAMPLE (cont'd)

- **Reinforced concrete floors**
- **Unreinforced walls**

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OLD-STYLE EXAMPLE (cont'd)

- **Built 1912**
- **Fire 9/11 to 9/12**
- **No collapse**

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UNREINFORCED MASONRY WALLS

- **Often found in high-rise buildings**
- **Prone to fail during fire and earthquakes**

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How do old-style construction factors affect firefighting in these types of buildings?

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How would you define a new-style high-rise building?

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NEW-STYLE HIGH-RISE

Building 7 World Trade Center (WTC)
- **Built 1987**
- **Uncontrolled burn for seven hours**
- **Collapsed 9/11**

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NEW-STYLE HIGH-RISE CONSTRUCTION

- Uses core construction
- Erect a steel skeleton using a column, beam and girder system

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NEW-STYLE HIGH-RISE CONSTRUCTION (cont'd)

Core area
- Elevators
- Stair shafts
- Utility shafts

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CENTER-CORE CONSTRUCTION

Core is located in the center of the building.

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SIDE-CORE CONSTRUCTION

- **Core is located on the side of the building.**
- **Elevators and stairways often located on exterior walls.**

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CORE CONSTRUCTION

- **Has less mass and more vulnerable to heat.**
- **Floors are known to sag.**
- **Wall assemblies can fall.**
- **May have structural steel with sprayed-on coating.**
- **Some modern high-rises are constructed without cores.**

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CORE CONSTRUCTION (cont'd)

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HEATING, VENTILATING, AND AIR CONDITIONING

- **Includes central air conditioning (A/C).**
- **Services multiple floors.**
- **Windows cannot be opened.**

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How do new-style construction features affect firefighting in these types of buildings?

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HIGH-RISE FEATURES/QUALITIES

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STRUCTURAL FEATURES

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STRUCTURAL FRAMING SYSTEMS

- **Considered the building's "skeleton"**
- **Supports dead and live load of building**
- **Uses interior and exterior columns**

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STRUCTURAL FRAMING SYSTEMS (cont'd)

- **Both styles use girders that:**
  – **Span horizontal distance between columns.**
  – **Support structural beams.**
- **Principal components of both styles have high degree of heat resistance.**

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STRUCTURAL FRAMING SYSTEMS (cont'd)

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STRUCTURAL FRAMING CONCERNS

- **Component failure is possible.**
- **Floor beam failure is serious (but localized).**
- **Girder failure is critical.**
- **Failure of two girders could cause column instability/progressive collapse.**
- **Column failure could lead to structural instability.**

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STRUCTURAL FRAMING CONCERNS (cont'd)

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How does the probability of collapse in both styles of construction affect incident scene decision making at a high-rise fire?

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FIRE PROTECTION

Steel-frame members are encased in:

- **Sprayed-on fire-resistive coating**
- **Concrete**
- **Sheet rock**

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FIRE PROTECTION (cont'd)

- **Concrete is most permanent but not normally used.**
- **Improperly sprayed-on coatings may spall.**
- **Concrete is good but prone to earthquake damage.**
- **Steel offers better earthquake damage resistance.**

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EXTERIOR WALLS

- Old-style
  - Poured-in-place concrete
  - Self-protected
- New-style
  - Commonly prefabricated in core-style buildings
  - Lighter weight (than old-style buildings)

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What is a curtain wall?

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CURTAIN WALL

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OLD-STYLE EXTERIOR WALLS

- **Poured-in-place**
- **Part of structure**

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NEW-STYLE EXTERIOR WALLS

- **Bolts to structural frame or floor slab clips**
- **Leaves a space between the floor assembly and wall**
- **If improperly sealed, can lead to fire/ smoke extension and water damage**

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NEW-STYLE EXTERIOR WALLS (cont'd)

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NEW-STYLE EXTERIOR WALLS (cont'd)

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NEW-STYLE HIGH-RISE BUILDINGS

Outside ("skin") of the building

- **Aluminum**
- **Stainless steel**
- **Lightweight concrete**
- **Large window area(s)**
- **Glass**
  - **In metal alloy frames**
  - **Plain, tempered or decorative**

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NEW-STYLE HIGH-RISE BUILDINGS (cont'd)

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What affect do curtain walls have on Command/Operations' decision making?

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ROOFS

- **Required to have a two-hour fire-resistive rating**
  - **Concrete construction exceeds this**
- **Note**
  - **Stair shaft exits**
  - **Obstructions that would limit activity**
  - **Microwave antennas**

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HIGH-RISE ROOFS

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ROOF STAIR SHAFT EXITS

- **All stair shafts do not have a roof exit.**
- **Knowledge of roof exits is critical:**
  - **Aid in ventilation.**
  - **Provide occupant and firefighter roof access.**

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ROOF STAIR SHAFT EXITS (cont'd)

- **Use of correct roof stair shaft is critical:**
  - **Evacuation stairs should be vented at roof.**
  - **Ventilation stair shafts must open to roof.**
- **May affect helicopter operations.**

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What negative effects can occur as a result of not knowing which stair shafts exit to the roof?

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EXAMPLES OF SHAFT ENCLOSURES

- **Stairs**
- **Elevators**
- **Utility**
- **HVAC**
- **Supply/Return**
- **Electrical**

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SHAFT ENCLOSURES

- **Old-style shaft construction is reinforced concrete and satisfies code requirements.**
- **New-style shaft enclosures are either concrete block or drywall on metal studs.**

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SHAFT ENCLOSURES (cont'd)

- **Must have a two-hour fire-resistive rating.**
- **If vertical, can transfer heat and smoke throughout building.**
- **Maintain shaft integrity to prevent smoke and fire spread.**

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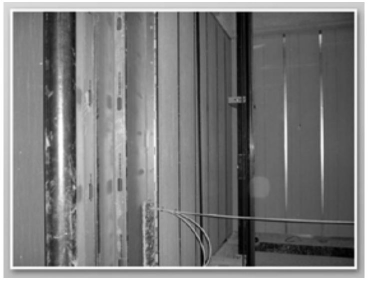
SHAFT ENCLOSURES (cont'd)



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SHAFT ENCLOSURES (cont'd)

Shafts

- **Transfer combustion products**
- **Impede safe exit of occupants**
- **Restrict fire personnel performance of tactical operations**

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What are the resulting effects of smoke entering stair shafts from open doors on the fire floor and floors above?

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STAIR SHAFT SYSTEMS

- **New-style versus old-style**
- **Additional shafts may be on building perimeter**
- **Smoke-proof towers**

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STAIR SHAFT SYSTEMS (cont'd)

Some may be pressurized or "smoke-proof":
- **Usually only one with this capability.**
- **More than three doors open defeats system.**
- **If intended use is for attack purposes, choose a stair shaft that vents to the roof.**

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SCISSOR STAIR SHAFTS

- **May be in new high-rises.**
- **Two sets of stairs are in one shaft.**
- **Serve each floor. (Each stairway exits at a different point on each floor.)**
- **Appropriate selection of stairway is important.**

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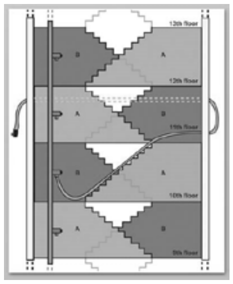
SCISSOR STAIRS



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RETURN STAIR SHAFT

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ACCESS STAIR SHAFT

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STAIR SHAFT DOORS

- **Firefighting personnel must have a key to operate effectively:**
  - **Forced entry is a slow process.**
  - **If forced entry is necessary, it may be easier to breach the wall.**
- **Automatic door releases.**

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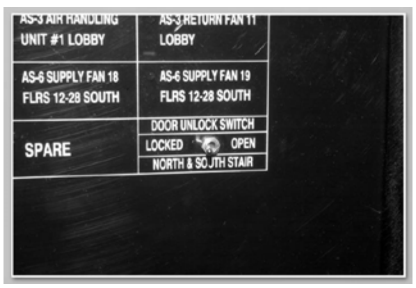
STAIR SHAFT DOORS (cont'd)



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EVACUATION FACTS

- **Stair shafts are not designed to hold all occupants simultaneously.**
- **Total evacuation may be impossible:**
  - **Shafts filled with heat or smoke.**
  - **Fire department operations.**

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OCCUPANT RELOCATION

- May be best to relocate occupants versus evacuate the building.
- Locate occupants where they will be safe.
- Plan an escape route in the event of occupant endangerment.

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What are some characteristics of stair shaft and floor-numbering systems?

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STAIR SHAFTS AND FLOOR MARKINGS

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FLOORS

- Required to have a two-hour fire-resistive rating.
- Normally are poured concrete over metal deck.
- Have bored holes for utility lines:
  – Integrity may be lost if poke-throughs are not protected.

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FLOORS (cont'd)

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POKE-THROUGH

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How does poke-through construction affect operations?

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INTERIOR PARTITION CONSTRUCTION AND COMPARTMENTATION

Old-style buildings:

- **Interior walls are poured concrete or concrete block.**
- **A high level of compartmentation exists.**
- **Walls go from floor to floor (providing spread protection).**

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INTERIOR PARTITION CONSTRUCTION AND COMPARTMENTATION (cont'd)

New-style buildings:

- **Interior partitions and walls are drywall on wood or metal stud.**
- **May or may not be high level of compartmentation.**

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INTERIOR PARTITION CONSTRUCTION AND COMPARTMENTATION (cont'd)

New-style buildings (cont'd):

- **Office-type building may have large, open spaces.**
- **Residential occupancies have enclosed units.**
- **Floor-to-ceiling partitions (interior of living units) may exist.**

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FLOOR CONFIGURATION

General design concepts for horizontal separation

- **Compartmentation**
- **Open space**

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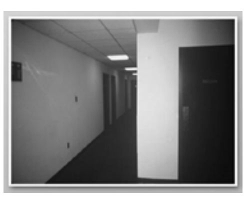
COMPARTMENTATION



Small, protected areas, separated from others, that will burn out and not extend easily to other areas.

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COMPARTMENTATION (cont'd)

- **Typically seen in residential designs**
- **An essential design consideration (in limiting fire size)**
- **Must offer sufficient fire resistivity**
- **Must prevent vertical extension**

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OPEN SPACE

A building area where lack of barriers allows fire to spread rapidly around the core.

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OPEN SPACE (cont'd)

- **A characteristic of high-rise office buildings.**
- **Allows unrestricted movement of employees.**
- **The partition often goes to the level of the suspended ceiling.**
- **May be divided into cubicles with 5-foot high partitions.**

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**What is a plenum area,
and what is it used for?**

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PLENUM AREA

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PLENUM AREA (cont'd)

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CEILING ASSEMBLIES

- **Usually suspended.**
- **Consist of steel wire attached to grid of metal channels.**
- **Channels hold ceiling tiles.**
- **Have an open space between the ceiling tiles and floor above.**

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WARNING

Under prolonged heat exposure, suspension wires will weaken, often causing the ceiling assembly to fall.

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SUMMARY

- **Prefire planning**
- **Knowledge of the building**
- **Old-/New-style construction**
- **Structural features**

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UNIT 3: HIGH-RISE BUILDING SYSTEMS

TERMINAL OBJECTIVE

The students will be able to identify the various fire behavior problems, high-rise building systems and their impact on strategy, tactics and life safety.

ENABLING OBJECTIVES

The students will:

1. *Explain the characteristics of fire behavior and building systems that affect strategy, tactics and life safety.*
2. *Identify building systems.*
3. *Explain fire department ventilation techniques at high-rise incidents.*

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FIRE BEHAVIOR AND SPREAD

The following fire behavior and fire spread phenomena must be considered by all Command Officers and operating forces at high-rise fires:

- positive stack effect;
- negative stack effect;
- stratification;
- vertical extension;
- core construction effect;
- fire loading; and
- heat buildup.

Positive Stack Effect

Stack effect is defined as "the vertical, natural air movement throughout a high-rise building caused by the difference in the outside and inside air temperatures." A normal stack effect occurs when air currents flow from the lower floors to the upper floors. The **normal (positive) stack** effect is more prevalent in the winter months in colder climates when the inside air temperature is warmer than the outside air temperature. Openings made on the lower floors will cause the colder dense air to enter the building displacing the warmer air, smoke and toxins causing it to draft upward toward the roof. The colder the weather, and the higher the building, the greater the stack effect will be.

The opposite occurs in warmer climates. A **reverse (negative) stack** effect occurs when the warmer air enters the building on the upper floors displacing the cooler, more dense inside air causing it to flow down to the ground floor. Stack effect is not caused by the fire; however, it is responsible for the significant amount of smoke spread in high-rise buildings.

A neutral plane exists in high-rise buildings and is defined as the area within the building where the barometric pressure inside the building equals the pressure outside the building. This neutral zone can exist over a number of floors; however, the exact location cannot be determined without an in-depth evaluation. Above the neutral plane when there is a positive stack effect, the air currents will move out away from the center of the building. Below the neutral plane the air will move toward the center from the exterior.

When there is a negative or reverse stack effect in the building, the air will flow toward the center of the structure from the exterior on the floors above the neutral plane, and the air will flow out and away from the center of the structure on floors below the neutral plane. This situation may cause Staging to be relocated farther from the fire or cause firefighters trying to reach the fire floor to use self-contained breathing apparatus (SCBA) earlier than desired.

Stack effect influencing factors:

- airtight exterior walls;
- air leakage between floors;

- air temperature between floors; and
- differences between inside and outside air temperature.

Stratification

As smoke rises inside a high-rise building, it eventually loses its thermal energy and cools to a point where its temperature is equal to or less than the ambient temperature inside the building. When this occurs, the smoke loses its buoyancy and stops rising and begins to spread out laterally. This can create a problem on upper floors remote from the fire floor. The cooler, stratified smoke still contains high levels of carbon monoxide, and toxic byproducts of combustion, and can be very deadly. Many lives have been lost, including those of firefighters operating in these areas, when they have been overcome by this cold but deadly smoke.

Vertical Extension

Typical construction methods for high-rise buildings provide common avenues through which fire may extend vertically. Three common methods of vertical fire extension in high-rise buildings include:

- auto exposure (lapping);
- curtain wall extension; and
- vertical shaft extension.

Auto exposure (lapping) occurs when the fire generates enough heat to break out windows, after which the fire "rolls out" of the fire floor and up the outside of the building. Heat is transmitted to the floor above causing the window glass to break and combustibles on the floor to ignite.

As discussed previously, most modern high-rise buildings are constructed of structural steel. Exterior walls (curtain walls) are attached to the structure. A space is created between the floor assemblies and the curtain wall. These spaces are supposed to be sealed during construction. Should there be faulty installation or heavy fire conditions, there may be vertical spread of the fire through this space. This is called a curtain wall extension.

The following features incorporated into high-rise design and construction contribute to vertical fire extension:

- stair shafts;
- elevator shafts;
- electrical chases;
- plumbing/electrical/data cable "poke-throughs" (holes created through floors for cable or piping distribution);
- heating, ventilating, and air conditioning (HVAC) supply/return shafts;
- mail chutes;
- trash chutes;

- access stairs (open, private stairways constructed for tenants who occupy more than one floor of a highrise); and
- tunnels.

Core Construction Effect

A fire that reaches the plenum area around the center core of a high-rise can spread in that plenum area. Firefighters entering the fire floor and advancing on the fire may push the fire around the center core inadvertently. This may cause the fire to circle behind the firefighters, cutting off their escape route.

When fire is predicted to be in the plenum area, firefighters entering the corridor from a stair shaft should remove the ceiling tiles in both directions before advancing. This may allow the firefighters to see if fire is in the plenum area. A backup hoseline should be in a stationary position so that it protects the advancing crew from the wraparound effect. Use caution to avoid advancing the fire into the attack crew.

Fire Loading

The quantity of fuel that is available to a fire on any given floor directly affects firefighters' ability to gain fire control. Where fuel is limited (such as on a vacant floor), it may be possible to mount a greater effort to keep the fire from getting by that floor.

Heat Buildup

Fires in high-rise buildings generate large quantities of heat. Unfortunately for firefighters, this heat cannot be dissipated easily from the building. Usually, there is no means to ventilate the building effectively. This high heat also takes its toll on the firefighter by accelerating which dehydrates the firefighter and removes energy. Rehydration at Staging and Rehab is critical.

ELECTRICAL SYSTEMS

Electrical systems in high-rise buildings can be extremely complex and very hazardous under fire conditions, so they demand consideration during fires. The amount of electrical power required for building operation and the complex equipment used to distribute it must be considered when fires occur. Electrical chases are one cause of vertical fire spread.

Much of the electrical equipment can be located throughout the building. If the equipment is located in the basement of the building, it is susceptible to flooding that occurs as a result of broken pipes or water used to control the fire. The danger of working near electrical equipment when water is present is well-known and must be remembered. Sending fire personnel into electrical vaults to terminate building power usually is not recommended for the following reasons.

- The shutdown procedure tends to be complicated and requires specific knowledge on how to perform it safely. Often total shutdown is not possible due to emergency backup systems designed to engage automatically.

- Randomly throwing switches in these types of situations can be extremely dangerous. (You could terminate power to equipment that should continue to operate.)

- If power must be terminated on the floor or floors involved in the fire, it usually can be done through subpanels that control the electrical supply to specific floors.

- Because of the high voltage and power present in electrical vaults, a sudden shutdown by inexperienced personnel can cause dangerous surges that can harm personnel. **Have a utility company representative or the building engineer do the shutdown in electrical vaults**.

An emergency power supply, usually provided by an engine-driven generator, may be found in many high-rise buildings. The building systems that receive power from the emergency system will vary and usually are dependent on code requirements in effect when the building was constructed. In older buildings, the emergency power may supply only exit lighting in the stair shafts. In newer buildings, it may serve a large number of fire protection or life safety features such as fire pumps, elevators and smoke-removal systems. Emergency power activation may be automatic when normal power is interrupted, or it may require manual activation (by throwing switches). During preincident planning inspections, be sure to determine if the building has emergency power, what it supplies, and how it is activated.

ELEVATORS

Under normal conditions, elevators are the only practical method of moving between floors in a high-rise building. **Under fire conditions**, elevator operation can become erratic and extremely dangerous. Many elevator system control components can be affected by smoke, moisture and heat, all of which are present during a fire situation. The loss of elevators generally occurs in about 20 minutes during a high-rise fire operation. Control components that can be affected include floor call buttons, electrical contacts located in shaftways, and electrical elements located at the bottom of the hoistway. Light-sensitive systems that keep doors from closing are affected by smoke.

A flashlight may be a practical means of activating the door closure mechanism.

Safe use of elevators under fire conditions requires:

- Knowledge of the type of elevator and how they work:

  - Hydraulic elevator,
  - Traction elevator, and
  - Freight elevators.

- Knowledge of the maximum number of personnel to allow into each car (generally five to six people).

- An understanding of what malfunctions may occur (e.g., erratic movement, traveling to unselected floors, traveling to the fire floor, ceasing to operate, doors opening without use of "Open Door" button).

- Familiarity with standard operating guidelines (SOGs) and their use under emergency conditions.

- A department wide policy regarding the use of elevators during fire conditions should be developed and adhered to by all department personnel.

Hoistways are the vertical shafts in which elevator cars travel. In buildings with multiple elevators, all elevator cars in a bank are usually in a common hoistway. Some high-rise buildings are equipped with low-, medium- and high-rise bank elevators (also known as split-bank). These are configured so that some elevators serve only lower floors of the building while others serve the upper floors. It is important to know whether or not the building has split-bank elevators and, if so, which floors the different banks serve. This information can be critical to deciding whether it is safe to use the elevator system.

The hoistway is separated from each floor by a hoistway door. This door is opened by movement of the elevator car door (once the car is level with the floor landing). Smoke and heat under pressure at the fire floor can enter the hoistway (even though the hoistway doors are closed) and travel up or down the shaft. If a large volume of fire enters the hoistway shaft, the shaft acts like a chimney and draws the fire upward where the heat may be sufficient to ignite materials on upper floors next to the hoistway. As heat and smoke rise within the hoistway, pressure will force it out of the hoistway doors onto the upper floors.

Elevator cars will burn to the point where hoisting cables can fail and cause the car to fall down the shaft. If fire has penetrated an elevator car or the hoistway, it is important that personnel be assigned to floors above and below the fire floor (including the floor where the shaft terminates) to check for spread of fire or smoke.

Almost every high-rise building is required to be equipped with elevator emergency service features that automatically move the elevator cars to specific locations under fire conditions. The feature also allows firefighting personnel to place the elevator cars in a Firefighter Service Mode that provides specific safety features. Automatic recall may be initiated whenever an alarm device is activated. Manual recall can be done through recall switches located in a lobby control panel or in a fire control room. Automatic or manual recall of elevators (available through Firefighter Service Mode) is important for a couple of reasons:

- reduces the possibility of occupants being trapped in an elevator car; and
- provides fire department access to elevator cars (if the decision is made to use them).

Prior to operating an elevator car in Fire Service Mode, Phase 2, check the elevator car control panel to make sure that the fire helmet symbol is not flashing. A flashing fire helmet symbol/Maltese cross indicates that a fire alarm detector in the elevator machine room, lobby or hoistway for that elevator bank has been activated by heat or smoke. This may be an indicator that the shunt trip may activate very soon. If this situation is encountered, it is recommended that an alternative bank of elevators be used until the fire location has been verified. If the elevator is used and the shunt trip is activated, the elevator will stop, and the firefighters will be trapped. If another elevator bank is not available, an alternate means of ascending should be considered.

Firefighter Service Mode

Elevators equipped with Firefighter Service Mode must be used for fire operations. Follow the following guidelines when using these elevators:

- Assure that the elevators have been placed in the Firefighter Service Mode.

- First-arriving units should (if possible) **initially** avoid a Firefighter Service Mode-equipped elevator that is capable of stopping at all floors.

  - Many of the converted service or freight elevators are capable of stopping at all floors and therefore are capable of being affected by fire on any floor.

  - Only after the Incident Commander (IC) has determined that the fire is not adjacent to the shaft should these elevators be used. Experience indicates that many fires in high-rise office buildings have been found in the service elevator lobby (in piles of collected rubbish). Heat and flame have affected the doors and control wiring of nearby service elevators.

- Personnel **should never** take an elevator that services all floors in order to travel to a floor above the fire.

  - When assigned to go above the fire via an elevator, choose an elevator that has a blind shaft on the fire floor.

  - Remember, a Firefighter Service Mode-equipped elevator is not necessarily a “safe” elevator. It still can be affected by heat, smoke or water entering the shaft.

  - If there is no blind-shaft elevator to go above the fire, stair shafts should be used. **Note:** When available, use a smoke tower-equipped stair shaft to ascend.

The decision to use elevators during a fire in a high-rise building is one that must be tempered with good judgment. While it is true that using elevators will speed up initial investigation and fire control efforts, a malfunction that causes response to a nonselected floor can result in loss of firefighters’ lives. Therefore, using stair shafts is the safest method of ascending to the fire floor.

The decision to use elevators should be based on assurances that the elevator lobby on any involved floor is safe and that the cars that are used are not physically capable of reaching the fire floor (they belong to a split-bank). Fire personnel already on fire floors can confirm that the elevator lobbies on those floors are tenable.

Even when assurances are in place that elevators can be used safely, any additional safety features or procedures should be employed. These include the use of split-bank elevators that terminate at least five floors below the lowest reported fire floor. Only use cars that allow firefighter service. In addition, all personnel riding in elevator cars should wear full protective equipment and have forcible entry tools, a means of communication, an extinguisher, and a knowledgeable firefighter assigned to operate the car.

All firefighting personnel should be well trained in the operation of Firefighter Service controls on elevator cars. The time to conduct this training or to develop department policies regarding emergency use of elevators is not on the day of the fire.

Do not use an elevator in a bank that services the fire floor unless it is determined to be safe using local SOGs. The one exception to this rule is that early consideration of elevator usage is acceptable when split-bank elevators exist in which the top of the shaft and machinery room is a minimum of five floors below the reported fire floor. In this case, take the low- or medium-bank elevator to the highest floor, and then take the most desirable access stair shaft to the fire floor. Progress up the stair shaft and check the floor two stories below the reported fire floor for use by Staging.

Information on the Staging floor and stair shaft number used by fire attack should be transmitted to the IC. A good rule of thumb is to give the IC an update every two to three floors during the ascent. On arrival at the reported fire floor, the IC should be given an update on conditions on the floor as well as for the floor above. In addition, the fire attack company should give a periodic update on conditions and fire location to the IC.

The first thing that should be done when assessing the safety of elevators that service the fire floor is to account for all cars serving the floor and then check them for victims. Upon verification by fire department personnel that the elevators are safe to use during emergency operations, a fire department member should be designated to control the operation of each elevator car. The operator, in addition to required safety equipment, should have a portable radio to maintain communication with the Systems Unit and a forcible entry tool for use in an emergency situation.

Elevator components are affected by water, so once the decision to use a specific elevator or bank of elevators is made, every precaution must be taken to preserve the integrity of those elevators. This can be accomplished by designating one of the first-arriving truck or squad companies the task of diking the elevator, or bank of elevators on the fire floor, with salvage covers. This can aid in keeping water from sprinklers and or hoselines from entering the shaft. Once this is accomplished, the situation must be monitored closely throughout the incident in an attempt to maintain the operation of the elevators.

Even though the elevator may be capable of traveling directly to the fire floor, it is always recommended that **all elevator travel cease five floors below the lowest fire floor**. Initial fire attack team personnel traveling in elevator cars, even though the maximum travel is five floors below the reported fire floor, must be equipped with donned breathing apparatus and facepiece, portable radio, dry chemical extinguisher, forcible entry tools, and portable spotlight. Breathing apparatus facepieces should be connected to regulators and ready for immediate use. The firefighter should be assigned to keep the dry chemical extinguisher in readiness with the lock pin removed and the nozzle pointed at the elevator door. The portable spotlight is to be used in case of lighting power failure. It also can be used to check the hoistway for smoke before use. **If even the slightest amount of smoke or water is in the hoistway, the elevator should not be used.**

At all times that the elevator is in motion, firefighters should be prepared to take immediate action that will cause the doors to close if the car responds to a floor where smoke or fire conditions are present. The action will be dictated by the elevator control equipment and the current operating mode. Precautionary stops should be made to confirm elevator operation and to check for smoke in the hoistway.

If sound-powered phone jacks are available in the elevator car, they should be placed in service with a sound-powered phone/headset. Also consider the weight capacity for the elevator car to prevent overloading with personnel and equipment.

Departments that allow personnel to use elevators at emergency incidents should consider the following items as a minimum when developing SOGs:

- Only use an elevator car with the Firefighter Service feature that allows for emergency control of the elevator car. (**Note:** In older high-rise buildings, "Firefighter Service" is sometimes identified as "Firemen Service.")

- Consult with the company that installed the elevator. Ask about the machine's features and use.

- Follow all previous guidelines for split-bank elevators.

- **For all personnel who respond to high-rise fires, there must be training on elevators and procedures. It is not enough simply to have procedures in local SOGs!**

Procedures: Firefighters Trapped in Stalled Elevator Cars (During Fire Operations)

If the elevator car door opens on the fire floor and exposes the firefighter to severe heat and/or smoke, discharge the dry chemical extinguisher to knock down a flame front and attempt to close the door **immediately**. This should be done either by pushing the **"Door Close"** button or manually forcing the doors closed. Push the button for a lower floor and exit the elevator when it reaches that floor.

If the car fails to move, check the emergency stop button. It may have been activated accidentally. Deactivate it by pulling it out, or, if it is a switch type, move the switch to the **"Off"** position. If this doesn't work, disengage firefighter control mode by turning the key to the off position. This should return the elevator to the lobby. Try to keep low in the car, and don your SCBA facepiece if necessary. Remember, it is important to conserve air. At this point, implement mayday or emergency traffic procedures per SOG.

An option is to open the elevator roof access and take control of the car by using controls located on the car roof. When two or more elevator cars exist in the same shaft, it also may be possible to gain access to the adjoining car. (This may be accomplished through roof access or side panels.)

If necessary and available, use the side emergency exit for a rope slide to the safety of a lower floor. If this is to be attempted, have power removed to the adjacent car. In an **extreme emergency**, fire department hose can be used to slide down to the floor below. If more than one length of hose is used, first tie the lengths together, then couple them. Personnel can be lowered to the hoistway door interlock and exit at the floor landing below.

Handlines on the floor below can be used to spray a fog stream between the car and the hoistway door. A 30-degree fog pattern should be used to cool and protect trapped people during the rescue operation.

Pertinent General Information

- Take time to become familiar with specific elevators before leaving the lobby. Early staffing by one or more personnel who have become familiar with the elevators is important.

- Use stairs whenever possible, and limit elevator use to those in banks that cannot be affected by the fire.

- Consider calling in an elevator repair/service company that provides personnel on emergency duty. Many high-rise buildings have these personnel on 24-hour call. The telephone numbers **must** be posted in the elevator machinery room and often are posted in the vicinity of the elevator lobby.

- Use all applicable procedures for elevators when under fire conditions.

- Consult the company that installed the elevator regarding the elevator's features and use.

- It is imperative to train on elevator procedures and use during fire operations.

Locked Hoistway Doors (Operational Considerations)

For security reasons, some occupants lock hoistway doors on their floor when the building is closed. If your elevator arrives at the selected floor, but the car door does not open, make no attempt to force it. In this instance, the locked hoistway door (attached via the vane to the elevator car door) is keeping both doors closed. **Any attempt at forcing them open may damage the interlock, putting the car out of service.** The following procedures may be employed to deal with a locked hoistway door:

- If the hoistway door security lock can be removed or opened with no damage to the door, do so.

- If removal of the locking device threatens bending or warping of the door or door buck, make no attempt at removal. Drop down to a floor where exiting is possible. Find the stair shaft and walk up to the original floor.

Caution: Warping or springing of the door assembly may interfere with the car's electrical circuits and put the car out of service.

VENTILATION TECHNIQUES

Smoke spread is unquestionably the most significant life hazard problem that exists at the time of a fire in a high-rise building. The movement of smoke, often to locations remote from the original fire floor, appears to be the result of several different factors and is not always easy to predict.

Ventilation in a high-rise building is a very complex issue. Any type of ventilation tactic applied in a high-rise fire must be done by considering the risks versus the benefits. There are four types of ventilation techniques that can be used in this situation:

- horizontal ventilation;
- vertical ventilation;
- mechanical (HVAC or smoke-control systems) ventilation; and
- positive-pressure ventilation.

Application of any one of these methods must be done using extreme caution and only when approved by the IC. The IC must consider how the ventilation will affect the fire's behavior and the smoke movement within the building. Improper ventilation techniques can have catastrophic consequences. For this reason, no ventilation should be performed without permission from and coordination with the Command Post (CP).

The IC must consider the following:

- location of the fire/hazard;
- location of the firefighters working in the building;

- location of the occupants in the building;
- how the "stack effect" affects the ventilation performed;
- weather conditions (i.e., wind, ambient temperature, humidity); and
- falling glass and debris hazards.

Horizontal Ventilation

Horizontal ventilation complexities usually will be dependent on the type of windows installed in the building. Inoperable windows complicate ventilation procedures. Operable windows, used in conjunction with normal smoke removal equipment, simplify ventilation.

Old-style constructions have small windows that generally can be opened (if not painted shut). New-style constructions have large plate or tempered glass window panels.

High-rise **residential** buildings normally have operable windows made from regular plate glass. In addition, many high-rise apartment buildings have large sliding glass doors that open onto balcony areas. Windows in high-rise **office** buildings often are inoperable and typically are made of plate glass. When broken, plate glass can produce large shards that would cause serious injury to those below. To reduce this risk, special "tempered" glass windows may be required at certain locations. When a tempered glass window is broken, it will shatter into very small pieces, providing a degree of safety that is not offered by plate glass under the same circumstances.

Depending on applicable building codes, tempered glass or operable windows (on every floor) may be required in sealed buildings. Usually, they are located in each corner of the exterior wall and at specific horizontal intervals. These special windows typically are required to be aligned vertically throughout the building. Tempered glass windows generally are designated by a special marking, such as a Maltese cross, in one of the lower corners. A decal may be affixed in a visible place near the window.

Instead of tempered glass for emergency ventilation, some buildings may be equipped with special operable window panels that are secured from the inside by a tool-operated locking device. This tool is required to be kept on the premises.

It is important to note that removal of window glass during a fire situation, whether caused by the fire or done intentionally for ventilation purposes, can create a situation where fire can extend up the building exterior to the floors above. Any time glass is removed or fails, consideration must be given to the possibility of exterior lapping.

Another very important consideration to note is that the removal of a window during a fire situation, whether caused by fire or done intentionally for ventilation purposes, can create an extreme fire situation known as a "wind-driven fire." Any time glass is removed or fails, consideration must be given to this possibility. In this type of situation, the fire is driven back into the building either by the wind or the sudden in-rush of cold, dense air prevalent in certain climates during the winter months. This is due primarily to the stack effect within the building itself, which is more prevalent during the winter months. In other climates, such as Los Angeles, this phenomenon may be more prevalent when the Santa Ana Winds are active. Fire can be driven back into the building with a blow torch-type effect. This can immediately endanger the attack crews or any civilians in the vicinity who have not been evacuated.

There is a pressure differential that exists between the interior and the exterior of the building with the higher pressure being outside. The fire itself is also creating a higher pressure in the fire apartment. When the door to the fire apartment is left open, or the door is opened by the fire attack crew, an area of low pressure is created. If the window fails due to heat or premature ventilation by the firefighters, the wind enters the interior of the building. The pressure suddenly drops and the velocity increases as the higher pressure from the exterior flows toward the lower pressure on the interior. In one fire test performed by the National Institute of Standards and Technology (NIST), a 15 mph wind striking the outside of the building accelerated to 30 mph inside the structure. The Venturi Effect causes the fire to accelerate at a very rapid rate. The temperature, even at floor level, becomes so intense so fast, and heat penetrates the firefighters personal protective equipment (PPE) at such an accelerated rate that firefighters are unable to successfully run for cover.

Currently, there is excellent research being conducted concerning wind-driven fires. NIST is leading the research along with fire officers from across the country including high-rise experts from the Chicago Fire Department, Fire Department New York (FDNY), and Toledo and Ottawa, Canada. Ultimately, these fire service leaders and NIST hope to demonstrate the value of and establish procedures and tactics that will help fire departments combat these wind-driven fires.

Personnel entering the building at ground level should do so from a location that provides as much safety as possible from falling glass. This may be from a side of the building away from the fire location or by using adjacent or attached structures as a shield. Hoselines supplying the sprinkler and/or the standpipe systems are subject to damage from falling glass. These hoselines may have to be covered to protect them. Salvage covers are not acceptable because they can be cut by glass, allowing the hose to be damaged.

Vertical Ventilation

Vertical ventilation can be accomplished by using stairwells and bulkheads or other vertical shafts that extend through the roof. Elevator shafts are not recommended for this use. Careful consideration must be given to this type of ventilation when the fire is not yet under control. Opening a bulkhead door or other vertical shaft without proper coordination between all Command locations can have devastating consequences. Fire can be drawn toward advancing fire crews or to areas not yet involved thereby endangering occupants. For these reasons, any firefighters sent to perform this type of ventilation must be equipped with a portable radio and remain at their assigned location until the effects of the ventilation are known. Any adverse effects can be reversed by maintaining control of the bulkhead door or other openings on the vertical shafts being used.

One very important safety consideration to practice when performing vertical and horizontal ventilation is to avoid placing firefighters between the fire and the point of ventilation.

Mechanical Ventilation — Smoke-Control Systems

The worst obstacle we face is smoke spread, so the best approach to use with HVAC systems during a fire operation is to completely shut down the HVAC system that is contaminating the other floors with smoke. It is also important to follow the fire department's preplan for operation of the HVAC system during a fire.

Smoke and its toxic products account for more than 80 percent of fire deaths in the United States. Plastics greatly increase the volume and toxicity of smoke. For example, polyvinyl chloride (commonly known as PVC) produces 500 times as much smoke as red oak. High-rise buildings have contents that, like most occupancies, are petrochemical products that produce large amounts of smoke and toxic gas.

The forces that affect smoke movement in a high-rise building include stack effect, expansion, wind and HVAC systems. Smoke control can be either passive or active in nature. Passive smoke-control measures have been in use for many years. Found in both old- and new-style buildings, they consist of:

- barriers;
- curtains;
- gravity venting;
- smoke-proof towers; and
- smoke-removal shafts.

Active smoke-control systems are relatively new and typically automatic; they usually are found only in new-style buildings. In addition to methods of passive smoke control that might be in use, active smoke control uses mechanical assistance to route smoke in a planned manner. Active smoke-control systems can be used to control the movement in many different ways.

A small high-rise may have a single HVAC system that controls the atmosphere on all floors. This simple system may (or may not) have a single control to exhaust the entire building. This control is referred to as the Building Smoke-Control System.

Zoned HVAC systems exist in more complex high-rise buildings. It may be possible to control single floors or an entire zone through these types of systems. (See the upcoming HVAC section for a discussion of zoned systems.) HVAC zones could cover any of the following:

- a stairway pressurization system (often accomplished by having fans in all or certain stair shafts);
- building smoke-control system;
- zone smoke-control system;
- a corridor smoke-control system;
- an elevator shaft-control system; and

- an atrium smoke-control system.

It is important to have this information on the prefire plan and to work together with the building engineer to control operation of various HVAC zones.

These smoke-control systems are prone to fail under fire conditions. The areas from which they are designed to clear smoke should be monitored closely. The system should be shut down immediately, if it adversely affects operations.

Positive-Pressure Ventilation

When areas or entire floors of a high-rise building are contaminated by smoke, we can implement the use of positive-pressure ventilation to aid in smoke removal. This can be a very complex operation that if not properly coordinated can produce very negative results. Consideration must be given to the fire location and extent, as well as the location of firefighters and occupants in the building.

The IC must decide if the positive-pressure ventilation is going to be used to help control the fire or be used as a post-fire control measure to remove or stop smoke spread throughout the structure. Currently, NIST is also conducting in-depth research in the area of positive-pressure ventilation for use in high-rise operations. The core of this research involves the development of guidelines to aid fire departments in the use of this method of ventilation in both prefire and post-fire control situations using large portable blowers as well as apparatus-mounted ventilation units.

Positive-pressure ventilation can be used prior to fire control by pressurizing stairwells and hallways effectively giving firefighters a tenable atmosphere to work in, allowing quicker advancement toward the seat of the fire. Positive-pressure ventilation can also be used to pressurize the evacuation stairwell allowing for the safer movement of building occupants. The research conducted to date has produced some very valuable data. According to NIST, positive-pressure ventilation fans used correctly can increase the effectiveness of firefighters and survivability of occupants in high-rise building fires.

In a high-rise building it is possible to increase the pressure of a stairwell to prevent infiltration of smoke if firefighters configure the fans properly. When configured properly, positive-pressure ventilation fans can meet or exceed previously established performance guidelines for fixed smoke-control systems. Proper configuration requires firefighters to consider a range of variables, including fan size, setback, angle and fan position inside or outside of the building, and the number and alignment of multiple fans.

HIGH-RISE WATER SUPPLY

A variety of different water supply systems can be found in high-rise buildings. They may include and are classified as follows:

- one and one half-inch wet standpipe systems: old-style buildings Class 2 System;
- two and one half-inch dry standpipe systems: old-style buildings Class 1 System;
- two and one half-inch wet standpipe systems: both old- and new-style buildings Class 1 System; and
- combination of 1 1/2-inch and 2 1/2-inch or 2 1/2-inch outlet with 2 1/2- to 1 1/2-inch reducer attached Class 3 System.

Note: The 1 1/2-inch and 2 1/2-inch sizes refer to the diameter of the fire hose discharge connections on the standpipe system. Piping within the standpipe system may be considerably larger than this.

The importance of the water supply systems built into high-rise buildings demands that we have knowledge of how these systems work and what problems may be expected in emergency situations. The specific types of water supply systems found in high-rise buildings will vary with the age of the particular building and code requirements that were in effect at the time it was constructed. Preincident planning information should include specifics on the water supply system, its capacity and functional components.

Water Supply Systems

One and One Half-Inch Wet Standpipe Systems

For many years, 1 1/2-inch wet standpipe systems have been used in high-rise buildings. These systems often are supplied by the domestic water system and are intended as a first-aid device for building occupants. They have limited water volume and pressure and inferior hoselines and nozzles. The 1 1/2-inch wet standpipe system should not be considered as adequate for primary fire department attack and should not be used.

Two and One Half-Inch Dry Standpipe Systems

The 2 1/2-inch dry standpipe system is used in many older high-rise buildings and, in some cases, in new buildings that do not exceed specific heights. These systems are relatively simple in design compared with wet standpipe systems, but they have some important differences that must be considered.

Because they do not have a constant water supply, it is important that they be charged by an engine company that hooks to the fire department connection as quickly as possible. This will give firefighters an available water supply for fire attack. Fire department connections on 2 1/2-inch dry standpipe systems typically serve only one standpipe riser, making it critical that the riser being supplied is the same one that is used for fire attack lines. The system should be drained after use.

Two and One Half-Inch Wet Standpipe Systems

The 2 1/2-inch wet standpipe system is required by code in all new high-rise buildings over certain heights. These systems provide a constant supply of water under pressure adequate to produce effective hose streams on each floor of the building. The primary water supply source for these systems may be the domestic supply that can be supplemented by an auxiliary supply (kept in a holding tank in the building). The 2 1/2-inch wet standpipe systems differ in design. They may serve both 1 1/2-inch and 2 1/2-inch outlets as well as the sprinkler system, if the building is so equipped.

The necessary pressure and flow for a 2 1/2-inch wet standpipe system usually is provided by one or more fire pumps that serve as the primary supply. Fire pumps for high-rise buildings tend to be multistage centrifugal pumps. They may be powered electrically or with diesel engines. These pumps are designed to produce the required flow at a pressure that is sufficient for working streams at the highest point in the building. If an emergency or backup pump is required by code, there will be a backup system that activates automatically should power to the electric pump(s) fail. Backup pumps are usually diesel driven. In many older high-rise buildings, the water flow capacity in gallons per minute (gpm) or liters per minute (lpm) is inadequate for the fire potential within the building.

Note: It is important to know what outlet pressure your system produces in order to determine the type of nozzle to use (smooth bore or fog). Typical outlet pressure is approximately 65 pounds per square inch (psi). This pressure would require a smooth-bore tip. Fog nozzles that require 100 psi at the nozzle will produce ineffective streams using 65 psi.

Combination of 1 1/2-Inch and 2 1/2-Inch Class 3 System

A Class 3 standpipe system is a combination of the Class 1 and the Class 2 systems. A Class 3 system may contain a 2 1/2-inch and 1 1/2-inch outlet or may contain a 2 1/2-inch outlet with a 2 1/2-inch to 1 1/2-inch reducer attached to the outlet. This type of system is designed for both fire department and occupant use. Many jurisdictions are attempting to limit the use by building occupants by removing the “houselines” and related appliances.

PRESSURE CONTROL

Because wet standpipe systems must contain sufficient pressure to produce effective hose streams at the topmost floor of the building, the pressure within the standpipes at lower floors must be reduced. This is accomplished by pressure-reducing devices installed at each outlet. These valves are preset to provide the proper outlet pressure for that location. Pressure-reducing valves (PRVs) have the advantage of being able to supply multiple hoselines (within reason) while maintaining the proper pressure and flow rate. These valves control the pressure but can adjust automatically to varying flows depending on the size of the hose and nozzle (or the number of hoselines). PRVs on each floor should be checked for proper operating pressure and flow before the floor is occupied. PRVs are found in new-style buildings.

In place of a valve, there may be orifice plates in the outlet valve barrel. Orifice plates are stainless steel or brass washers with calibrated holes and are designed to handle one line. These holes control the outlet pressure by restricting the flow from the outlet. The plates often are tack-welded into the standpipe valve outlet barrel. The outlet pressure from these devices is not reduced until water is flowing. Orifice plates are found in old-style buildings and some new-style buildings.

Pressure-restricting devices are yet another method of providing proper pressure to standpipe hoselines. They reduce outlet pressure in much the same manner as orifice plates. The pressure-restricting device allows the valve to be opened only a predetermined distance. Firefighters who remove orifice plates or alter the setting of pressure-restricting devices need to be aware that the outlet then will deliver increased pressure from the system. Pressure-restricting devices are found in many old- and new-style buildings.

Two drawbacks to the orifice plate and other pressure-restricting devices are that they:

- have no affect on static pressure; and
- do not allow for multiple hoselines (because of the limited flow that comes through the orifice opening).

If orifice plates are removed to provide for multiple hoselines from an outlet, the pressure to the lines must be controlled at the standpipe valve and care must be taken when opening or closing nozzles.

It is important to become familiar with these standpipe systems. Note their locations and the type of system at hand. During prefire planning, look for problems that might occur if the system is utilized. Ensure that all proper notifications are made if any deficiencies are found.

National Fire Protection Association Standards

National Fire Protection Association (NFPA) 14, *Standard for the Installation of Standpipes and Hose Systems* and NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, were changed after the One Meridian Plaza fire in Philadelphia.

The previous Standards required an outlet pressure of at least 65 psi minimum. NFPA 25 required an acceptance test before the building could be occupied.

The new Standards require a minimum of 100 psi at an outlet or as determined by the authority having jurisdiction (AHJ). The AHJ is your fire department, in most cases. The Standards also require that the pressure regulation devices and their outlet pressure be tested once per year. This is a responsibility of building management. The fire department should simply receive a certification from the contractor who performs the testing.

SPRINKLER SYSTEMS

Sprinkler systems in high-rise buildings now are required by code in virtually every area of the country. However, there are many older high-rise buildings (perhaps some in your jurisdiction) that still do not contain sprinkler systems. Most high-rise buildings, new- or old-style, are not sprinklered today. There is no doubt that sprinkler systems provide the added degree of life safety for newer buildings that is sadly lacking in older, unsprinklered high-rise buildings. In some cases, retroactive legislation, enacted as the result of tragic high-rise fires, has mandated that older high-rise buildings be fully sprinklered. However, these cases are the exception rather than the rule. Prefire or preincident planning inspections should take particular note of sprinkler systems when present, what areas they serve and how they can be supplemented.

SOGs require initial response units to supplement any built-in water supply system in a high-rise building during a fire. To do this effectively, firefighting personnel must be acquainted with the building, water supply system and the location of fire department water supply inlets.

A fire department must have SOGs for connecting to and supplying the high-rise sprinkler system. Officers and pump operators must understand the pressure and flow required to be supplied from the engine(s) supplying the sprinkler system. Current national standards for supplying sprinkler systems (such as NFPA 13E, *Recommended Practice for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems*) should be referenced.

COMMUNICATIONS SYSTEMS

When discussing problems that occur at emergency incidents, communications always seem to be at the top of the list. High-rise fires are no exception. Communication problems can be magnified and their results much more severe than those seen at ground-level incidents. In any type of an emergency, good communication is vital to effective operations — maybe even more so at a high-rise emergency.

It is a known fact that portable fire department communications equipment can be ineffective or even completely unusable in a high-rise. There are locations inside high-rise buildings where it is virtually impossible to transmit or receive messages using portable radios. In some cases, satisfactory communications will cease with the movement of the radio location by only a few feet.

There is a definite correlation between portable radio effectiveness and the frequencies on which they operate. As a rule, radio frequencies in the very high frequency (VHF) band are very ineffective. Those in the ultra high frequency (UHF) band are fairly effective in most situations. Those in the 800-megahertz (MHz) band produce the most consistent, although not perfect, results. It is important to note that any frequency (in any building) may have inherent transmission/reception problems. Evaluate the system during prefire planning to avoid future trouble.

Many new high-rise buildings (and a number of older ones that have been retrofitted) have built-in emergency communications systems. These hard-wired systems have jacks at specific locations on every floor (and in some cases even in elevator cars) that allow fire personnel at different building locations to communicate. Using the system requires plugging into it with a handset or headset. A number of handsets normally are kept on-site. A built-in emergency communications system can be used as a primary communications channel if portable equipment is not functioning properly. It also can be used as a secondary channel to avoid overloading fire department frequencies.

Built-in emergency communications systems are not the same in every high-rise building. Effective use of these systems requires preincident planning by fire department personnel on how the particular system works and how it would be used during an actual emergency.

In the unlikely event of losing radio communication, set up a relay (triangular) communications network.

Here are some forms of communication:

- cellphones;
- stairwell phones;
- radios;
- emergency phone jacks;
- fire control room phone — get that number (hard-wired);
- elevator and elevator lobby phones;
- portable repeaters; and
- runners or face-to-face.

DETECTION AND ALARM SYSTEMS

There are four basic types of detection and alarm systems:

1. Smoke/Heat detectors.
2. Annunciator panels.
3. Manual fire alarm stations.
4. Water flow/Sprinkler.

Smoke/Heat detectors in a high-rise building may or may not be connected to an annunciator panel. It is possible for smoke detectors to be incorporated into the HVAC system and be located in building airshafts. These detectors then may activate fire dampers within the HVAC system. Effective management of a high-rise fire through prefire or preincident planning (obtaining knowledge of these types of building characteristics) is necessary for effective decision making.

It is important to know of the existence/location of any annunciator panel(s) in the building. Annunciator panels are found in both old and new styles of construction. They may be located on a wall at a specific location, or they may be part of the fire control room or station. A full understanding of how to interpret the information given on the panel is critical to effective response.

Manual fire alarm boxes may be located on each floor of a high-rise. Several boxes may be present on each floor. These boxes may be local alarms for the floor, connected to an annunciator panel or connected to the fire control room/station. They are found in both old and new styles of construction.

Water flow/Sprinkler alarms usually will be connected to an annunciator panel, if present. These alarms will sound if water flows either through a wet standpipe or a sprinkler head. An alarm may also sound if there is a surge or diminished pressure in the water supply system. This can occur during an electrical failure.

FIRE CONTROL STATIONS/ROOMS

Most current codes require that newly constructed high-rise buildings contain a fire control room or station within the building. At a minimum, the room should provide

- specific information on alarms that have been activated; and
- status of fire protection systems within the building.

The information available at this location can be extremely useful for determining the exact location of a fire and the status of fire protection systems that may have activated. These rooms or stations frequently have communication systems that allow the transmission of emergency alarms or instructions to building occupants and firefighters.

While a great deal of information is available from a fire control room or station, there are several reasons why it may not be the best place to locate the IC. If the room is on a basement level, then radio communication probably will be difficult. Positioning the IC at the fire control room also may remove that person from face-to-face contact with other officers. In all cases, fire department personnel should be sent to monitor the information available at the fire control room or station and **relay** it to the IC. This relay often can be established by commercial telephone from the fire control room or station to the fire department dispatch office.

As with other systems installed in high-rise buildings, fire control rooms or stations are not all the same. Monitoring the information that is displayed in these locations or accessing the various systems that they contain requires prior knowledge that can be gained only through prefire or preincident planning.

LIFE SAFETY

Upon arrival, initiate occupant control. In newer buildings, use the public-announcement system to control occupant movement.

Large numbers of people can be exposed to potential danger during a high-rise fire. This requires that immediate attention be given to the issue of life safety. The following life safety issues must be taken into consideration by fire personnel when responding to a high-rise fire:

- Inform and initiate occupant control.

- Life safety can be enhanced by timely control of the HVAC system.

- Failure to control smoke movement within the building can put many lives at great risk.

- Evacuation takes time. This must be anticipated by Command Staff and sufficient personnel must be assigned to perform the task.

- Occupant behavior during a high-rise fire is **largely unpredictable**.

- If occupants are going to be evacuated from the building, it is critical that they use stair shafts that are not contaminated with smoke and heat.

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NOTE-TAKING GUIDE

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UNIT 3: HIGH-RISE BUILDING SYSTEMS

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Slide 3-2

TERMINAL OBJECTIVE

The students will be able to identify the various fire behavior problems, high-rise building systems and their impact on strategy, tactics and life safety.

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Slide 3-3

ENABLING OBJECTIVES

The students will:

- **Explain the characteristics of fire behavior and building systems that affect strategy, tactics and life safety.**
- **Identify building systems.**
- **Explain fire department ventilation techniques at high-rise incidents.**

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FIRE BEHAVIOR AND SPREAD

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FIRE EXTENSION ELEMENTS

- **Positive stack effect**
- **Negative stack effect**
- **Stratification**
- **Vertical extension**
- **Core construction effect**
- **Fire loading**
- **Heat buildup**

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POSITIVE STACK EFFECT

"The vertical, natural air movement throughout a high-rise building caused by the difference in the outside and inside air temperatures."

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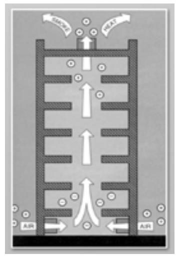
POSITIVE STACK EFFECT (cont'd)

- Cool air enters.
- Warm air is displaced.
- Spreads lower to upper floors.



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POSITIVE STACK EFFECT (cont'd)

The colder the weather and the higher the building, the greater the positive stack effect will be.

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What is negative stack effect and what is its impact on the firefighter?

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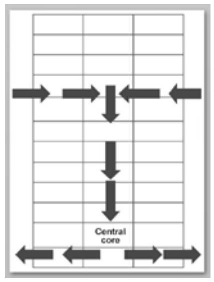
NEGATIVE STACK EFFECT

- $^oF_{outside} > {^oF_{inside}}$
- **Smoke is forced downward.**
- **Smoke settles below fire floor.**



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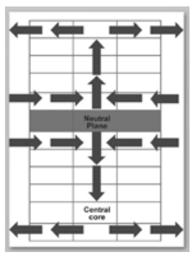
NEUTRAL PLANE

- **Barometric pressure is equal.**
- **Above neutral plane:**
  - **Positive.**
- **Below neutral plane:**
  - **Negative.**



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STRATIFICATION

- **Smoke rises and loses thermal energy.**
- **Loses buoyancy and spreads laterally.**
- **Contains toxic smoke and byproducts.**

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VERTICAL EXTENSION

Three methods

- **Auto exposure (lapping)**
- **Curtain wall**
- **Vertical shaft**

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AUTO EXPOSURE

- **Heat breaks windows.**
- **Fire laps up the outside of the building to the floor above.**

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CURTAIN WALLS

Create a space between building and wall.

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CURTAIN WALLS (cont'd)

- **Supposed to be sealed.**
  - **Many may not be or may fail.**
- **Walls above need to be checked for heat buildup and possible extension.**

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VERTICAL SHAFT EXTENSION

- **Stair shafts**
- **Elevator shafts**
- **Electrical chases**
- **Poke-throughs**
- **Heating, ventilating, and air conditioning (HVAC) supply and return shafts**
- **Mail and trash chutes**
- **Access stairs**
- **Tunnels**

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VERTICAL SHAFT EXTENSION (cont'd)

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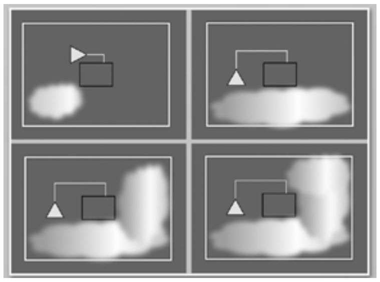
CORE CONSTRUCTION EFFECT



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FIRE LOADING

- Fuel quantity on floors should be identified in preplanning.
- Vacant floors offer the "best" chance at stopping the fire.
- Disparity between the rated fire load and the actual fire load.

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HEAT BUILDUP

- Heat is not easily dissipated from a high-rise.
- Usually because of little or no means to ventilate effectively.
- Takes its toll on firefighters.
- Rehydration is necessary (at Staging/ Rehab).

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ELECTRICAL SYSTEMS

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ELECTRICAL SYSTEM CONSIDERATIONS

- **Can be complex and hazardous.**
- **Demand consideration during fires.**
- **Electrical chases are one cause of vertical fire spread.**

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ELECTRICAL SYSTEM CONSIDERATIONS (cont'd)

- **Components can be found throughout the building.**
- **Should be shut down by the utility company or building engineer.**

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Why is it inadvisable to send personnel into an electrical vault?

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EMERGENCY POWER

- **Usually provided by an engine-driven generator.**
- **Power systems are dictated by codes.**

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EMERGENCY POWER (cont'd)

- **Older building generators may supply only emergency lighting.**
- **Newer building generators may have a large number of fire protection and life safety features.**

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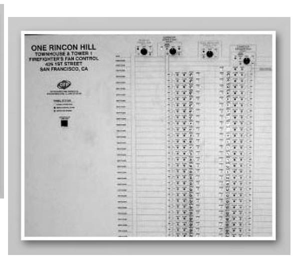
EMERGENCY POWER (cont'd)



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ELEVATORS

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What are some advantages and disadvantages of elevator use?

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ELEVATORS

- Are practical under normal conditions.
- Can become erratic and dangerous under fire conditions.

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ELEVATORS AND LOBBIES

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CONTROL FEATURES

- Floor call buttons
- Electrical contacts
- Electrical elements
- Light-sensitive systems (in car doors)

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CONTROL FEATURES (cont'd)

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CONTROL FEATURES (cont'd)

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Slide 3-36

CONTROL FEATURES (cont'd)

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SAFE USE OF ELEVATORS

Knowledge of the type of elevator and how it works

- **Hydraulic**
- **Traction**
- **Freight**

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SAFE USE OF ELEVATORS (cont'd)

- **Knowledge of maximum number of people allowed into each car.**
- **Familiarity with standard operating guidelines (SOGs) and their use.**
- **Adherence to department policy.**

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SAFE USE OF ELEVATORS (cont'd)

Understanding of possible malfunctions

- **Erratic movement**
- **No control over floor selection**
- **Car moving to fire floor**
- **Car halting**
- **Doors opening independently**

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HOISTWAYS

- **Are vertical shafts in which elevator cars travel.**
- **Multiple elevator cars usually have one hoistway.**

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HOISTWAYS (cont'd)

Low-, medium- and high-rise bank elevators are referred to as "split-bank" elevators.

- **Some serve only lower floors.**
- **Some serve first and higher floors.**
- **Information is critical to decision making.**

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Do split-bank elevators affect fire operations?

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HOISTWAYS (cont'd)

- Separated from each floor by a hoistway door.
- Can permit smoke/heat to pass into the elevator or hoistway.
- Can act like a chimney (if penetrated by fire).
- Can permit heat/smoke to pass to other (nonfire) floors.

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HOISTWAYS (cont'd)

- Cars can burn and separate from cables.
- If fire enters shaft or car, have crews on floors above/below check for extension.
- Top floors will be exposed as heat rises.

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HOISTWAYS (cont'd)

Shunt trip activation
- Elevator stops
- Firefighters trapped

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ELEVATOR EMERGENCY SERVICE

- **Called Firefighter Service Mode.**
- **Will move cars to designated locations.**
- **Activated by the fire alarm system.**
- **Manual recall is done by switches in lobby, fire control room or elevator.**

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FIREFIGHTER SERVICE MODE

- **Reduces occupant entrapment**
- **Access to elevators**
- **Intended for use during fire operations**

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FIREFIGHTER SERVICE MODE (cont'd)

- **Avoid elevators not equipped with this service.**
- **Never take an elevator that serves all floors.**
- **Choose an elevator with a blind shaft.**

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FIREFIGHTER SERVICE MODE (cont'd)

- Must have trained elevator operators.
- These elevators are not necessarily safe.
- Use stairs if the elevator can stop at the fire floor.

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ELEVATORS UNDER FIRE CONDITIONS

- Must be tempered with good judgment.
- Can speed up efforts.
- Can malfunction and take firefighters directly to the fire floor.
- Using stair shaft is the safest method.
- Ride elevator no closer than five floors below the fire floor.
- Prepare to take defensive action.

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Slide 3-51

What departmental procedures can be set for elevator use in high-rises?

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Slide 3-52

ELEVATOR USE

- **Become familiar with elevator before use.**
- **Use stairs whenever possible.**
- **Seek information from installation company on features/use.**

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ELEVATOR USE (cont'd)

- **Train on elevator's use.**
- **Use all appropriate procedures for elevators under fire conditions.**

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What procedures may be used for elevator entrapment?

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LOCKED HOISTWAYS

- Remove the security lock.
- Do not attempt removal if it may cause bending or warping of door.
  – Bending/Warping may cause the car to halt and trap firefighters.
- Go one or more floors down to an unlocked door.

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VENTILATION TECHNIQUES

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VENTILATION TECHNIQUES (cont'd)

- Smoke spread is a significant life hazard.
- High-rise ventilation is a complex issue.
- Consider risks versus benefits.

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FOUR VENTILATION TECHNIQUES

- **Horizontal**
- **Vertical**
- **Mechanical (HVAC or smoke-control systems)**
- **Positive-pressure ventilation**

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INCIDENT COMMANDER CONSIDERATIONS

- **Location of**
  - **Fire/Hazard**
  - **Firefighters**
  - **Occupants**
- **"Stack effect"**
- **Weather/Wind conditions**
- **Falling hazards**
  - **Glass**
  - **Debris**

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HORIZONTAL VENTILATION

Complexities depend on window type:

- **Inoperable windows complicate procedures.**
- **Operable windows used with smoke removal equipment simplify the procedure.**

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HORIZONTAL VENTILATION (cont'd)

- **Old-style construction**
  - **Small, operable windows**
- **New-style construction**
  - **Large plate or tempered glass panels**
- **High-rise residential**
  - **Operable plate glass windows**
  - **Large sliding glass doors**

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TYPES OF WINDOWS

- **Residential high-rises usually have operable windows.**
- **Many apartment buildings have sliding glass doors.**
- **Office building windows usually are inoperable.**
- **Special operable windows may exist (a special tool is required to open them).**

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TYPES OF WINDOW GLASS

- **Plate (used most often)**
  - **Produces large shards when broken**
- **Tempered**
  - **Designated areas**
  - **Special markings**
  - **Shatters in small pieces**

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Slide 3-64

BROKEN GLASS HAZARDS

- **Enter from a safe location.**
- **Protect hoselines, standpipe systems and apparatus.**

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LAPPING

- **Removal of window glass can cause "lapping."**
- **Fire extends to floors above by traveling outside the building.**

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WIND-DRIVEN FIRE

Fire is driven back into the building.

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FIVE CONDITIONS

1. Fire in an apartment
2. Door left open or opened by firefighters
3. Window failure
   – Self-vented
   – Left open by occupant
   – Vented by firefighters
4. Wind
5. Exhaust outlet (area of low pressure)

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VENTURI EFFECT

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What affect does the inability to ventilate a high-rise building have on an operation?

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VERTICAL VENTILATION

- **Uses:**
  - **stairwells;**
  - **bulkheads; and**
  - **vertical shafts.**
- **Elevator shafts not recommended.**
- **Use caution.**

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VERTICAL VENTILATION (cont'd)

- **Maintain constant communication.**
- **Adverse effects can be reversed (sometimes).**

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MECHANICAL VENTILATION

Smoke and its toxic products account for more than 80 percent of fire deaths.

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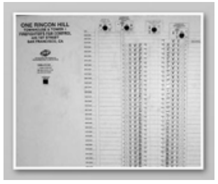
MECHANICAL VENTILATION (cont'd)

- HVAC
- Smoke-control systems



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What forces affect smoke movement in high-rise buildings?

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SMOKE CONTROL (PASSIVE MEASURES)

- Barriers
- Curtains
- Gravity venting
- Smoke-proof towers
- Smoke-removal shafts

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SMOKE CONTROL (ACTIVE MEASURES)

- **Stairway pressurization**
- **Smoke-control systems**
  - **Building**
  - **Zone**
  - **Corridor**
  - **Elevator**
  - **Atrium**

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HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

- **Under fire conditions, can pump heat, smoke and toxins to unaffected areas of the building.**
- **HVAC dampers intended to help control spread of smoke:**
  - **Don't rely heavily on this component.**
  - **May not be in place or may malfunction.**

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SMOKE-CONTROL SYSTEMS

- **Found in new-style construction**
- **Relatively new system**
- **Typically automatic**
- **Prone to fail under fire conditions**

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SMOKE-CONTROL SYSTEMS (cont'd)

- **Areas should be monitored closely.**
- **Shut down immediately during system malfunction.**

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POSITIVE-PRESSURE VENTILATION

- **Smoke removal**
- **Complex operation**
- **Used in prefire and post-fire operations**
- **Pressurize stairwells**

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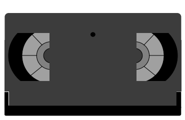
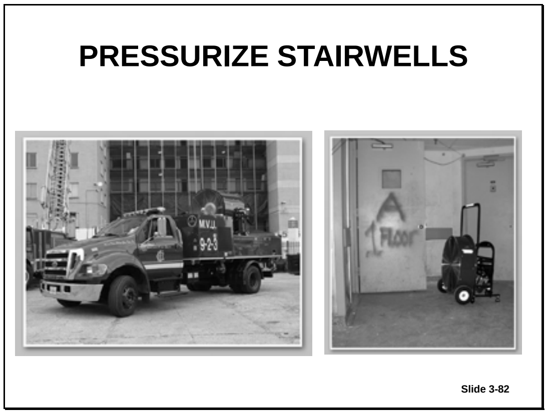
Video: "Positive-Pressure Ventilation"



Slide 3-81

Slide 3-82



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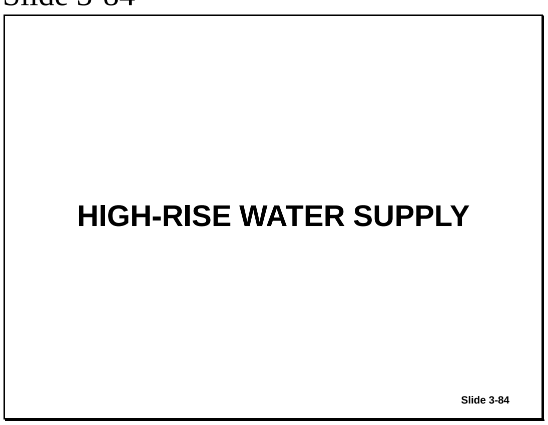

Slide 3-85

HIGH-RISE WATER SUPPLY (cont'd)

Several types of water supply systems are found in high-rise buildings.

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What are the differences between high-rise firefighting water supplies and those of a one- or two-story building fire?

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WATER SUPPLY SYSTEMS

- **1 1/2-inch wet standpipe (old-style)**
- **2 1/2-inch dry standpipe (old-style)**
- **2 1/2-inch wet standpipe (both old- and new-style)**
- **Combination 1 1/2 inch and 2 1/2 inch with reducer**

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KNOWLEDGE OF THE SYSTEM

- **What can be expected under fire conditions?**
- **Vary per building and code.**
- **Specifics of the system (i.e., capacity, functional components).**

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1 1/2-INCH WET STANDPIPE (CLASS 2)

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2 1/2-INCH DRY STANDPIPE (CLASS 1)

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2 1/2-INCH WET STANDPIPE (CLASS 1)

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COMBINATION (CLASS 3)

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PRESSURE CONTROL

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SYSTEM PRESSURE

- **Smooth-bore tip**
- **Low-pressure fog nozzle**

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SYSTEM PRESSURE (cont'd)

- **Typical pressure is approximately 65 pounds per square inch (psi) (smooth bore).**
- **Fog requires 100 psi (produce ineffective streams at 65 psi).**

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ELECTRIC AND DIESEL-POWERED PUMPS

- **May be required to maintain flow and pressure.**
- **Diesel may exist as a backup for failure of electric.**

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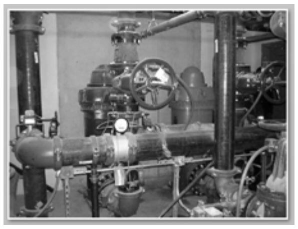
ELECTRIC AND DIESEL-POWERED PUMPS (cont'd)



In older buildings, flow may be insufficient for building's fire potential.

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PRESSURE-REDUCING VALVES

- **Needed to allow effective control of pressure on lower floors**
- **Placed at each outlet in new-style construction**
- **Preset**

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PRESSURE-REDUCING VALVES (cont'd)

- **Can supply multiple hoselines**
- **Need to be checked (each floor) for proper pressure/ flow before the floor is occupied**

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ORIFICE PLATES

- May replace valves
- Found in old- and new-style construction
- Designed to handle one line
- Are stainless steel or brass washers

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Slide 3-101

ORIFICE PLATES (cont'd)

- Have calibrated holes
- Control flow and pressure
- Are tack-welded in place in the outlet barrel
- Do not reduce pressure until water flows

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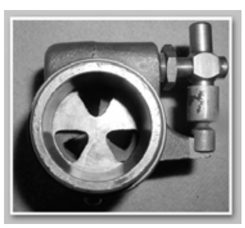
PRESSURE-RESTRICTING DEVICES

- Similar to orifice plates
- Found in old- and new-style construction



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PRESSURE-RESTRICTING DEVICES (cont'd)

- Restrict amount/degree that valve can be opened.
- Increased pressure on hoseline needs to be considered when removed or altered by firefighters.

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DRAWBACKS

- They have no affect on static pressure.
- Do not allow for multiple hoselines.
- Allow full system pressure to valve (when removed).
  – Control flow and pressure at the valve.

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SPRINKLER SYSTEMS

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COMMUNICATIONS

- **Problem at most fires**
  – Can be worse at high-rise fires
- **Necessary for effective control and life safety operations**

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PORTABLE EQUIPMENT

- **Can be ineffective or completely unusable.**
- **Areas present in high-rise structures can prevent reception/transmission of signals.**
- **Frequency used affects communications capability.**

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RADIO COMMUNICATIONS

Radio facts:

- **Very high frequency (VHF) is usually ineffective.**
- **Ultra high frequency (UHF) is fairly effective.**
- **The best results are produced by 800 megahertz (MHz).**

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RADIO COMMUNICATIONS (cont'd)

- **Any frequency (in any building) may have transmission/reception problems.**
- **Frequencies need to be evaluated during preplanning.**

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BUILT-IN SYSTEMS

- **Not always found in old-style**
- **May be hard-wired with jacks**
- **May be in elevator cars**

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BUILT-IN SYSTEMS (cont'd)

- **Should be required by local codes in new buildings.**
- **Sound-powered headsets should be kept at high-rise.**
- **Can be used to reduce load on radio.**

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FORMS OF COMMUNICATION

- Cellphones
- Stairwell phones
- Radios
- Emergency phone jacks
- Fire control room phone
- Elevator lobby
- Elevators
- Portable repeaters
- Runners

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DETECTION AND ALARM SYSTEMS

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DETECTION AND ALARM SYSTEMS (cont'd)

Prefire or preincident planning is necessary for effective decision making.

- Smoke/Heat detector.
- Annunciator panels.
- Manual fire alarm stations.
- Water flow/Sprinkler.

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SMOKE/HEAT DETECTORS

- **May be present in high-rises, depending on local ordinances**
- **May/May not be connected to an annunciator panel**
- **May be part of the HVAC system**
  - **Located in airshafts**

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ANNUNCIATOR PANEL

- **Found in old- and new-style construction, depending on built-in protection**
- **Location of the panel**
- **How to “read” panel**
- **May be located on a wall in a specific area**

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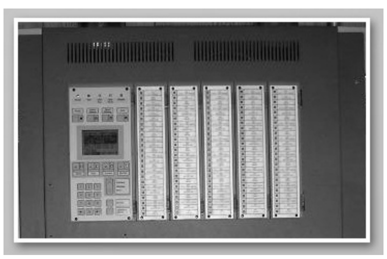
ANNUNCIATOR PANEL (cont’d)



It may be part of the fire control room/station.

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MANUAL FIRE ALARM STATIONS

- **Found in both old- and new-style construction**
- **Consists of "pull boxes" (one or more located on each floor)**
- **May be local alarms for the floor or can be connected to an annunciator panel or fire control room/station**

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WATER FLOW/SPRINKLER

- **Usually connected to an annunciator panel**
- **Fire alarm sounds when**
  - **Water flows from standpipe**
  - **Surge of water pressure**
  - **Low water pressure**

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FIRE CONTROL STATIONS/ ROOMS

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FIRE CONTROL STATIONS/ROOMS (cont'd)

They are generally in newly constructed high-rises.

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FIRE CONTROL STATIONS/ROOMS (cont'd)

- **Should provide a minimum of**
  - **Specific information on alarms activated**
  - **Fire protection systems status**
- **Often have a building communications system to warn building occupants**
- **Various locations**

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FIRE CONTROL STATIONS/ROOMS (cont'd)

In modern high-rises, should provide the locations and activation of
- **Pull stations**
- **Smoke detectors**
- **Thermal detectors**
- **Sprinkler water flow**
- **HVAC and elevator status**
- **Other building systems**

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FIRE CONTROL ROOM STAFFING

- **Should be monitored by a firefighter who relays information to the Incident Commander (IC).**
- **A telephone may be available to contact the Command Post (CP).**
- **Use prefire or preincident planning to determine capabilities.**

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LOCATING THE INCIDENT COMMANDER

- **Do not locate the IC in the fire control room.**
- **This room removes the IC from face-to-face contact with personnel.**
- **May affect radio communications.**

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LIFE SAFETY

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LIFE SAFETY (cont'd)

- **Large numbers of people can be endangered during a high-rise fire.**
- **Inform and initiate occupant control.**
- **Can be enhanced by timely control of the HVAC system.**
- **Failure to control smoke can risk lives.**

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LIFE SAFETY (cont'd)

- **Occupant behavior can be unpredictable.**
- **Evacuations take time.**
- **Assign sufficient personnel.**
- **Designate evacuation and attack stairs.**

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SUMMARY

- **Fire behavior and spread**
- **Electrical systems**
- **Elevators**
- **Ventilation techniques**
- **High-rise water supply**
- **Pressure control**

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SUMMARY (cont'd)

- **Sprinkler systems**
- **Communications systems**
- **Detection and alarm systems**
- **Fire control stations/rooms**
- **Life safety**

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APPENDIX
HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

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INTRODUCTION

Heat, smoke and toxic products of combustion present a significant problem to the operating forces during high-rise fire operations. Evidence shows that these forces cause more than 80 percent of fire deaths.

Because of high-rise building design, it is not easy to expel heat, smoke and toxic combustion products. To complicate matters, most newer high-rise office buildings do not have operable windows; however, many residential type high-rises do have operable windows.

GOALS OF EFFECTIVE HEATING, VENTILATING, AND AIR CONDITIONING MANAGEMENT

The fire department's goals for effective use of a high-rise building's heating, ventilating, and air conditioning (HVAC) system should include the following:

- use the HVAC system to limit the spread of smoke and heat from the origin and into building egress corridors, passageways and exits;
- prevent the HVAC system from intensifying the fire and spreading it beyond the initial area of involvement;
- provide the fire attack crews the greatest assistance in reaching the seat of the fire;
- provide fresh air to occupants who may be trapped within the building, sheltering in place or who are still evacuating the building; and
- prevent the components of the HVAC system from becoming avenues for the spread of smoke throughout the building.

HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

HVAC systems are designed to process and treat air. The HVAC system simultaneously controls the air's temperature, humidity, and cleanliness and distributes it to meet the requirements of the conditioned spaces. Another function is to collect the air from the conditioned spaces and return it for reprocessing and reuse. HVAC systems found in high-rise buildings fall into two categories:

1. Central air conditioning systems (where the processing equipment supplies air to more than one floor).

2. Noncentral air conditioning systems (that supply air only to the floor on which the processing equipment is located).

Central air conditioning systems are most common and create the most problems during a fire.

Before a strategic plan to accomplish the previously stated goals can be developed, the Incident Commander (IC) must understand the components (and configuration of the components) that make up the HVAC system and become familiar with all building systems and controls. HVAC systems are divided into three subsystems:

1. The processing system.

2. The supply system.

3. The return system.

The Processing System

The processing system usually is installed on the floors of the building where the mechanical equipment rooms (MERs) are located. The following equipment for the processing of the air should be found in the MER:

- outside air-supply dampers;
- equipment for heating, cooling, filtering and humidifying the air;
- supply air fans;
- smoke and/or heat detectors within ductwork or plenum;
- ductwork to the supply airshaft;
- ductwork from the return airshaft;
- return air fans;
- exhaust air dampers; and
- mixing dampers.

Figure 3-1 illustrates these items.

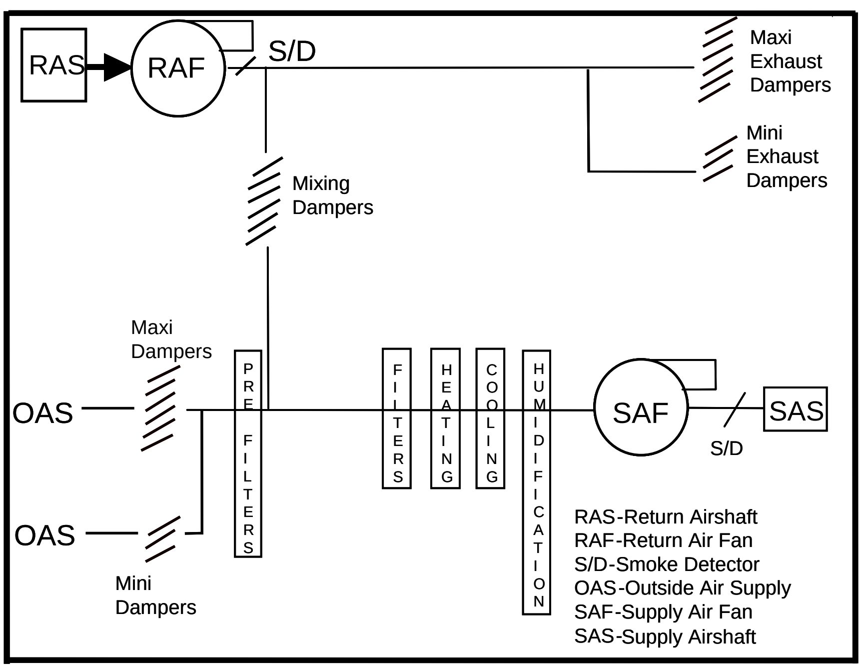

Figure 3-1
Mechanical Equipment Room Air-Processing System Components

The Supply System

Supply system components consist of:

- a supply airshaft;
- fire, smoke, heat or combination dampers;
- supply air ducts; and
- air diffusers.

Fire Dampers

Fire dampers are installed in air-distribution systems in order to maintain the required integrity of a fire-resistive assembly when ducts penetrate fire-rated wall partitions or floors. They are designed to close automatically on detection of heat to restrict the passage of flame and heat.

Smoke Dampers

Smoke dampers are installed in air-distribution systems to control the movement of smoke. They are controlled by an automatic alarm device (usually smoke detectors) and also may be opened manually from a firefighter command station.

Combination Fire/Smoke Dampers

These are designed to solve both functions of a fire and smoke damper when the location lends itself to multiple required functions. For example, a smoke-control system that is part of a building HVAC system that connects to a two-hour rated mechanical shaft.

Figure 3-2 may be used to trace the path of air through the system.

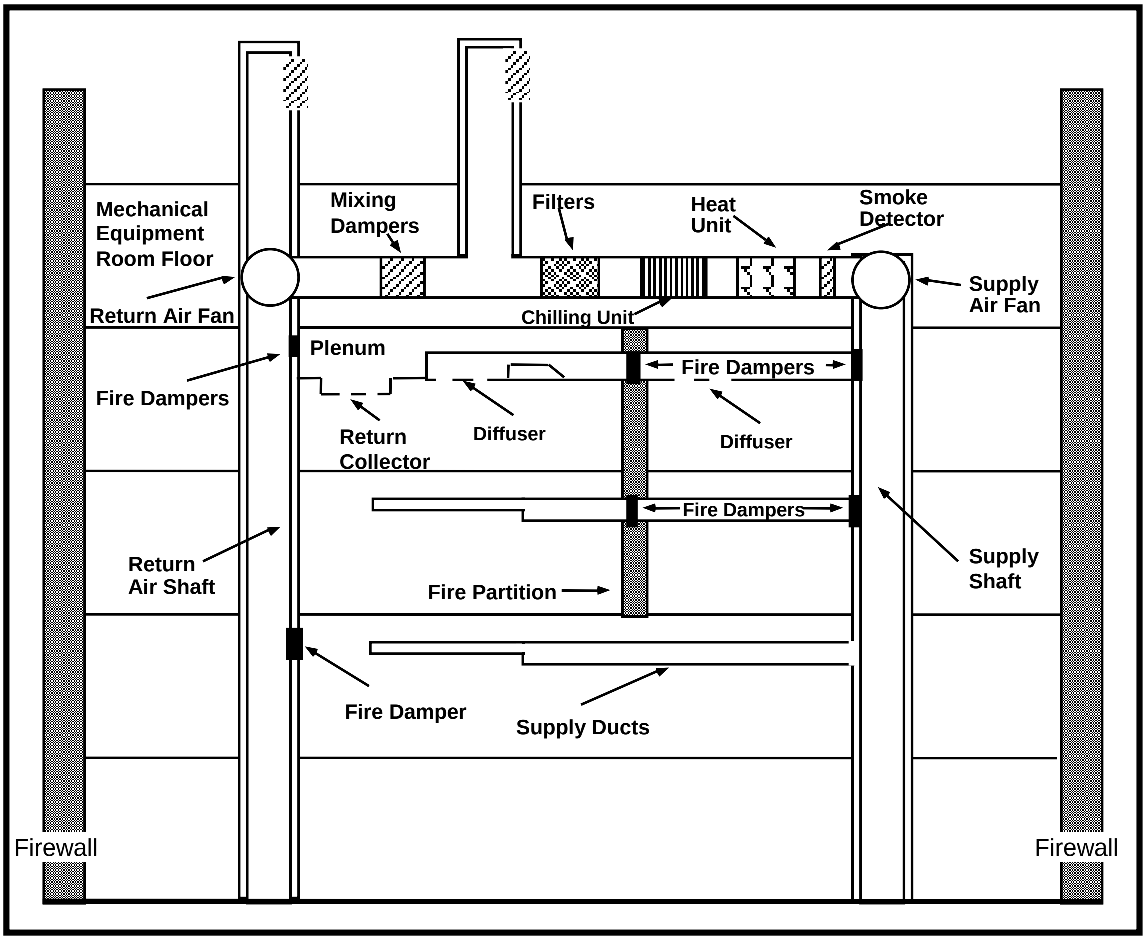

Figure 3-2
Heating, Ventilating, and Air Conditioning System

The Return System

Figure 3-2 also can be used to trace the path of return air from the floors to the MER. The return air system components consist of:

- Return air ductwork and inlets.
- Return air plenums. (A plenum is an air compartment or chamber to which one or more ducts are connected to form a part of an air-distribution system. In high-rise buildings, the space between the suspended ceiling and the underside of the floor above is used as a plenum for the collection of the return air back to a mechanical air-handling shaft.)
- Fire, smoke, heat or combination dampers.
- Smoke detectors located in the air-handling ductwork to shut down the HVAC unit automatically or activate a smoke-control system.

- Return airshaft.

In a typical central air conditioned building, the large volume of air required precludes the use of a **single** HVAC system. A number of HVAC systems usually exist — each supplying a number of floors. The groups are referred to as HVAC system supply zones. Figure 3-3 illustrates a typical zoned system.

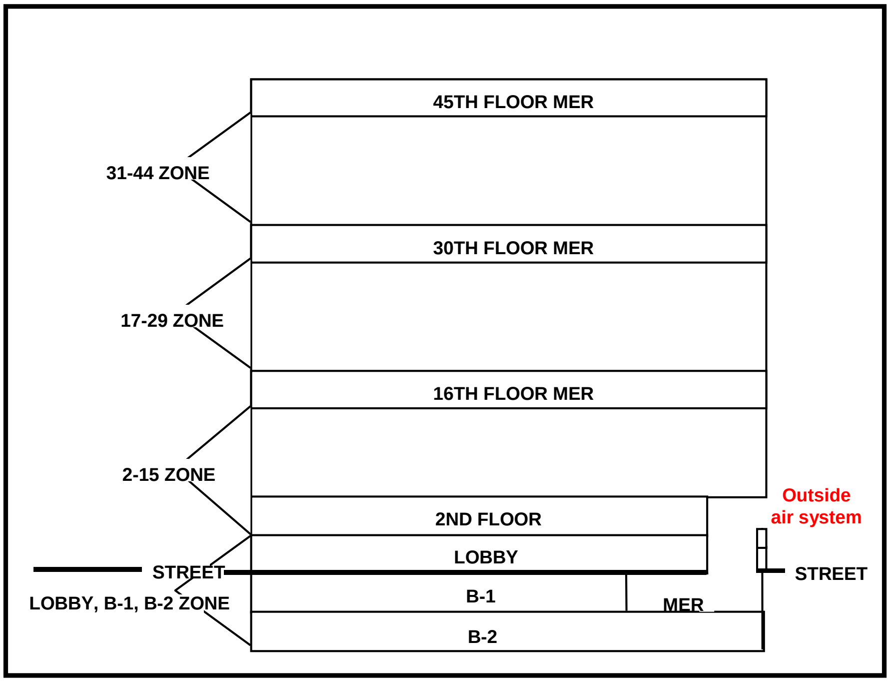

Figure 3-3
Heating, Ventilating, and Air Conditioning Zones

Heating, Ventilating, and Air Conditioning System Air Flow

Normal airflow through an HVAC system follows certain predetermined steps. The following detailed review of the airflow process describes these steps.

Airflow Through Processing Equipment

Refer to Figure 3-4.

1. Air is returned from the occupancy areas of the building for reprocessing via the return airshaft.

2. The return air fan is used to assist movement of air in the return airshaft to the MER.

3. Air from the return air fan then flows through the mixing dampers.

4. The air then is mixed with a set percentage of outside air. The amount depends on the outside air temperature and humidity. This can be controlled manually (by the engineer on duty) or automatically (by local or computerized controls).

5. The mixed air then is processed by flowing through filters, heating/cooling equipment and (optional) humidification apparatus.

6. The supply air fan assists the movement of air into and through the supply airshaft to the occupancy areas.

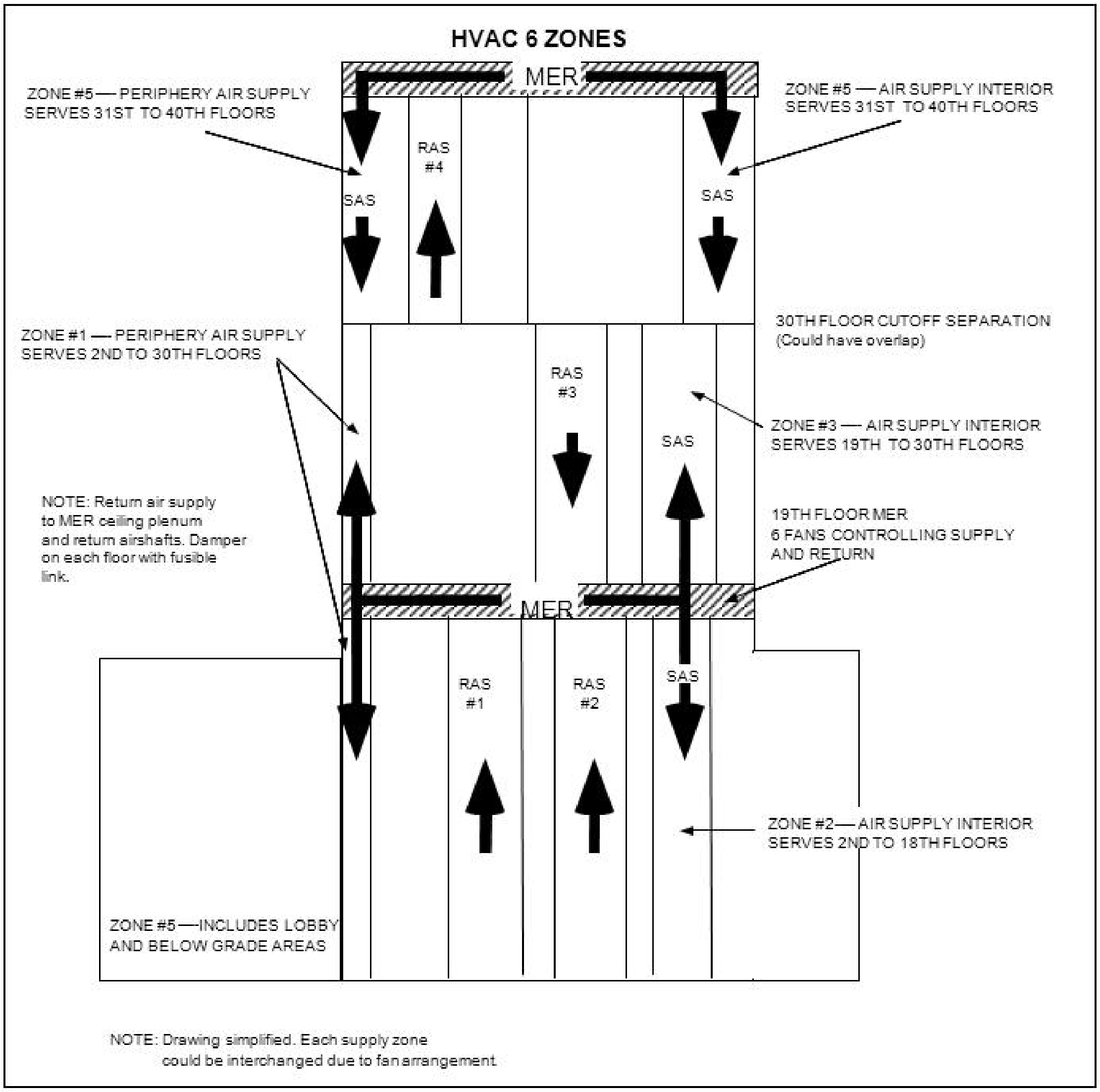

Figure 3-4
Six Heating, Ventilating, and Air Conditioning Zones

Airflow Through the Supply System

Refer back to Figure 3-2.

1. Air is distributed to all floors via the supply airshaft.

2. Air from the supply airshaft is distributed throughout the floor by ducts. The ducts are located in the plenum.

3. Fire dampers will be found where ducts meet the supply airshaft and, in most instances, wherever ducts pass through a rated fire partition.

4. Air from the supply ducts is distributed to the occupied areas by air diffusers mounted in the ceiling or by air grills located in the walls.

Airflow Through the Return System

Refer back to Figure 3-2.

1. Air from the occupied areas flows through the return collectors into the plenum or ductwork.

2. The air flows through the plenum or ductwork to the return airshaft. (The return air may or may not be ducted.)

3. Fire dampers will be found where the air enters the return airshaft and wherever the air flows through a fire-rated partition. If the building has a smoke-control system, smoke or combination dampers will be found.

4. Some used air is vented outside. The remaining air then is mixed with a set percentage of outside air. The amount is dependent upon outside air temperature and humidity. This can be controlled manually (by the engineer on duty) or automatically (by local or computerized controls). The air then is returned to the processing equipment via the return airshaft.

Note: Smoke detectors may be found in some systems where the air enters the return airshaft. These smoke detectors will shut down the dampers when smoke is detected or automatically operate the smoke control system.

HEATING, VENTILATING, AND AIR CONDITIONING STRATEGIC OPERATING PLAN

The HVAC strategic operating plan is a detailed written document composed for a specific building. The document delineates where and how to shut off various elements of the HVAC system.

The IC at a high-rise fire should establish a liaison with the building engineer **early** in the incident and obtain information necessary to construct the plan. This information will determine

- the location of the MER floors and the zones that they serve;
- if there are any special HVAC systems (theaters, public assembly spaces, restaurants, computer rooms, etc.) in the building;
- if there is a central control of the HVAC system and where it is located;
- the number of return airshafts (and their locations);
- if the return airshafts are common to more than one HVAC zone;
- if each floor's supply and return dampers are centrally controlled;
- if the building has a smoke-control system;
- if the supply air exhaust can be put into 100 percent air intake and the return air exhaust be put into 100 percent exhaust; and
- if there is a periphery air supply system and, if one exists, how it is zoned. (These are explained in more detail in the Other Considerations section.)

Now that you have a functional knowledge of the HVAC system, we can develop a strategy/plan to achieve the goals that were stated previously. The following tactical operations shall be taken in the following sequence.

WARNING
It is critical that the following tactical operations only be considered if the fire officer has a high degree of technical knowledge and training on the mechanical system in the specific building. Use the building engineer, as necessary, for the technical data.

Phase 1 (Upon Arrival)

- Determine the status of the HVAC systems in the building. Any system that has not been shut down automatically should be shut down manually. This should include both supply and return fans. In some systems, the smoke detector system will shut down **only the supply fans** and allow the return fans to continue to run. The return fans also must be shut down manually if they don't discharge 100 percent to the outside.

- Before any further action can be taken with the HVAC system, the floor where the fire is located must be determined accurately.

- All HVAC systems in the building should be placed in the nonrecirculating mode (with 100-percent exhaust) if possible, by:

  - opening all outside air supply dampers,
  - closing all mixing dampers, and
  - opening all exhaust dampers.

- After the fire floor has been determined accurately, all HVAC zones that do not include the fire area should have their supply fans activated. This will supply fresh outside air to these zones. It will pressurize these zones and limit the spread of smoke, if the return air is not operating.

WARNING
Whenever any of the HVAC systems are reactivated, all companies shall be alerted to report any adverse effects. If the activation of the HVAC system creates worsening fire conditions, the system should be shut down immediately.

Phase 2

Upon completion of Phase 1, the IC should consider the use of return fans to exhaust the fire floor. However, before a decision can be made, the IC must have accurate knowledge of conditions on the fire floor. The IC must know:

- The exact location of the fire on the fire floor and the intensity in nonsprinklered buildings.

- The location of the return airshaft (or shafts) and whether they can handle temperatures that exceed 250 to 300 F (121 to 148.8 C).

- IC must be aware of locations of operating companies and people sheltered in place.

Note: When the heat is above 165 F (73.8 C) in the shafts, fire dampers may operate shutting off the airflow.

- The location of the stairway from which operating forces are making their attack on the fire.

Once the IC has this information, he or she must evaluate the following:

- Will the use of the return fans intensify or spread the fire?

- Will the use of the return fans pull the fire toward or away from the operating forces?

- Will the temperature reaching the fire dampers cause them to close (above 165 F)?

The IC may choose to use return fans to exhaust the fire floor if:

- Their use will not intensify or spread the fire or smoke.

- They will pull the fire or smoke away from the operating forces.

- Their use will not cause the fire dampers to close.

Before the IC can implement Phase 2, operating forces on the fire floor should be alerted and backed out to the fire stairs. When the IC is assured that this has been accomplished, the building engineer should turn on the return fans for the zone that is serving the fire floor. The operating forces on the fire floor should be alert to report any adverse effects. When conditions on the fire floor have stabilized, the operating forces should re-establish their attack on the fire. The building engineer will remain at the controls and be in contact with the IC. A firefighter with a portable radio should be assigned to the building engineer to facilitate this communication. If the building has a smoke-control system, a firefighter will be needed at the smoke-control system panel.

The IC must be aware that if the temperature of the air reaching the entrance to the return airshaft exceeds the setting of the fusible link on the fire dampers, the fire dampers will close, negating the exhausting of the fire floor and creating a negative effect on the other floors in this HVAC zone. This will increase the spread of smoke to these floors. The IC also must be aware that any smoke detector control of dampers in the return air system will require bypassing to enable the return fans to run and exhaust the smoke from the fire floor. If the HVAC or fire alarm system does not have easy-to-use controls to accomplish the override, consult a building engineer to provide assistance.

OTHER CONSIDERATIONS

There are a number of methods to shut down the HVAC system automatically in the event that fire conditions are present. The system is shut down upon detection of a fire by some type of smoke- or heat-actuated detection device. These devices include smoke detectors or other approved heat-activated devices. These devices are located where they will be readily affected by smoke or an abnormal rise in the temperature in the duct.

Activation of any of the devices stops the supply air into, and the return air from, the affected floor. Manual operation may be accomplished either by shutting down the supply fans and the return fans serving the affected floor or by activating approved remote-controlled reversible smoke dampers on the fire floor. Fusible links commonly are used to close fire dampers. Smoke dampers usually are used to shut down fans; however, they also may be used to control smoke dampers.

Fusible links for fire dampers should have a temperature rating that is 50 F (10 C) above the maximum temperature that normally would be encountered within the system. Once a fire damper has closed, it must be opened manually before any air can pass through the opening it is protecting. Supply and return fans that have been shut down by the activation of a smoke detector cannot be reactivated until the smoke detector has been cleared or bypassed.

High-rise buildings constructed within the last 15 years may be equipped with a smoke-control system that incorporates the components of the building HVAC system. These types of systems are designed to operate automatically in the control of the spread of smoke in the building. When these systems are installed, they use automatic smoke dampers that are interconnected with the building smoke detection system. A manual for the smoke-control system should be kept within the building fire command center. These controls require a high degree of knowledge and understanding before anyone should attempt to use them in other than the automatic mode of operation.

Temperature variations that occur in the periphery of the building, due to weather changes and movement of the sun, require supplementary treatment of the air.

- Air supply may be from the main supply shaft, from a separate periphery supply shaft or from the floor in the vicinity of the periphery of the building.

- Air supply to the periphery is treated locally or centrally to suit the needs of the periphery. Piping containing heated or chilled water is used sometimes to treat this air locally (as in the case of a fan coil or an induction system). The air then is discharged into the periphery of the building.

- Air that is supplied to the periphery from the main supply shaft is ducted through the plenum of the floor below. This air then travels, via bonfire-rated flexible connectors, from the ducts to the air treatment equipment on the floor that is being served. Fire experience has shown that fire entering the plenum can extend from one floor to another via failure of these flexible connectors or, if these connectors are not properly fire-stopped, via the space that was left around them.

- Peripheral air is returned to the MER via the normal air return system.

Due to the many variations that may be found in HVAC systems, fire officers should consult with the building engineer during the preparation of the prefire plan for the building. They should gather information as described above and conduct simulations of fire problems to preplan the handling of the HVAC system. This procedure not only will familiarize the building engineer with the functions that would be required during a fire but also will allow fire officers the opportunity to become familiar with the configurations, abilities and limitations of the HVAC systems in their response district. The fire officer needs to visit buildings under construction during the installation of the HVAC and during operational acceptance tests of the mechanical system.

UNIT 4:
STRATEGY AND TACTICS

TERMINAL OBJECTIVE

The students will be able to identify strategic and tactical operations and resource needs for high-rise firefighting.

ENABLING OBJECTIVES

The students will:

1. *Identify the high-rise fire standard operating guidelines (SOGs).*
2. *Describe primary assignments for engine and truck company operations.*
3. *Identify life safety considerations involving evacuation procedures, rapid intervention, responder rehabilitation, and personnel accountability.*

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HIGH-RISE FIREFIGHTING CONCERNS

Firefighting concerns in high-rise buildings are more complex than those in smaller structures. Firefighters should keep safety and crew accountability in mind during high-rise incidents. The safety of occupants and confining the fire are paramount. These two missions are accomplished with controlled occupant movement, diligent search and rescue operations, and aggressive fire attack. Extinguishing high-rise fires requires aggressive firefighters advancing 2 1/2-inch handlines.

High-rise fires are extremely labor-intensive and provide many obstacles that prevent rapid extinguishment. Strategic and tactical considerations for fighting high-rise office building fires must be proactive. Because of the operational problems involved in controlling a vertically extending fire, containment on the floor of origin must be the main objective.

Empirical evidence reveals that flashover can occur in as few as two minutes, though the standard for many years has been 10 minutes. The contents of buildings are frequently made of synthetic materials which burn much more quickly. The loss of elevators typically occurs about 20 minutes into the operation. The cause of elevator failure is hoseline runoff water that enters the elevator shafts and shorts out the electrical contacts. Water usage at serious high-rise fires will result in elevator loss more than 90 percent of the time.

If possible, enough resources to handle the incident should be on scene within the first 20 minutes. Significant high-rise fires require a minimum of three handlines. When necessary, the presence of three handlines allows parallel lines on the fire floor and a line on the floor above to cover extension.

Fire environment, fire floor location, building construction, unreliable water supply, and firefighters who are inexperienced with high-rise fires dramatically increase operational problems in high-rise buildings. The fire environment is severely affected by:

- slab construction;
- heavy, sealed windows;
- intense heat and smoke production;
- limited means of ventilation; and
- fire load.

The height of the fire area requires the fire service to rely on unreliable means of transportation during firefighting operations. Firefighters are at the mercy of elevators and face the probability that elevators will not operate properly during fire operations. The task of multifloor ascent via stairwells slows operations down considerably.

STANDARD OPERATING GUIDELINES

The following are suggested basic standard operating guidelines (SOGs) that may be used at a high-rise fire. These strategies are listed in order of importance.

Locate the Fire and Consider Rescue Problems

Determine the fire floor location(s) as rapidly as possible. All future actions hinge on this vital piece of information. Determine the specific fire floor (if possible) or the floors on which smoke is reported from information available to you in the building lobby. Frequently (especially during off-business hours) specific fire floor information will not be available. You may receive only a report of smoke on numerous floors (e.g., 20th to 35th floors). Verify fire floor information received from responsible occupant/building management personnel, fire control, and the alarm display panel.

Simultaneously (or as Soon as Possible) Begin the Process of Controlling Evacuation

Use all building communication systems to immediately institute occupant control. This may be difficult as occupants of numerous floors may have initiated self-evacuation. This often can cause a mob scene or near panic in stair shafts or lobby areas. Also, due to large floor areas or maze-like corridors, fire floor occupants may be unaware of the fire until it is too late to evacuate. Therefore, a search of all large areas always is required. As soon as possible, search and evacuate the floor above the fire. Always check conditions on the building's top floor (due to possible smoke travel). Take measures to control the lobby.

Gain Control of Building Systems

These systems include

- elevators;
- heating, ventilating, and air conditioning (HVAC) systems;
- communications equipment;
- fire pumps; and
- fire control systems.

Confine and Extinguish the Fire

Experience indicates that any serious fire will require a large commitment of personnel and equipment. This is due to **extensive** logistical problems and the need for frequent relief of personnel. Proper placement of hose streams will facilitate fire control and rescue of occupants. Companies must be knowledgeable regarding high-rise buildings in their districts. Engine companies that are aware of the location of standpipe-equipped stairwells will accelerate procedures required to place water on the fire.

Severe fire conditions may overwhelm resources and delay entry to the fire floor. **This situation will occur even when two handlines are operating.** Critical decisions will have to be made by the Incident Commander (IC) when the fire is beyond the control of initial attack methods. The following options are available for consideration:

- Operate interior master-stream appliance into the fire area from the stairwell or vestibule/hallway on the fire floor.

- Flood the floor above the fire floor with hoselines operating from the stairwell. (**Note:** This procedure will be ineffective on hidden fire, and it takes water away from fire attack.)

- Operate exterior master-stream appliance if within reach of an aerial device.

- Operate exterior master-stream appliance from an exposure building or a built-in setback on the fire building.

Deploy Lines on the Floor Above the Fire to Control Extension

The number of personnel and hoselines needed to accomplish this will vary depending on the size of the building and the severity of fire conditions.

ENGINE COMPANY OPERATIONS

The variables and complexities built into high-rise buildings may be compounded by the fire location and fire load within the floor's tenant space. Due to this fact, pairing of engine companies must be considered. Companies operating in tandem will facilitate effective hoseline management.

Many fires will be within easy reach of hose streams operating from the immediate stairway enclosure area. Other fires may require extending hoselines, using rolled-up lengths.

When firefighters are able to determine the particular section of a floor where the fire is located, they should attack the fire from the unburned side. The fire should be pushed toward the side that has burned already. This may not always be possible. Initial stairwell selection, pressurized stairwell, standpipe location, and occupant evacuation all may prevent the ideal stairwell selection. Firefighter and occupant safety are the most important considerations when selecting which stairwell from which to attack the fire. A hoseline from the standpipe outlet on the floor below the fire must be stretched to attack the fire. This is so firefighters are able to protect the stairs and control the water supply should they have to abandon the fire floor.

Always ensure the first hoseline has been stretched properly and has begun to advance toward the seat of the fire prior to stretching a backup hoseline. Severe fire, heat and smoke conditions may stop the advance of a single hoseline. When two handlines operating from the same stairwell are necessary, the second line should always hook up **below** the fire floor. Many Class 3 standpipe systems are equipped with two outlets, a 2 1/2-inch outlet for fire department use and a 1 1/2-inch outlet for occupant use. By using the 1 1/2-inch to 2 1/2-inch increaser, and attaching it to the 1 1/2-inch outlet, you have created a second 2 1/2-inch outlet. Generally on most Class 3 systems, the same diameter riser supplies both the 2 1/2-inch and 1 1/2-inch outlets. Therefore an adequate water supply exists to supply both lines. If this situation does not exist, the second hoseline must be stretched from the same stairwell, two floors below the fire floor. Hooking up the second hoseline from the standpipe outlet on the fire floor is never recommended.[1]

When there is a large area of uncontrolled fire, evacuation is complete, and life safety is assured completely, ascertain if the building has more than one standpipe riser. Buildings with two or more standpipe risers increase operational capabilities and provide additional security for operating forces and occupants. The initial commitment of engine companies in two separate standpipe-equipped stairwells will allow

- the engine company in the best position to commence aggressive fire attack;
- two handlines to be operated;
- increased stream coverage on the fire floor;
- prevention of the fire wrapping around the core;
- the ability to maintain the integrity of both stairwells (to protect companies operating above the fire);
- increased fire attack options and flanking movements; and
- the availability of standby line (to attack fire extension on the floor above).

Coordination of handlines is critical if a two-prong attack is necessary. Care must be taken to prevent an opposing or “dueling handline” scenario where each crew is working against the other. This situation is counterproductive and dangerous. **Operating lines must never oppose each other.**

The high pressure required to supply water to the upper floors of a high-rise building limits the amount of water that a fire department pumper can supply. A good “rule of thumb” is to have a separate pumper supply the standpipe system for each handline in operation.

Engine companies also can be used to set up Base, Lobby, Staging or Ground Support.

TRUCK COMPANY OPERATIONS

Whether or not a fire department has sufficient truck companies to assign to these jobs, sufficient trained personnel must be dedicated by the IC/Operations for these tasks.

Truck companies normally are assigned the following responsibilities at a high-rise fire:

- Determine attack stairs.

[1] McGrail, Dave. *Firefighting Operations in High-Rise and Standpipe Equipped Buildings.* Pennwell Publications, 2007, p. 174.

- Determine the best stairway to be used by occupants for evacuation (and advise IC/ Operations).

- Determine the number of stairways serving the fire floor (and the floor above).

- Determine the life hazard on the fire floor and initiate evacuation procedures where required.

- Conduct a primary search of the fire floor and the floor above.

- Provide support to the advancing engine company by removing obstructions, forcing entry, and opening the ceiling to expose plenum.

- Proceed to the floor above the fire using stairways other than those designated as attack stairways.

- Examine the floor above the fire, and report the following information to the IC/Operations:

  - heat and smoke buildup;
  - status of evacuation;
  - any extension of fire; and
  - the presence of stairs (down to fire floor or upward to floor above the fire floor).

- Examine all stairways for occupants and smoke conditions, starting with attack stairwell. Stairwell searches should begin at the top and work down.

- Remove all occupants from the attack stairway. (Occupants should be moved to a safe area above or below the fire floor. Future use of the stairway by other occupants should be prevented.)

- Upon arrival at the top floor, the officer will report the following conditions to the IC/Operations:

  - smoke and heat conditions in the area and stairways;
  - the presence of building occupants;
  - the existence and identification of all stairways and elevator shafts; and
  - all means available for ventilation, especially over the stairways using bulkhead doors, or other vertical shafts which penetrate the roof.

- Quickly check the roof and relay any pertinent information to the IC/Operations (occupants on the roof, proper operation of smoke towers, etc.):

  - any unusual conditions;
  - fire or occupants seen at windows; and
  - remain on the roof to monitor and report changes.

Sending personnel into a stair shaft for access to the roof (or anywhere above the fire) is a high-risk operation. A prefire plan is necessary for this action so that Command Officers always know exactly where each stair shaft terminates. If the upper termination point is not known by the officer directing companies into the stair shaft, the result may be serious injury or death of company personnel. Personnel entering a stair shaft (to reach these upper floors or roof) always should carry an extra self-contained breathing apparatus (SCBA) bottle. Personnel ascending stair shafts also should be aware of the "point of no return" (which usually is dictated by the amount of air remaining in their SCBA).

Roof responsibilities and general guidelines for truck companies consist of:

- adhering to the guideline that roof ventilation **should not** be performed unless ordered by IC/Operations;
- conducting a primary search of the roof area (as assigned);
- moving roof occupants to a safe area (or assuring occupants that they are safe to remain where they are); and
- remaining in the roof area to monitor and report changing conditions until otherwise ordered by IC/Operations.

Truck companies may be used to perform fire attack or relief for engine companies. All functions must be assigned to on-scene personnel, regardless of the status of truck companies in a community. Truck companies also can be used to set up Base, Lobby, Staging or Ground Support.

EVACUATION

The most effective means of saving lives and facilitating rescue is a quick, aggressive attack on the fire supported by ventilation. It is critical to life safety that we control the fire and its toxic products of combustion. The simple closing of doors or positive-pressure ventilation can be very effective tactics.

The initial attack companies should designate an attack stairwell for use by operating companies and that information should be relayed to the IC. Access to the fire floor by operating companies should be done by this stairwell. Smoke will enter the stairwell during the attack operations. This phenomenon should be expected; measures taken to ventilate the stairwell should be monitored for adverse affects. Fire attack may have to be delayed until the attack stairwell is controlled and all occupants have exited.

Occupants may be relocated within the structure. This action must be coordinated with rescue, evacuation, fire attack and ventilation crews. One stairwell should be dedicated to occupant traffic: it is called the "evacuation stairs." You may be able to use the building communication system to direct occupants to the evacuation stairs (if the building is so equipped). It is best to pressurize the evacuation stairs with fire department fans to keep smoke out of the stairwell when necessary.

A high-rise may house many thousands of people. Because of this, there are several reasons for relocating people within the building (versus taking them outside of the structure).

- Removal may take hours.
- Stairways are not designed for the load.
- People can get hurt.
- Promote more efficient operations (keeping people out of the way helps the firefighter perform his or her task).

A safe area of refuge for the relocation of occupants, in most cases, can be secured by clearing five floors above and five floors below the fire floor. There are obvious exceptions to this rule, and each fire must be analyzed correctly by those in charge. If further evacuation is necessary, coordinate with the building evacuation plan and fire department resources.

Often, evacuation is already underway when the first fire department unit arrives on scene. Our ability to control the fire and ensure the safety of building occupants is dependent upon our control of the stair shafts. You should take action with sufficient resources to gain control of self-evacuation as soon as possible after arrival.

The procedure and process for evacuation:

- Beginning at the second floor, attempt to control existing occupants.
- The IC should be notified immediately if firefighters cannot gain control of a stairwell due to self-evacuation of occupants.
- In order to gain control, the IC may elect to have an evacuation group initiate a top down search of the stairwell. This top-down method may be effective in establishing stair shaft control.
- Once firefighters control evacuation stairwells:
    - Occupants should be removed first from the fire floor and from the two floors above the fire and relocated five floors above the fire floor.
    - Occupants five floors below the fire floor should be directed to remain where they are.
    - Firefighters should be assigned to each floor that houses occupants (to prevent occupants from re-entering the stairwell).
    - Firefighters should continue to reassure occupants of their safety and our need to control their actions.
- In the event that large numbers need to be evacuated, the IC should consider requesting additional resources, including Emergency Medical Services (EMS).

RAPID INTERVENTION CREWS

A Rapid Intervention Crew (RIC) must be designated per the recommendation of National Fire Protection Association (NFPA) 1500, *Standard on Fire Department Occupational Safety and Health Program* (required by Occupational Safety and Health Administration (OSHA) states). The IC/Operations Chief must identify the level of risk to which personnel will be exposed. A high level of risk requires a greater commitment of rapid intervention for rescue of emergency personnel. Risk may be increased by the nature of the task (e.g., working above the fire floor). More than one RIC may be necessary at a high-rise incident. RICs **often** are placed at Staging, stairwells of the fire floor, or floor below the fire. They would be under the direction of the IC, the Operations Section Chief (OSC), or RIC supervisor.

The composition and placement of an RIC is normally agency-specific. It is important that each agency have SOGs for the RIC at high-rise incidents. Guidelines should contain evacuation signals. Remember: Air horn warnings do not work for high-rise operations (consider a radio signal or tone). The guidelines should address firefighter and other responder evacuation and relocation procedures (away from the danger area). Your department should develop consistent guidelines for RICs in cooperation with mutual-aid companies that may respond to your high-rise incidents.

An RIC is composed of a minimum of two fully equipped personnel (with appropriate clothing, SCBAs, portable radios, and the necessary tools to be effective). A high-rise RIC should have a minimum of four personnel as soon as it can be assembled. It is recommended that an RIC supervisor be assigned (battalion or chief officer). The RIC should monitor the tactical channel to gain an understanding of the operation in general.

Do not confuse RICs with the minimum crew size (two-in/two-out in some states). It must be a separate entity for interior operations. RICs must be in place when crews are operating in the Immediately Dangerous to Life and Health (IDLH) atmosphere.

RESPONDER REHABILITATION

Responder rehabilitation (Rehab) is required at any working incident or fire. Rehab is a critical factor in the prevention of heat injury. Part of the Rehab process is providing water and electrolytes to personnel. Food also should be provided when operations exceed three hours.

The “two air bottle rule” (or a maximum of 45 minutes of work time) is the recommended time to expend before rehabilitating personnel. Rest at Rehab should be for a minimum of 10 minutes; however, some personnel may require an hour or more before being ready to re-enter the tactical operations. When crews are released from Rehab by the Rehab Manager, they should report directly to Staging for reassignment as needed.

Medical services must be provided at Rehab. The heart rate should be monitored early in the rest period. Monitoring should be performed by qualified personnel for 30 seconds early in the period. If the rate is above 100 beats per minute, the individual’s temperature should be taken. If the temperature is above 100.6 F (38.1 C), he or she must not be permitted to wear protective equipment. Once the heart rate and body temperature return to normal, a medical decision (on whether to return to tactical activities) needs to be made. Note that these are general guidelines. You may wish to establish protocol specific to your jurisdiction.

Crews should enter and leave Rehab as a unit. There also should be a check-in/check-out sheet that is managed by the Rehab Manager. Rehab usually is located one floor below Staging and is under the supervision of the Medical Unit (in the Logistics Section).

PERSONNEL ACCOUNTABILITY

All officers are responsible for the welfare and accountability of their personnel. Common elements of a personnel accountability system include

- a directive requiring the use of the system;
- hardware (nametags or other identifying equipment);
- control of tags/identification equipment at point of entry;
- accountability of officers;
- benchmarks for required roll calls throughout the operational period;
- a plan for reacting to lost or missing personnel; and
- use of RICs.

Accountability at a high-rise incident is more difficult to accomplish. Due to the large number of resources and the high relief rate, accountability must be done at more than one location. At the Command Post (CP), the Resource Unit Leader will not be able to maintain a **full** account of all personnel and their exact location at all times during the operation. The best information that this position can be expected to provide to the CP is what companies were dispatched and which have arrived on location.

Staging, Responder Rehab, and Base must keep track of personnel in their respective areas. This requires the use of check-in/check-out sheets. Each division and group supervisor must have a full account of companies assigned to them and where their companies are working.

The OSC's aide must have a general account of all companies operating on the fire floor and the floors above. (A list of all companies presently operating is the best that can be expected.)

The Personnel Accountability Report (PAR) should be requested by the IC at periodic intervals. A PAR can be conducted face-to-face or via radio. When a PAR is done too often, it will interfere with the ability to pass critical information along to the various units of the organization. This is due to the amount of radio traffic required to complete a PAR. However, a PAR performed too infrequently increases the probability that companies and personnel will become separated from their supervisors, and no one will be aware of this.

SAFETY CONSIDERATIONS

Safety is a major responsibility of all personnel at an incident scene. Risk/Benefit analysis is a task that must be performed by all personnel, including individual firefighters, the IC, and Safety Officer(s). The following methodology (referred to as lookouts, communications, escape routes, and safety zones (LCES)) is valuable for addressing important safety issue areas at an incident:

- **Lookouts**: Know where the fire is, where it is going, and what areas are dangerous.

- **Communications**: Know who is operating above, below and adjacent to you and what their functions are. Be able to communicate with them.

- **Escape routes**: Know more than one way out of your area and operating site.

- **Safety zones**: Know where to go for safe refuge.

NOTE-TAKING GUIDE

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NOTE-TAKING GUIDE

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UNIT 4:
STRATEGY AND TACTICS

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TERMINAL OBJECTIVE

The students will be able to identify strategic and tactical operations and resource needs for high-rise firefighting.

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ENABLING OBJECTIVES

The students will:

- **Identify the high-rise fire standard operating guidelines (SOGs).**
- **Describe primary assignments for engine and truck company operations.**
- **Identify life safety considerations involving evacuation procedures, rapid intervention, responder rehabilitation, and personnel accountability.**

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HIGH-RISE FIREFIGHTING CONCERNS

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HIGH-RISE FIREFIGHTING CONCERNS (cont'd)

- **Firefighter safety and accountability is of concern.**
- **Occupant safety and fire confinement are paramount.**
- **Diligent search and rescue of occupants.**
- **Aggressive fire attack on fire floor.**
- **Extinguishing requires use of 2 1/2-inch lines (preferred).**

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HIGH-RISE FIREFIGHTING CONCERNS (cont'd)

- **Operations are extremely labor-intensive.**
- **Operations must be proactive.**
- **Primary objective — attack fire floor.**
- **Sufficient resources need to be on the scene as soon as possible.**

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FLASHOVER

Flashover can occur in two minutes.

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ELEVATORS

Are lost:
- **In approximately 20 minutes**
- **Due to water runoff entering electrical contacts**
- **In 90 percent of all fires**

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SIGNIFICANT HIGH-RISE FIRES

Require a minimum of three handlines:
- **Two on the fire floor**
- **One on the floor above**

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OPERATIONAL PROBLEMS

- Fire environment
- Fire floor location
- Building construction
- Unreliable water supply
- Inexperience with high-rise fires

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FIRE ENVIRONMENT

- Slab construction
- Heavy, sealed windows
- Intense heat and smoke
- Limited ventilation
- Fire load

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FIREFIGHTER TRANSPORTATION

- Elevators likely to fail
- Use of stair ascent for tools and equipment slows operations

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STANDARD OPERATING GUIDELINES

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STANDARD OPERATING GUIDELINES (cont'd)

Locate the fire and consider rescue problems

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LOCATE THE FIRE

- **Determine fire floor location.**
- **Determine specific floor(s) involved as soon as possible.**
- **Gather information.**

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LOCATE THE FIRE (cont'd)

Verify specific floor information from occupants and the alarm display panel.

- **Floor**
- **Observations**
- **Smoke**
- **Occupants**

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LOCATE THE FIRE: EXAMPLE

"Fire extension on third floor north wall…"

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STANDARD OPERATING GUIDELINES (cont'd)

Simultaneously (or as soon as possible) begin the process of controlling evacuation

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CONTROLLING EVACUATION

- **Occupants may have self-initiated evacuation.**
- **Building layout may prevent occupants from escaping.**
- **A search of large areas will be necessary.**

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CONTROLLING EVACUATION (cont'd)

- **Search and evacuate the floor above the fire floor.**
- **Check conditions on the building's top floor.**
- **Control lobby.**
- **Use all building communications systems immediately to institute occupant control.**

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STANDARD OPERATING GUIDELINES (cont'd)

Gain control of building systems

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What building systems do you need to gain control of during a fire situation and why?

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STANDARD OPERATING GUIDELINES (cont'd)

Confine and extinguish the fire

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CONFINEMENT/ EXTINGUISHMENT

- **Large number of personnel and equipment needed.**
- **Logistical problems may exist.**
- **Fire confinement will facilitate occupants' rescue.**
- **Knowledge of districts' buildings.**

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CONFINEMENT/ EXTINGUISHMENT (cont'd)

- **Awareness of standpipe locations is necessary.**
- **Severe fire conditions may overwhelm resources.**
- **Severe fire conditions will occur (even with two hose streams).**
- **When fire is beyond control of initial attack, critical decisions need to be made.**

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SEVERE FIRE CONDITIONS

- **Operate interior master-stream appliance into the fire area.**
- **Flood the floor above fire floor.**

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SEVERE FIRE CONDITIONS (cont'd)

Exterior master-stream appliance:
- **Aerial device**
- **Exposure building**
- **Built-in setback**

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STANDARD OPERATING GUIDELINES (cont'd)

SOG #5

Deploy lines on the floor above the fire to control extension.

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CONTROLLING EXTENSION

Number of personnel and hoselines needed will vary depending on:
- **Size of building**
- **Severity of fire conditions**

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ENGINE COMPANY OPERATIONS

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ENGINE COMPANY OPERATIONS (cont'd)

Variables and complexities compounded by:
- **Fire location**
- **Fire load within tenant space**

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ENGINE COMPANY OPERATIONS (cont'd)

- **Consider pairing of engine companies:**
  – **Facilitate effective hose management.**
- **Many fires will be within easy reach from the immediate stairway.**

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ENGINE COMPANY OPERATIONS (cont'd)

- **Attack fire from the unburned side toward the burned.**
- **Push fire back toward what has burned already.**
- **Stretch the hoseline from the floor below the fire.**

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ENGINE COMPANY OPERATIONS (cont'd)

Severe fire, heat and smoke may stop the advance of a single hoseline.
- **Connect a second hoseline from the floor below.**
- **Second hoseline from the fire floor is never recommended.**
- **Attack in tandem.**

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ENGINE COMPANY OPERATIONS (cont'd)

Class 3 standpipes:
- **Two outlets**
- **Use increaser**

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ENGINE COMPANY OPERATIONS (cont'd)

If the building is not equipped with a Class 3 standpipe:
- **Stretch hoseline from two floors below the fire floor.**
- **Hooking a second hoseline from the fire floor is never recommended (McGrail, 2007).**

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ENGINE COMPANY OPERATIONS (cont'd)

If there is a large area of uncontrolled fire, use two standpipes to:

- **Increase operational capability on the fire floor**
- **Provide additional safety and security**

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ENGINE COMPANY OPERATIONS (cont'd)

Committing companies in two separate standpipe stairwells allows:

- **Best positioned company to make aggressive attack**
- **Operation of two handlines**
- **Increased stream coverage**
- **Prevention of fire from wrapping around core**

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ENGINE COMPANY OPERATIONS (cont'd)

- **Maintained stairwell integrity**
- **Increased fire attack options and flanking movements**
- **Availability of standby lines to attack fire extension on the floor above**

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ENGINE COMPANY OPERATIONS (cont'd)

Coordinate handlines for two-prong attack:
- **Take care to prevent opposing or "dueling handlines."**
- **This is counterproductive and dangerous.**

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ENGINE COMPANY OPERATIONS (cont'd)

- **High pressure required to supply water to upper floors limits the amount of water available.**
- **Engine companies also can be used to set up Base, Lobby, Staging and Ground Support.**

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TRUCK COMPANY OPERATIONS

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ON-SCENE PERSONNEL

Whether or not there are sufficient truck companies in a community, these previous functions must be assigned to on-scene personnel.

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TRUCK COMPANY RESPONSIBILITIES

- **Determine the following:**
  - **Attack stairs.**
  - **Best stairway to be used by occupants for evacuation.**
  - **Advise Incident Commander (IC)/Operations.**
  - **Number of stairways serving the fire floor (and the floors above) and life hazard on the fire floor.**
- **Initiate evacuation procedures where required.**

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TRUCK COMPANY RESPONSIBILITIES (cont'd)

- **Conduct primary search of the fire floor and the floor above.**
- **Provide support to advancing engine company:**
  - **Remove obstructions.**
  - **Force entry.**
  - **Open the ceiling to expose plenum.**

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TRUCK COMPANY RESPONSIBILITIES (cont'd)

- **Examine floor above the fire.**
- **Report to IC/Operations:**
  - **Heat/Smoke buildup.**
  - **Status of evacuation.**
  - **Any extension of the fire.**
  - **Presence of stairs (down to fire floor or upward to floor above).**

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TRUCK COMPANY RESPONSIBILITIES (cont'd)

- **Examine all stairways for occupants and smoke conditions.**
- **Remove all occupants from attack stairway:**
  - **Relocate to safe area above/below fire floor.**
  - **Prevent future use.**

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TRUCK COMPANY RESPONSIBILITIES (cont'd)

At the top floor, the officer will report to the IC/Operations:

- **Smoke and heat conditions in the area and stairways**
- **Presence of building occupants**
- **Existence and identification of all stairways and elevator shafts**
- **Any means for ventilation**

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TRUCK COMPANY RESPONSIBILITIES (cont'd)

Conduct primary search of roof and report to the IC/Operations:

- **Any unusual conditions.**
- **Proper operations of smoke towers.**
- **Fire or occupants seen at visible windows.**
- **Remain on the roof to monitor and report changes.**

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ASCENDING STAIRS

- **High-risk operation**
- **Prefire plan**
- **Stair termination point**
- **Extra self-contained breathing apparatus (SCBA)**
- **"Point of no return"**

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Once on the roof, what information do you think the officer should report to the IC/Operations?

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ROOF RESPONSIBILITIES/ GUIDELINES

- **Do not undertake roof ventilation unless ordered by IC/Operations.**
- **Conduct primary search of roof area.**
- **Move any roof occupants to safe area.**
- **Remain in the roof area to monitor and report changing conditions until ordered off the roof by IC/Operations.**

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TRUCK COMPANY OPERATIONS

Truck companies may be used for:

- **Fire attack**
- **Relief for engine companies**
- **Must be assigned to on-scene personnel**

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TRUCK COMPANY OPERATIONS (cont'd)

Truck companies may be used to set up:

- **Base**
- **Lobby**
- **Staging**
- **Ground Support**

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EVACUATION

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FIRE ATTACK

- **Most effective means of saving lives and facilitating rescue.**
- **Quick and aggressive with effective ventilation.**
- **Confine the fire and products of combustion:**
  - **Simply closing doors is effective.**
  - **Positive pressure ventilation also may be helpful.**

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USING STAIRWELL FOR ATTACK

- **Access fire floor via designated stairwell.**
- **Smoke will enter the stairwell during fire attack operations.**
- **May be delayed until stairwell is controlled after occupants have exited.**

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RELOCATION OF OCCUPANTS

- **Must be coordinated with rescue, evacuation, fire attack and ventilation crews.**
- **One stairwell should be dedicated to occupant traffic — evacuation stairs.**
- **Use the building communication system (if available).**
- **Pressurize all evacuation stairwells with fire department fans.**

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What is the rationale for defending occupants in place during a high-rise fire (in lieu of moving everyone from the building)?

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SAFE REFUGE

- **This area is at least five floors above or below the fire floor.**
- **Sufficient safety/fire department access can be secured by clearing five floors.**
- **Coordinate with building evacuation plan and resources if further evacuation is needed.**

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SELF-EVACUATION

- **Often underway when first engine arrives on scene.**
- **Controlling the fire and maintaining occupant safety depends on stairwell control.**
- **Gain control of occupants as soon as possible.**
- **Direct occupants to designated evacuation stairs or safe areas.**

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EVACUATION PROCEDURE AND PROCESS

- **Begin at the second floor.**
- **Attempt to control occupants:**
  - **Advise IC if control cannot be gained over a stair shaft.**
  - **May elect to have an evacuation group delivered to the roof.**
  - **Initiate a top-down search.**
- **Group would then work its way down.**

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EVACUATION PROCEDURE AND PROCESS (cont'd)

If control can be assumed:

- **Occupants five floors below the fire should be directed to remain where they are.**
- **Occupants from the fire floor and two floors above and below should be removed first.**
- **Firefighters should be assigned to each floor that houses occupants. Their purpose is to prevent occupants from re-entering the stair shaft.**

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EVACUATION PROCEDURE AND PROCESS (cont'd)

- **Reassure occupants of their safety and of our need to control their actions.**
- **If large numbers need to be evacuated, the IC should consider requesting additional resources (i.e., Emergency Medical Services (EMS)).**

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RAPID INTERVENTION CREWS

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RAPID INTERVENTION CREWS (cont'd)

- **Rapid Intervention Crews (RICs):**
  – Recommended by the National Fire Protection Association (NFPA).
  – Required by Occupational Safety and Health Administration (OSHA) states.
- **Often agency-specific.**
- **Develop guidelines for RICs in cooperation with mutual-aid companies.**

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ASSESS RISK

Identify risks of the activities in which personnel must be engaged.

- **High level of risk requires greater commitment of rapid intervention for rescue of emergency personnel.**
- **Risk may be increased by the nature of the task (e.g., working above the fire floor).**
- **More than one RIC may be necessary at a high-rise incident.**

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WRITTEN GUIDELINES

RIC written guidelines should exist for each agency.

- **Contain evacuation signals.**
- **Address firefighter and other responder evacuation and relocation procedures.**
- **Consistent with mutual-aid companies.**

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Where would the most effective location be for an RIC during a high-rise fire?

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COMPOSITION OF A RAPID INTERVENTION CREW

- **A minimum of two fully equipped personnel is necessary.**
- **A high-rise RIC should have a minimum of four personnel.**
- **RIC should monitor the tactical channel.**

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COMPOSITION OF A RAPID INTERVENTION CREW (cont'd)

Do not confuse RIC with minimum crew size for interior operations (two-in/two-out).

- **RIC and minimum crew size for interior operations are distinct and separate.**
- **An RIC must be in place when crews are operating in the Immediately Dangerous to Life and Health (IDLH) atmosphere.**

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RESPONDER REHABILITATION

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RESPONDER REHABILITATION (cont'd)

- Required at any working incident or fire.
- Is a critical factor in prevention of heat injury.
- Food also should be provided when operations exceed three hours.

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RESPONDER REHABILITATION (cont'd)

- "Two air bottle rule" should be followed.
- Rest should be for a minimum of 10 minutes.
- Companies released from Rehab should report to Staging.
- Crew must be released from Rehab by the Rehab Manager.

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MEDICAL SERVICES FACTS

- Heart rate should be monitored for 30 seconds early in the rest period. If rate is above 100 beats per minute, take the temperature.
- Temperature also should be monitored.
- Crews shall enter and leave Rehab as a unit.
- Rehab usually is located below Staging and is under the supervision of the Medical Unit (in the Logistics Section).

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PERSONNEL ACCOUNTABILITY

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COMMON ELEMENTS OF A PERSONNEL ACCOUNTABILITY SYSTEM

- A directive
- Hardware
- Control of tags at point of entry
- Accountability officers
- Benchmarks for required roll calls
- Plan for lost/missing personnel
- Use of RICs

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PERSONNEL ACCOUNTABILITY

- Must be performed at more than one location.
- Command Post (CP) will track companies dispatched and on scene.
- Staging, Rehab and Base must track in their respective areas.

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SAFETY CONSIDERATIONS (cont'd)

- **Safety is a major responsibility of all personnel at an incident scene.**
- **Incident risk/benefit analysis must be performed by all personnel.**

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LCES

- **Lookouts**
- **Communications**
- **Escape routes**
- **Safety zones**

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SUMMARY

- **High-rise firefighting concerns**
- **SOGs**
- **Engine company operations**
- **Truck company operations**
- **Evacuation**

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SUMMARY (cont'd)

- **RIC**
- **Responder rehabilitation**
- **Personnel accountability**
- **Safety considerations**

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UNIT 5:
BASIC ORGANIZATIONAL APPROACH

TERMINAL OBJECTIVE

The students will be able to identify roles and responsibilities for Command and Control procedures for major high-rise operations and hazards.

ENABLING OBJECTIVES

The students will:

1. *List time and distance factors.*
2. *Explain the need for Staging.*
3. *Explain necessary logistical functions of Base, Lobby Control, Ground Support, Communications and Systems.*
4. *Identify first-alarm capabilities and the Incident Command System (ICS) organization.*

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INTRODUCTION

The purpose of this unit is to relate the basic organizational approach taken toward high-rise firefighting using the framework of the Incident Command System (ICS). The information in this unit provides the firefighter with a clearer understanding of how to organize a command system specifically for a high-rise incident. There must be a high-rise operational plan.

HIGH-RISE INCIDENT COMMAND SYSTEM SUPPORT FUNCTIONS

The ICS is used to manage resources at a high-rise incident. While a high-rise incident may seem to pose the same problems as those that appear in one- or two-story buildings, there are certain aspects of the building's configuration that affect the ICS.

The location of Staging and the need for special functions within the ICS are factors that are unique to high-rise structures.

Time and Distance Factors

Time factors play an important role in control operations at high-rise fires. At any fire, time is needed to transform orders into actions. At a high-rise fire, the time factor becomes a much more critical element. Being reactive and waiting for things to happen before requesting additional resources (or before moving on-scene resources close to the fire area) can be disastrous for Command Officers.

The adverse effects of "wasting" too much time can be reduced greatly by placing personnel and equipment in the Staging Area (normally two floors below the fire) quickly. Being proactive is the key. Anticipate what may happen, and move resources before the need arises. It is important to realize that it takes longer to perform critical tactical operations during a high-rise fire. The heat of a high-rise fire is physically draining; rehydration rehabilitation is critical.

Staging

In the initial phases of an incident, Staging reports to the Incident Commander (IC). If (and when) Operations is staffed, Staging reports directly to the Operations Section Chief (OSC). Figure 5-1, How Staging Reports, illustrates this chain of command.

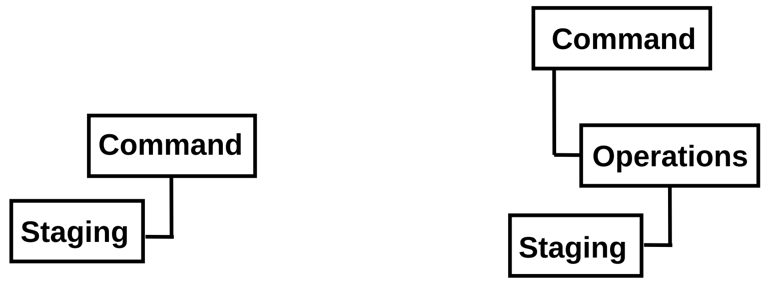


Figure 5-1
How Staging Reports

The purpose of Staging is twofold. It is a designated area to pool and deploy personnel and equipment in proximity to the incident quickly. It also is established to manage and control the flow of personnel and equipment to the upper portions of the building. Staging also can provide previously assigned companies with an area for rehabilitation, equipment exchange, and medical care.

Staging should be a priority at all working high-rise incidents. It is recommended that a company from the first-alarm assignment be used to set up Staging. The Staging Area Manager and personnel assigned this responsibility must ascend by a safe route. Some fire departments have preassigned companies to establish Staging. However, company availability or staffing constraints may not allow the preassigned company to establish Staging. When this occurs, the IC shall assure that the responsibility for Staging is reassigned to another company.

Normally, Staging is located two floors below the fire floor to minimize the time/distance factor. The location may be altered based on floor arrangement or incident conditions. Staging shall be the primary point for all fire department personnel who enter/leave the fire area. Staging is also the assembly point where a reserve of personnel and equipment is maintained awaiting deployment within the building.

The Staging Area Manager reports to the IC or Operations Chief (when staffed) and verifies the location of the Staging Area. The Staging Area Manager maintains separate stockpiles of reserve and expended equipment as well as a reserve force at a level specified by the IC/Operations. A medical treatment station shall be established in Staging to provide medical treatment/ rehabilitation care for incident personnel. Resources are dispatched from Staging at the direction of the IC/Operations. Any time reserves fall below the specified level, additional resources are requested by the Staging Area Manager.

Functions of Staging

A minimum of two functions will be performed by the Staging Area Manager when implementing Staging during a high-rise incident:

1. Verify location of Staging with the IC/Operations.

2. Maintain a complete and accurate record of resources for personnel accountability.

After the above minimum requirements are met, the following issues also must be considered

- Staging personnel must control stairwell access and prevent arriving companies from bypassing Staging.

- Establish effective communications with the IC/Operations to coordinate personnel deployment and communicate with the Logistics Section, Lobby Control, and Base to coordinate equipment movement. Ideally, a separate radio frequency should be used for communications between IC/Operations and Logistics/Base. Cellular phones or regular telephones may be used as an alternative to radios.

- Plan the layout of the Staging Area. Use signs taped to walls or write directly on walls to identify specific areas. Consider using open storage rooms for fire department equipment. Control reserve and rehabbing personnel in separate areas.

- Maintain a separate stockpile of reserve and expended equipment. Expended equipment should be placed well apart from ready equipment, preferably at the opposite end of the established Staging Area. Equipment ready for use should be placed in areas closest to stairwells ascending to the fire floor.

- Develop an equipment inventory and order specific quantities from Logistics/Base. Record what equipment was ordered, the time it was ordered, and the time it was delivered. Equipment that is typically stockpiled in Staging includes

  - Self-contained breathing apparatus (SCBA) air cylinders;
  - Firehose and fittings;
  - Forcible entry tools;
  - Ladders;
  - Resuscitators;
  - Complete SCBA;
  - Smoke ejectors/fans;
  - Salvage equipment;
  - Medical supplies;
  - Flashlights/Batteries;
  - Radios; and
  - Water.

Additional companies directed to Staging should bring priority equipment from Base/Lobby. **No one should come to Staging empty-handed.**

Staging also must make arrangements to take care of the physical needs of firefighters who will be located in the area. A medical treatment area should be established to handle firefighter injuries and to observe and evaluate personnel. If space and level of activity dictate, a medical treatment area may be located one floor below Staging. Locate and open restrooms for firefighter use. Secure liquids for firefighters who are in Staging. If available, consider using five-gallon drinking water bottles on the Staging floor.

The building's lighting system should be used to illuminate Staging as long as possible. Once this becomes impossible, consider the use of portable generators on the floor below Staging. Extension cords then may be run to the Staging floor. An ample supply of flashlights with spare batteries should be available in the event that other lighting systems fail. Flashlights will probably be in high demand by firefighters operating on or above the fire floor.

The Staging Area Manager must anticipate future needs and request appropriate resources at all times. All requests for additional personnel for Staging shall be made through the IC/Operations. It may help the Staging Area Manager to operate from a Staging Responsibility Check-off Sheet for smoother operations.

In many jurisdictions, the term Staging Area as it is applied to structure fires is used to describe a location one or two blocks from the fire scene where apparatus and equipment are located in a state of readiness for tactical deployment. **In a high-rise firefighting operation**, the term "Staging Area" is applied to a floor where personnel and equipment pools are (typically) located. This area is usually two floors below the lowest fire floor. The organizational structure is expanded to include an incident base to facilitate the parking of apparatus, consolidation of equipment, and logistical support.

INITIAL FIRST-ALARM COMMITMENT

The commitment of initial alarm resources dispatched to a reported high-rise fire is critical. Recognize the potential for life loss and the need to have adequate resources on the scene quickly. Most departments increase the number of resources dispatched to a high-rise fire (compared with those sent to other types of structure incidents).

Most fire departments do not dispatch enough first-alarm resources to handle the full potential of a large-scale high-rise fire. First-alarm responses typically are based on the number of resources required to handle immediate work. Resource needs must take into account the number of personnel needed to perform the following operations — Attack, Lobby Control, Staging, Base — commonly referred to as ALSBASE. Additional support will be needed to handle Ground Support, Systems, etc. The need to relieve and/or rehab personnel assigned to tactical operations frequently also must be considered. A large number of personnel will be needed at the time of dispatch to handle a minor high-rise fire.

First-alarm resources should be sufficient to:

- provide prompt investigation and location of the reported fire;
- start an initial fire attack;
- sustain an effective fire attack; and
- handle any immediate support functions required to ensure the safety of building occupants.

The number of resources dispatched on the first alarm should be standard, regardless of how the alarm is received. This ensures that a planned course of action can be followed by Command Officers at the incident scene.

If the first-arriving company has any indication that a working fire is in progress, an immediate request should be made for additional resources. This early call for help minimizes the lead time needed by second-due companies to get to the scene and into operational positions. These additional resources should be directed to report to Base. Base should be located relatively close to the incident. However, hazards (such as falling glass) should preclude it from ever being positioned any closer than 200 feet from the involved building. The Base location must be identified and communicated to Dispatch. If preliminary investigation indicates that these additional resources are not needed, they can be returned to available status from the incident scene or while en route.

RESOURCE REQUIREMENTS AT A WORKING HIGH-RISE FIRE

The following **example** reviews how to estimate companies needed at a working high-rise fire. **This information is offered as a guideline only.** The actual number of companies needed by a specific department will depend on company staffing and training levels. This example illustrates the need for:

- sufficient first-alarm resources on dispatch to the initial report of a high-rise fire; and
- a prompt request for additional help when a working fire actually is encountered.

This example uses **four-person staffing** on each unit. You should adjust the number of your companies to match (approximately) the number of response personnel required. It is important to remember that when working high-rise incidents, the **number of personnel** is the critical point, **not** the number of fire department apparatus. Individual departmental standard operating guidelines (SOGs) will dictate your tactics.

The hypothetical fire situation used to illustrate the need for additional first-alarm resources includes the following factors:

- The fire is on the 12th floor.
- Potential exists for fire extension to the 13th floor.
- The elevators cannot be used.
- Ventilation problems exist on two floors.
- Rescue/Evacuation procedures will be needed.

Basic Functional Organization

12th floor fire attack	3 companies
13th floor	1 company
Lobby Control and Base	1 company (divided)
Staging (10th floor)	1 company (initial Rapid Intervention Crew (RIC))
Total basic commitment	**6 companies**

The fire attack and support resources total six companies. This response totals 24 personnel and a chief. It is recommended that your first-alarm response be similar in numbers of personnel.

Additional resources called (on recognition of a working fire) may be used as follows:

Rescue/Evacuation	2 companies
Ventilation	1 company
Ground Support	1 company
Total resources for basic working fire	**10 companies**

There are seven companies assigned to fire attack, extension control, ventilation, and rescue/evacuation. Three companies are starting to set up the support operations at Base, Lobby Control, Ground Support, and Staging.

Using this example for a moderate fire in a high-rise building with potential extension problems, a minimum of 10 four-person firefighting companies is required. Ten companies provide the minimum resource to allow an attack on the fire and initiate the needed support functions. Additional chief officers, resources permitting, should be dispatched to staff Command functions. If the fire were to be prolonged and three companies for each working hoseline were used, a commitment of 18 or more companies would be needed to provide a sustained attack on the fire and perform the needed support functions.

Based on response patterns of fire departments that have experience with high-rise fires, it generally is agreed that a **minimum of 50 personnel** will be required to handle a relatively small working fire in a high-rise. These departments place at least this many personnel on scene with the arrival of the:

- first-alarm assignment (24 or more personnel); and
- first call for assistance when an indication of a fire in the building is recognized (24 or more personnel plus additional chief officers).

Departments with limited resources **must** have working mutual- or automatic-aid agreements. In addition, they must train with their mutual- or automatic-aid companies for high-rise operations. They must also have equipment compatibility.

The Relief Cycle

The objective of the relief cycle is to maintain a constant application of water on the fire. It is based on the use of three companies for each handline placed in service. One company operates the handline, one company is at the stair shaft landing, and one company is at the Staging Area.

- The company at the stair shaft landing moves into position on the hoseline. This occurs early enough to ensure that the company being relieved has enough air to exit the floor and return to Staging safely.

- The company being relieved returns to Staging to change air cylinders and take a brief rest.

- The third company in the relief cycle (that had been waiting in Staging) moves up to the stair shaft landing. This company relieves the company on the hoseline at the appropriate time.

The coordination of the relief cycle should be the responsibility of the tactical-level management unit supervisor. The Staging Area Manager must be informed of the relief cycle and must have companies ready to provide relief at needed times. IC/Operations is accountable for deployment and tracking of all resources. The Staging Area Manager shall maintain a complete and accurate record of resource status for personnel accountability.

Air Cylinders

Operating in the hostile and humid environment of a high-rise fire will mean that time actually spent attacking the fire will be extremely limited. A 30-minute breathing apparatus cylinder typically is usable for only 15 minutes of work (depending on the skill and physical condition of the individual). Normally, it takes the firefighter two or three minutes both to reach and to exit the fire area. This means that 10 minutes **may be the maximum** time spent actually suppressing the fire.

The relatively short time that can be spent in actually fighting the fire and the debilitating effects of an extremely hot and humid environment are reasons why large numbers of personnel must be committed to suppression activities. The number of times that firefighters can change cylinders and return to firefighting is limited. In most cases, after firefighters have used two SCBA cylinders, they should be assigned to a rehab area in Staging for a brief rest before returning to tactical activities.

FIRST-ARRIVING UNIT RESPONSIBILITIES

In order to successfully achieve the goals set forth by the ICS, the first-arriving companies at the scene of an incident must create the foundation that supports the successful stabilization of the event. This includes the initial scene size-up and assessment, information gathering, and the assignment of initial duties and responsibilities. The initiation of such procedures in the first minutes of the incident is critical. Equally important is ensuring that the aforementioned actions that have taken place, and initial information obtained, is passed on to the first-arriving Chief Officer to successfully complete the transfer of Command and prepare the new commander for the next level of Incident Command operations.

There are certain tasks required of the first-arriving units at a high-rise incident. No single company should go above the main floor/lobby or grade entrance to make the initial investigation. If the first-arriving unit is an engine company, they should wait for the arrival of the second unit, preferably a truck company, before ascending. In jurisdictions where the arrival of a truck company may be delayed, and both companies ascending are engines, the second engine must include the proper forcible entry tools necessary to begin the investigation.

At a minimum, the first company should carry out the following tasks:

- Perform an initial size-up/radio report — rapidly evaluate the situation. There are a number of considerations that the first-arriving Company Officer (CO) should keep in mind when doing the initial size-up. Do not be fooled by a lack of visible fire conditions outside the building upon arrival. It is possible to have a working fire and not see anything from outside the building.

  Obviously, if smoke and/or fire is showing from the building, additional resources should be requested immediately. However, there are other indicators that may signal a fire condition within the building. Fire alarm system annunciator panels in the building will indicate if (and which) smoke alarms or water flow alarms have been tripped. However, annunciator panels are not 100 percent reliable in terms of verifying location/existence of fire (proceed with caution). Elevators that have returned to ground level because of a fire alarm activation are another clue that indicates problems. Finally, information from building personnel or occupants (indicating that there is fire or smoke in the building) is usually a reliable method of determining that a fire exists and that additional resources may be required.

- Give an additional radio report of visible conditions. This report includes, at a minimum, the following information:

  - building size;
  - occupancy type;
  - obvious conditions (working fire and what levels are involved);
  - safety concerns (e.g., falling glass/debris);
  - actions being taken;

- assume and announce Command (for example, “Captain Engine 1 is Wilshire Command”); and
- request additional resources.

Figure 5-2, Incident Command System Organization for Initial Arriving, illustrates the ICS organization for initial arriving (once Command is established).

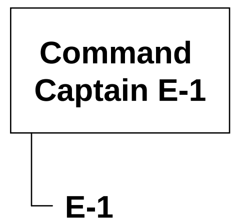


Figure 5-2
Incident Command System Organization for Initial Arriving

The first-arriving CO should assume initial incident command. This will allow the IC to assign companies and personnel consistent with standard operating guidelines (SOGs). On first sign of a smoke or fire condition, the IC should request additional resources immediately. Preparations must be made to augment the water supply to any fixed fire protection systems in the building. The IC also should try to obtain keys for affected portions of the building. This action will simplify access for firefighting crews. The IC should be prepared to maintain Command until a proper transfer of Command can be made to a chief officer.

- decide what first-alarm companies will supply the standpipe system (and, if the building is equipped, the sprinkler system);
- obtain keys for affected areas of the building;
- remain in Command until proper transfer is accomplished;
- determine the location of the fire or emergency:
  - monitor the building’s annunciator panel (if building is equipped with one),
  - gather information from occupants,
  - gather information from the building engineer or fire safety director, and
  - act on visual observations;
- determine the status of occupants in the immediate fire area, above the fire, and below the fire:
  - begin informational announcements using available mass communication (public announcement system, etc.) device to control occupant movement;
- control the elevators:
  - all cars should be returned to the ground level, and
  - cars are placed in Firefighter Service Mode; and
- locate interior stairwells/exterior fire escapes:
  - smoke towers.

Additional Considerations

There are a number of other functions that can be performed if sufficient personnel are available, e.g., obtaining the telephone numbers for a lobby telephone and fire control room telephone. These telephones can be used if communications become disabled, distorted, or excess radio traffic causes loss of communication between companies. Companies operating at different levels can use the lobby telephone to call to relay information or make requests.

Attempt to obtain as much information about the building as possible by referring to the building's prefire plan, making contact with the building engineer (or fire safety director), and/or reading on-site building diagrams.

INCIDENT COMMANDER DUTIES

When considering the task of developing and deploying the initial investigation team, the officers of the first-arriving companies should always remember that standard practice requires that two companies ascend above the lobby or grade entrance together to make the initial investigation. Preferably this should be one engine company and one truck company. In some jurisdictions where the arrival of a truck company may be delayed, two engine companies may have to ascend together. When this is the case, the second engine company must make provisions to designate a member to bring the necessary forcible entry tools which may be needed to begin the investigation.

The officer of the **first-arriving company** should establish a Command Post (CP) at ground level and assume Command until relieved by the first-arriving chief officer. It is essential that an IC be at ground level to ensure effective Command, control and support of operating forces. Some departments prefer to operate Command from the building lobby; others prefer an exterior position located 200 feet (60 meters) from the building. When the first IC is a CO, he or she should perform the following:

- Assume or transfer Command.
  - Confirm and announce Command or transfer of Command.
  - Announce the location of the CP.
  - Brief incoming Chief Officer on the actions already taken.
  - Upon the successful transfer of Command, the CO rejoins his or her company or is given another assignment designated by the IC.
- Size up and report conditions (as they are on assumption of Command).

Figure 5-3, Company Officer as the Incident Commander, illustrates the ICS organization for an incident where the first IC is a CO.

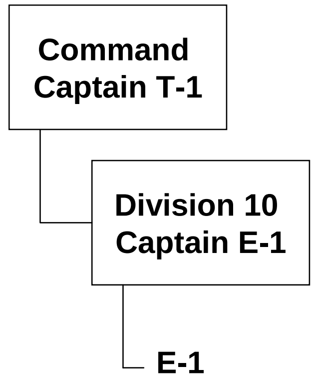


Figure 5-3
Company Officer as the Incident Commander

- Confirm the Staging floor and Base location.

  - Establish resources on this floor (include personnel, equipment, etc.).

  - Announce location.

- Determine initial strategy and tactics.

  - Develop the initial incident strategy.

  - Assign tactical objectives to other companies/personnel.

- Evaluate resource needs.

  - Are there enough personnel to accomplish the tactical objectives desired?

  - Anticipate the need for future resource needs.

Should the first ground level officer be a chief officer, then, in addition to the above, the following must be accomplished

- determine overall strategy and tactics:
  - develop the incident strategy,
  - assign tactical objectives to other companies/personnel, and
  - obtain progress reports on a periodic basis;
- assign personnel to the Planning Section as needed to maintain situation and resource status;
- provide for the safety, accountability and welfare of personnel (ongoing throughout the incident); and
- coordinate and control the incident by expanding the ICS to include the necessary functions to gain control of the incident.

Figure 5-4, Chief Officer as the Incident Commander, shows the incident's ICS organization when a Chief Officer arrives before a CO.

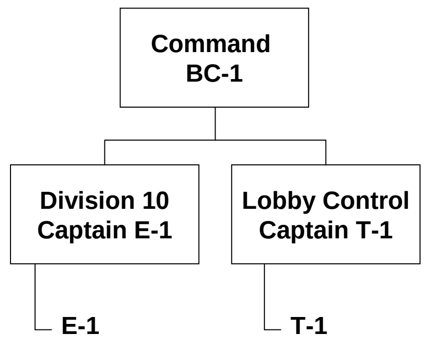


Figure 5-4
Chief Officer as the Incident Commander

FIRST-ASCENDING OFFICER DUTIES

COs in charge of the investigation team must try to obtain as much information as possible before ascending. Try to determine the fire floor from information that is provided upon dispatch, information received from the command/alarm panel, if present, and information gathered from building management or a responsible party, and/or building occupants. Attempt to verify the fire floor by collating the information received, and begin your ascent as quickly and safely as possible. Based on local SOGs, the first company to arrive on the scene may not perform this task.

The initial actions of the first-ascending company at a high-rise fire are extremely critical to the outcome of the incident. The first-ascending company not only has the responsibility to initiate confinement and suppression efforts, they also provide valuable information that will assist the IC in the development of strategy, tactics and organization.

The fire department must have SOGs regarding the use of elevators, stair shafts or combinations of both when ascending to the upper floors during high-rise fire (or reported fire) operations. The safest method of ascending to the fire floor is to use a stair shaft that accesses the reported fire floor. However, in some situations (such as extremely tall buildings) this might not be practical. Therefore, it may be necessary to explore the use of elevators for firefighting operations. The determination to use the elevator is ultimately the responsibility of the IC. Information received from ascending team(s) regarding the safety of elevators and actual conditions on the reported fire floor (and preceding floors) should be relayed immediately to the IC. The IC then will determine if the elevators are safe to use. Initial attack team(s) may need to use stairwells to reach reported fire floors and then make a visual assessment of actual conditions that might affect elevator use.

A fire attack company that uses a stair shaft for fire attack should pace itself while ascending. Personnel should take aloft necessary equipment only (i.e., SCBA, high-rise hose packs with nozzles, forcible entry tools, radios, and stair shaft keys).

Determining Floor Configuration

The determination of the floor configuration is critical information that will assist fire-attack companies as tactical objectives are assigned. It is important for the first-ascending company to determine the fire floor layout. This can be accomplished through the use of preincident plans, floor surveys during ascent, or an assessment of the fire floor.

Reporting During Ascent

On the way to the fire floor, the officer should check several floors below the predicted fire floor and check standpipe valves. This should give the officer an idea of the general layout of the building and, therefore, the layout of the fire floor. This check will allow the officer to recommend (to the IC) a habitable floor for Staging that is two or three floors below the fire floor. It also will allow the officer to report on the condition of floors other than the fire floor(s).

Reporting from the Fire Floor

On arrival at the fire floor, immediately transmit a description of conditions found, including:

- floor number;
- occupancy type;
- smoke and fire conditions (light, moderate, heavy, possible extension);
- report which stairs have been designated fire attack/evacuation;
- rescue problems;
- other specific problems;
- what your company is doing; and
- additional company needed (and for what purpose).

Example: Engine 14 has reached the 17th floor which is the fire floor. This is office occupancy. I have heavy smoke and heat conditions, fire may have extended outside of original office. There is no obvious rescue, primary search is underway, and we are connecting to the standpipe in the east stairwell for fire attack. The west stairwell will be used for evacuation. I need two additional engine companies and one truck company. Companies need to be sent to the floor above for search and rescue and for fire extension.

Initiating Initial Fire Floor Operations

The primary objectives of the first-ascending companies are to provide for rescue and to locate and confine the fire. The order in which these objectives normally should be achieved:

- determine fire attack/evacuation stairs;
- communicate information;
- conduct primary search; and
- begin initial fire attack.

Checking the Floor above the Fire Floor

After giving the brief (initial) report, the officer should check the floor above quickly. This should provide information necessary for initial determination of fire spread. Checking the floor above should be accomplished while connecting to the standpipe on the floor below.

Figure 5-5, First-Ascending Officer (Captain Engine 1), illustrates the first-ascending officer (Division 10, Captain E-1) and his or her place in the organization (at this time).

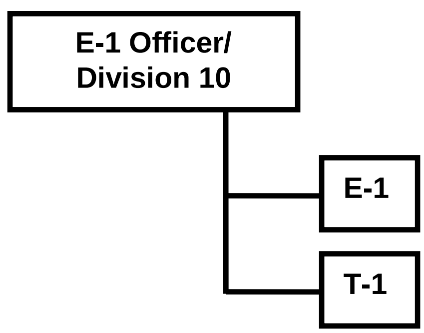


Figure 5-5
First-Ascending Officer (Captain Engine 1)

The first four functions (Base, Lobby Control, Systems, and Ground Support) in the ICS are elements that, when implemented early, allow continued operations in a high-rise fire situation. These functions also may be applicable in other types of structure incidents. Base for high-rise situations is simply a more limited definition than the original Base used in wildland situations. Figure 5-6, Base, Lobby, Control, Ground Support, Communications, and Systems, illustrates where these functions fall within the ICS.

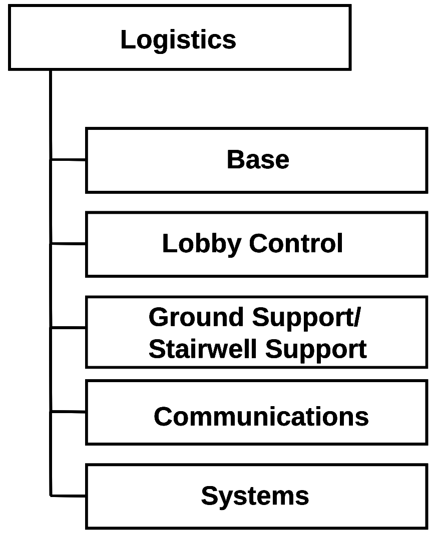


Figure 5-6
Base, Lobby Control, Ground Support, Communications, and Systems

Base

The Base area of a high-rise structural incident serves as an assembly and deployment point from which large quantities of personnel and equipment are distributed. The Base area also serves as the primary point outside the structure to which responding resources report and from which resources receive their initial orders for entering the incident. Base works in coordination with Lobby Control. The Base Manager reports to the Logistics Section Chief (LSC) or to the IC if the Logistics Section has not been activated.

The IC will determine the need/location for Base at any high-rise incident. The IC will establish the level of resources required in Base and request those resources from the dispatching center. Once the level of resources is established, the Base Manager will assure that the level is maintained (replenished) until notified by the appropriate incident supervisor. The Base Manager must maintain communication with resource status (RESTAT) (Planning Section) to assure accountability of resources within the incident.

The responsibilities of the Base Manager may be summarized as follows:

- verifies location of Base with the IC;
- assures that Base location is a safe distance from the involved high-rise, normally 200 feet (60 meters) or more from the structure;
- determines and advises Dispatch (through Command) of the most effective access route to Base for responding resources;
- establishes one or more safe routes to the fire building (coordinates the route(s) with Lobby Control);
- maintains an accurate log of apparatus, equipment and available personnel within Base;

- coordinates movement of equipment and resources into the fire building through Lobby Control;
- according to the Incident Action Plan (IAP), establishes equipment pools by priority of need (coordinates with Logistics Chief);
- assures that Base resources (apparatus, equipment, personnel) are requested **before** they are actually needed; and
- assures the security of Base (use police if necessary).

The Base Manager must control resources as they arrive at Base. Strict control must be maintained over the parking location and movement of personnel and equipment through Base. The Base Manager must select a Base site that is large enough for the parking and movement of a large number of responding apparatus. Typical Base sites include very wide streets or large parking areas. Park apparatus at diagonal angles (\\\\\\\\\) to allow easy access and egress in Base. Block the street to nonemergency vehicles if a street is used as a Base site. If police are not available for this function, use aerial ladder apparatus or other large fire department vehicles.

The Base Manager should establish safe traffic flow routes that will ensure the effective movement of personnel and equipment into and out of the high-rise. Pickup trucks or similar vehicles may be used to move personnel and portable equipment if necessary. The Base Manager also should establish a priority order for deployment of personnel and equipment to the incident (**Spare SCBA air cylinders are always the first priority**.)

This person must ensure that fire company integrity is maintained. Fire companies **must** stay together as cohesive units. They will maintain an accurate log of fire companies (their arrival in and departure from Base by time intervals).

LOBBY CONTROL

The responsibilities of Lobby Control at a high-rise incident are extensive. Like Staging, Lobby Control should be a priority. It is recommended that Lobby Control be established on all working high-rise incidents from the first-alarm assignment. As shown in Figure 5-7, Lobby Control, the Lobby Control Manager reports to the Logistics Section Chief (or the IC if the Logistics position has not been established).

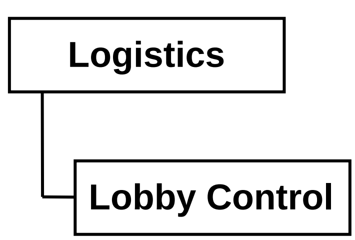


Figure 5-7
Lobby Control

The Lobby Control Manager should report (to Logistics/IC) the number of floors in the building, e.g., using elevator floor indicators and whether elevators have been recalled. This is valuable information for the IC because people may be trapped in elevators.

The Lobby Control Manager is responsible for the control of fire department personnel and civilians entering and exiting the building. It is very important to direct incoming resources to the correct stairwell when they are ascending to upper floors or Staging. All personnel entering or exiting the building should be accounted for by maintaining records that include in and out times and destinations. When directing companies to upper floors, they need to make sure that these people are carrying additional equipment.

When the elevators are determined to be safe, the Lobby Control Manager shall designate specific elevators to be used by fire personnel. Lobby Control will assign additional elevator operators. Any car not equipped with Firefighter Service Mode should be placed out of service.

The responsibilities of the Lobby Control Manager:

- control fire department and civilian personnel entering and exiting the building;
- ensure that companies who are directed to upper floors carry equipment with them;
- designate which elevators will be used by personnel (and assigning an elevator operator);
- place cars without Firefighter Service Mode out of service;
- pressurize the stairwell with fans (when the building heating, ventilating, and air conditioning (HVAC) system cannot be used for this purpose); and
- ensure updated information via the public announcement system to building occupants.

GROUND SUPPORT

Ground Support functions are implemented to move equipment from Base to Staging or when additional water supply is needed. This operation can require a large number of personnel (not only for initial setup but also for relief personnel). As illustrated in Figure 5-8, Ground Support, the Ground Support Unit Leaders report to the LSC (or the IC if the Logistics Section has not been activated).

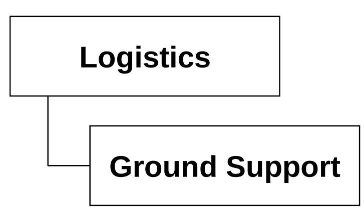


Figure 5-8
Ground Support

A primary responsibility of Ground Support is the transportation of equipment by way of a stairwell from Base to Staging. If equipment is delivered to the roof by helicopter (a very risky endeavor that is rarely practiced), Ground Support will handle equipment movement down the stairwell to Staging. If an auxiliary water supply is required by way of the stairwell, a request should be made to Ground Support to provide a water supply line to the stairwell entrance. A hoseline always should be placed in the stairwell to protect personnel working above the fire. The function of Stairwell Support is now the responsibility of Ground Support.

The following strategies will be helpful in performing Ground Support functions:

- Determine the number of personnel necessary to accomplish the task. Consider one person per two floors and one officer per four or five personnel.

- If available, provide a separate radio channel for Ground Support.

- Officers must remain mobile to supervise the operation. Ground Support is very demanding work. Officers must ensure a smooth flow of equipment at a pace that can be sustained.

- Officers must monitor their personnel for signs of undue fatigue or distress. If it is to be an extended operation, they need to arrange for timely relief and consider assigning two-person teams (alternating with one carrying and one resting).

Normally, one person picks up equipment at the ground floor entrance to the stairwell and carries it to the third floor landing. That person then returns to the ground floor for another load. The person at the third floor carries the equipment to the fifth floor landing and then returns to the third floor for another load. This process continues until the equipment is delivered to the Staging floor hallway. Moving equipment beyond that point is the responsibility of the Staging Area Manager.

Supervising officers may need to adjust assignments if the route involves unusual problems (i.e., long or crossover hallways, scissor stairwells, etc.). Ground Support personnel should have their personal safety equipment (turnouts, helmets, breathing apparatus, and flashlights) available to them in the stairwell. In addition, officers will have their portable radios and (when available) building sound-powered telephones.

COMMUNICATIONS UNIT

As illustrated in Figure 5-9, Communications Unit, the Communications Unit Leader reports to the LSC. The Communications Unit Leader ensures that an effective communications system is maintained between the IC and incident personnel. The communication system includes portable radios, spare batteries, and cellular phones. The Communications Unit Leader also will coordinate communication needs with outside agencies.

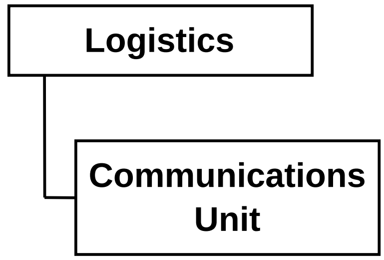


Figure 5-9
Communications Unit

SYSTEMS UNIT

The Systems Unit Leader monitors and maintains built-in fire control, life safety, environmental control, communications, and elevator systems. This unit may operate, support or augment the systems as required to support the building prefire plan.

As indicated in Figure 5-10, Systems Unit, the System Unit Leader reports to the LSC or the IC (if the LSC has not been staffed). This unit may respond to direct requests from the OSC.

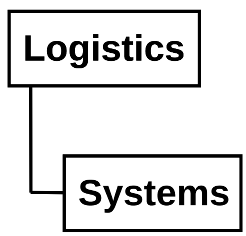


Figure 5-10
Systems Unit

The Unit Leader must establish a close liaison with the building engineer (or fire safety director), utility company representatives, and the Technical Specialists.

The major responsibilities of the Systems Unit Leader are to:

- obtain a briefing from the LSC or the IC and building staff;
- assess the current situation and request needed personnel and resources;
- request response from and make contact with:
  - building engineer,
  - utility company representative,
  - elevator service company representative, and
  - others (as necessary);
- anticipate the failure of critical building systems;

- appoint personnel to monitor and operate system display/control panels (personnel should be radio equipped);
- evaluate status and operation of fire and domestic water pumps and water supply;
- monitor the HVAC and smoke removal and stairwell protection systems;
- evaluate, support and control the building electrical system and emergency power plant;
- evaluate, support and secure the public address, telephone, emergency telephone, and other building communication systems; and
- secure operations and demobilize personnel (as determined by the Demobilization Plan).

PERSONNEL ACCOUNTABILITY

Tracking the location and movement of personnel during high-rise incidents is difficult even under the best conditions. The turnover and relief of personnel at a working high-rise fire are almost continuous once sufficient resources are on scene.

At ground level (CP), it is expected that only those units that have been dispatched and those that have arrived would be able to be tracked (except after a Personnel Accountability Report (PAR) where records could be updated).

Other ICS functions also are responsible for tracking the arrival, departure, destination and location of resources. The Base Manager maintains a list of all companies that have arrived in Base and the time that these people left for Lobby Control. The Lobby Control Unit Leader would have a list of all companies that came through Lobby and where they were sent (e.g., Staging, Base or some other part of the organization either entering or existing the building). In addition, firefighters operating elevators may track the companies ascending to various locations in the building. Planning and Logistics Section Chiefs would have a record of their companies and personnel. Staging would have a list of all companies that reached Staging (and if they were still there or where they went, e.g., if they were sent to Operations, Division 10, Vent Group, or other areas). Each Division and Group Supervisor also has to track his or her companies by recording their exact location(s) and time(s).

Getting a PAR requires a report from all elements of the organization (in order to determine the **exact** location of each company). Command should direct all requests for PARs to the appropriate Section Chief.

At the time that a PAR is received, the ground level tracking (Resource Status Unit Leader) could update company locations. This would provide a “snapshot” of personnel accountability **for that instant**. PARs conducted too frequently use extensive radio time, while those conducted too infrequently leave Command (and others) without the knowledge of where companies are operating.

Activity 5.1

High-Rise Incident Management Team Functions

Purpose

To identify Incident Management Team (IMT) key roles and responsibilities during a high-rise incident.

Directions

1. Each IMT will be required to:

   - Develop incident objectives.
   - Identify operational strategies and tactics.
   - Identify planning Issues and forecasts.
   - Identify logistics support concerns.
   - Specify safety concerns.
   - Identify liaison support from agency representatives.

2. The instructor will assemble IMT groups consisting of eight students for each group and will assign one student to each Command and General Staff IMT function listed below.

   Incident Management Team Functions:

   - IC.
   - IC Aide*.
   - Operations Chief.
   - Operations Aide.
   - Planning Chief.
   - Logistics Chief.
   - Safety Officer.
   - Information Officer.
   - Liaison Officer.

   *The IC Aide position is not staffed unless nine students are assigned to an IMT group.

3. The instructor will distribute Exercise Support Documents to each group.

   Exercise Support Documents

   - IC: ICS Form 202.
   - Operations Chief: (201).
   - Operations Aide: (201).

- Planning Section Chief: (201).
- Logistics Section Chief: (201).
- Safety Officer: (208).
- Liaison: (8 x 11 Scratch Pad).
- Information Officer: (8 x 11 Scratch Pad).

4. You will use p. 5-25 in your Student Manuals (SMs) to review the plot plan for the Plaza High-Rise building located at 22nd and LL streets in Central City. The Plaza high-rise is a 22-story condominium occupancy. There are four apartments per floor. The building is sprinklered in the basement only.

5. You should consider the following issues and concerns for your respective assignment.

   IMT Functions:

   IC: Establish First Operational Period Objectives. (Developing guidance statements.)

   Operations Chief: Develop incident strategy and tactics. (Identifying strategies/tactics to meet incident objectives.)

   Planning Chief: Identify situational concerns and forecast potential incident issues.

   Logistics Chief: Identify resource needs, ground support considerations, and stairwell support practices.

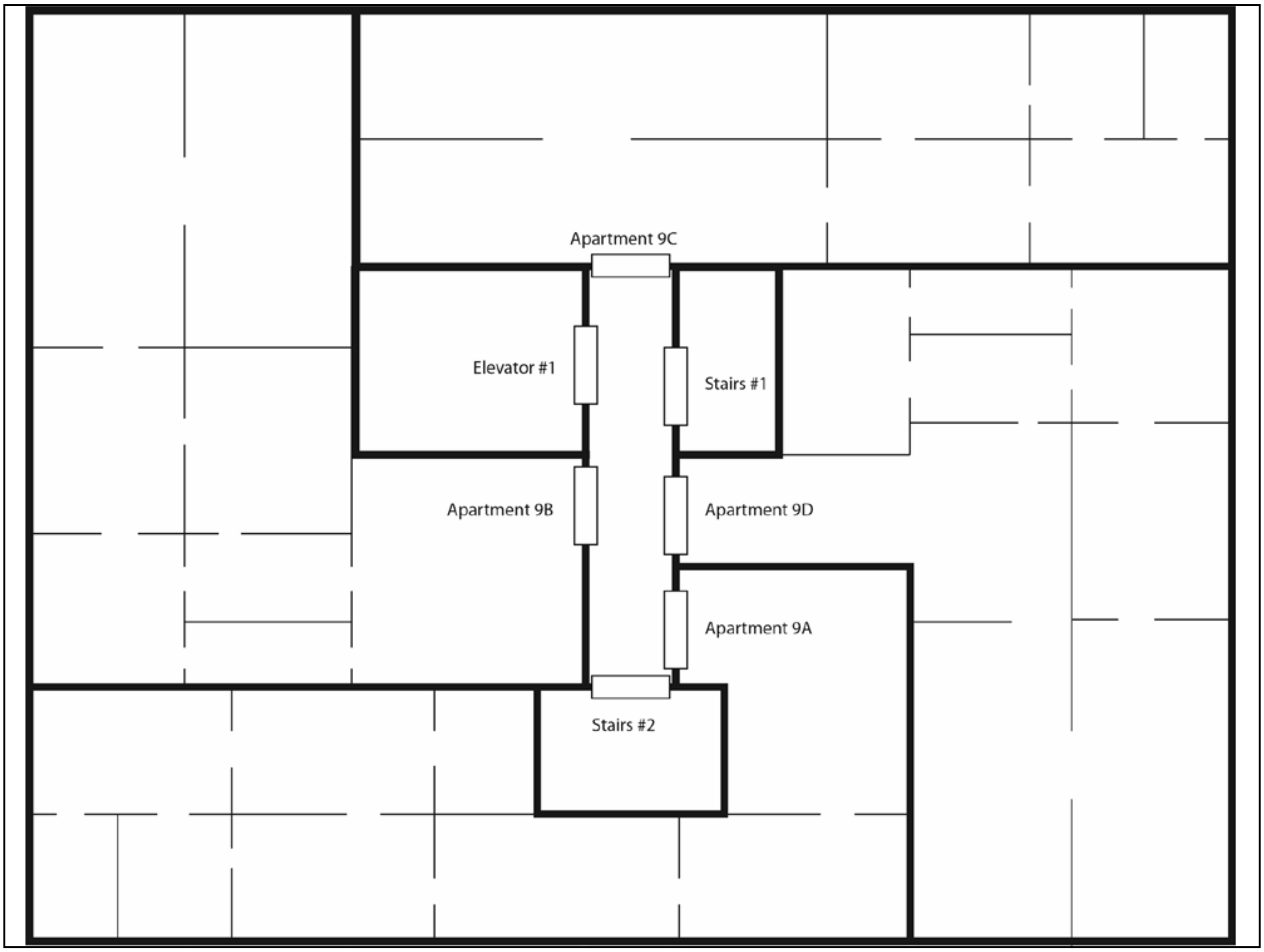
   Safety Officer: Identify responder safety concerns for high-rise firefighting.

   Liaison Officer: Coordinate support agencies' capabilities.

   Information Officer: Gather and share incident information.

6. You are allowed 30 minutes to complete your list of issues and concerns for your assigned function. You should maintain your list of concerns and issues you identified for possible issues and concerns during the exercise scenario.

Plot Plan


Apartment 9C
Elevator #1
Stairs #1
Apartment 9B
Apartment 9D
Apartment 9A
Stairs #2

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Activity 5.2

High-Rise Simulation

Purpose

To effectively manage a simulated, complex, high-life hazard occupancy fire.

Directions

1. You will remain in your same IMT groups assigned for Activity 5.1.

   CCFD IMT Positions:

   - IC.
   - IC Aide*.
   - Operations Chief.
   - Operations Aide.
   - Planning Chief.
   - Logistics Chief.
   - Information Officer.
   - Liaison Officer.
   - Safety Officer.

2. Two student controllers will be selected to assist the instructor in running the exercise. One will be a messenger controller, and one will be a resource controller (if student count allows).

3. You will receive the following forms before the simulation.

   - IC: Incident Objectives on ICS Form 202.
   - Planning: Situation Analysis and Incident Forecasting (201).
   - The Safety Officer: Safety Message on the Safety Message Form (208).
   - Operations Aide: Enter Actions Taken on Incident Action Chart.
   - Logistics: Resources Ordered and Logistic Operations (201).
   - Liaison: Document Agencies Contacted and Responding (8 x 11 Scratch Pad).
   - Information Officer: Press Release (8 x 11 Scratch Pad).

4. When the simulation begins, a first-alarm assignment will have already been dispatched and the first engine company will be on scene. All members of the IMT will arrive one minute after arrival of Engine 1.

First-Alarm Response plus IMT:

- Engine 1.
- Ladder 1.
- ALS-M1.
- Engine 2.
- Tower Ladder 3.
- Battalion 2.
- Engine 3.
- Squad 1.
- Deputy Chief 1.

5. Resources.

- All resources must be requested and recorded by each IMT LSC.
- IMTs cannot deploy a resource unless they receive an index card indicating resource has arrived on scene.
- Requested fire department resource will require a 10-minute response time to arrive on scene from time ordered.
- Requested nonfire department resource will require a 15-minute response time to arrive on scene from time ordered.
- Ensure index cards are available for approving and distributing approved simulation resources.

Central City Resources:

- 11 Engine Companies (4 FF each Company).
- 4 Ladder Companies (4 FF each Company).
- 1 Squad (Hazmat Equipped) (4 FF).
- 1 Air Unit.
- 1 Light Unit.
- 1 Foam Unit.
- 1 Collapse Unit.
- 1 Utility Unit.
- 1 Communications Unit.
- Mutual aid is available in Liberty County. Generally, anticipate a 20-minute response time.

6. Simulation Situation:

At 1900 hours, Tuesday, Jan. 25, dispatch received a report of fire on the ninth floor of the 22-story Plaza Apartments at LL and 22nd streets. It is a condominium-type occupancy with four apartments per floor. A full first-alarm response has been dispatched. Temperature 25 degrees, wind from south 10 mph.

Engine 1 has arrived on location and reports fire showing from two ninth-floor windows on Side A and B, with medium to heavy smoke showing from the upper floors. Engine 1 is taking a 1 3/4-inch water line to fire floor by way of stairway 2. Engine 1 has ordered a second alarm. The building is fully occupied. The IMT arrives one minute later.

7. Instructor shall monitor all IMT groups during exercise. Instructor shall assume role of nonfire agency representatives during exercise. Instructor shall rotate among IMTs during simulation assuming various agency representative roles that IMTs have requested to respond. Give feedback as a simulated agency representative to IMT groups as required. (Keep agency feedback real.)

   - Building Engineer — report that the HVAC system was shut down by the fire alarm system. It does have an exhaust feature. Report that the fire pumps are operating at this time.
   - Police Supervisor — make every effort to comply with assistance requests.
   - Other Agency Roles: Instructor is required to assume the role of other agencies that were requested and arrive at scene.

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1. Incident Name:	2. Incident Number:	3. Date/Time Initiated: Date: Time:

4. Map/Sketch (include sketch, showing the total area of operations, the incident site/area, impacted and threatened areas, overflight results, trajectories, impacted shorelines, or other graphics depicting situational status and resource assignment)**:**

5. Situation Summary and Health and Safety Briefing (for briefings or transfer of command)**:** Recognize potential incident Health and Safety Hazards and develop necessary measures (remove hazard, provide personal protective equipment, warn people of the hazard) to protect responders from those hazards.

6. Prepared by: Name: ________________ Position/Title: _______________ Signature: ________

ICS 201, Page 1	Date/Time: __________________________________

Incident Briefing (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

7. Current and Planned Objectives:

8. Current and Planned Actions, Strategies, and Tactics:

Time:	Actions:

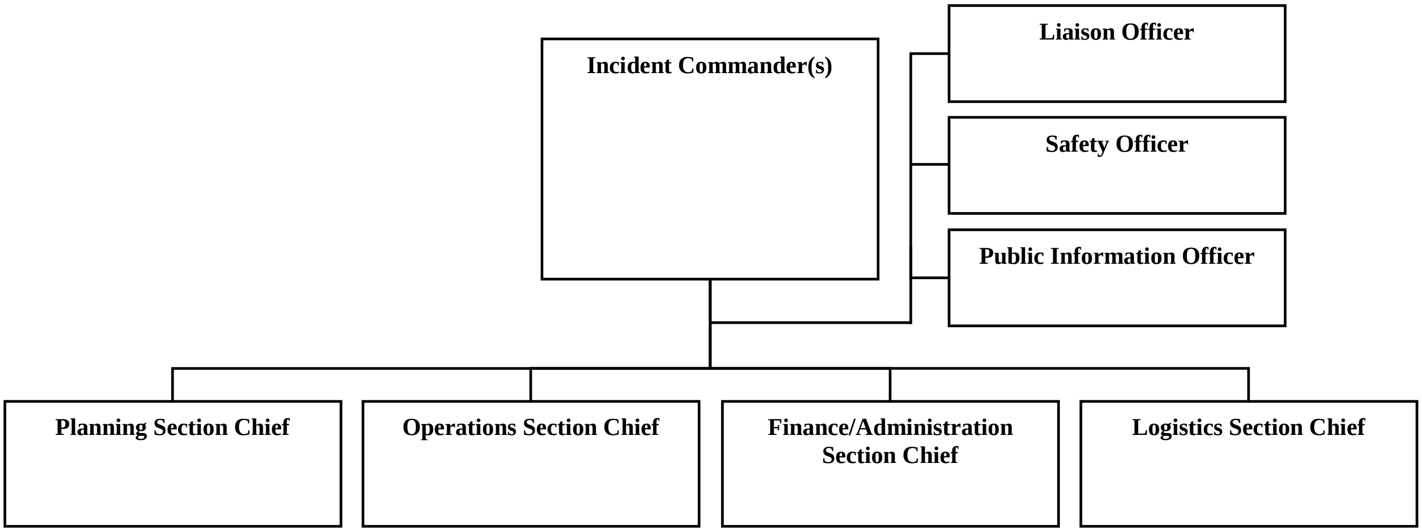
6. Prepared by: Name: ________________ Position/Title: _______________ Signature: ________

ICS 201, Page 2 Date/Time: ______________________________________

Incident Briefing (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

9. Current Organization (fill in additional organization as appropriate)**:**



6. Prepared by: Name: ________________ Position/Title: _______________ Signature: _________________

ICS 201, Page 3 Date/Time: ____

Incident Briefing (ICS 201)

1. Incident Name:	**2. Incident Number:**	**3. Date/Time Initiated:** Date: Time:

10. Resource Summary:

Resource	Resource Identifier	Date/Time Ordered	ETA	Arrive	Notes (location/assignment/status)
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	
				☐	

6. Prepared by: Name: ______________ Position/Title: ____________ Signature: _________________

ICS 201, Page 4 Date/Time: ______________________

Incident Objectives (ICS 202)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:

3. Objective(s):

4. Operational Period Command Emphasis:

General Situational Awareness

5. Site Safety Plan Required? Yes ☐ No ☐
Approved Site Safety Plan(s) Located at:

6. Incident Action Plan (the items checked below are included in this Incident Action Plan)**:**

☐ ICS 203	☐ ICS 207	Other Attachments:
☐ ICS 204	☐ ICS 208	☐ ______________
☐ ICS 205	☐ Map/Chart	☐ ______________
☐ ICS 205A	☐ Weather Forcast/Tides/Currents	☐ ______________
☐ ICS 206		☐ ______________

7. Prepared by: Name: ________________ Position/Title: _______________ Signature: ________

8. Approved by Incident Commander: Name: ___________________ Signature: __________

ICS 202	**IAP Page _____**	Date/Time: ______________________

Safety Message/Plan (ICS 208)

1. Incident Name:	**2. Operational Period:** Date From: Date To: Time From: Time To:
3. Safety Message/Expanded Safety Message, Safety Plan, Site Safety Plan:	
4. Site Safety Plan Required? Yes ☐ No ☐ **Approved Site Safety Plan(s) Located At:**	
5. Prepared by: Name: ________________ Position/Title: _____________ Signature: __________	

ICS 208	**IAP Page _____**	Date/Time: ______________________________________

NOTE-TAKING GUIDE

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NOTE-TAKING GUIDE

Slide 5-1

UNIT 5:
BASIC ORGANIZATIONAL APPROACH

Slide 5-1

Slide 5-2

What would an Incident Commander (IC) and Operations Section Chief (OSC) need to manage a high-rise incident successfully?

Slide 5-2

Slide 5-3

TERMINAL OBJECTIVE

The students will be able to identify roles and responsibilities for Command and Control procedures for major high-rise operations and hazards.

Slide 5-3

Slide 5-4

ENABLING OBJECTIVES

The students will:
- **List time and distance factors.**
- **Explain the need for Staging.**
- **Explain the necessary logistical functions of Base, Lobby Control, Ground Support, Communications and Systems.**
- **Identify first-alarm capabilities and the Incident Command System (ICS) organization.**

Slide 5-4

Slide 5-5

HIGH-RISE INCIDENT COMMAND SYSTEM

- **Must have a high-rise operational plan.**
- **Important to understand the framework of ICS.**
- **The application of the system to the specific organization is invaluable to Command Officers.**

Slide 5-5

Slide 5-6

HIGH-RISE INCIDENT COMMAND SYSTEM (cont'd)

- **High-rise structures pose different problems than smaller structures.**
- **Their configuration affects the ICS.**
- **Location of Staging and other special functions is unique.**

Slide 5-6

Slide 5-7

TIME AND DISTANCE FACTORS

- **Play an important role.**
- **Time is a critical element.**
- **Being proactive is key.**
- **Being reactive can be disastrous.**
- **Fast placement of equipment and personnel.**

Slide 5-7

Slide 5-8

STAGING

Slide 5-8

Slide 5-9

STAGING (cont'd)

- **Reports to the IC during initial phases.**
- **Reports to Operations once OSC is staffed.**
- **Serves two purposes:**
  - **To pool and deploy personnel and equipment quickly.**
  - **To manage and control flow of personnel and equipment.**

Slide 5-9

Slide 5-10

STAGING (cont'd)

- **Can be used for rehabilitation, equipment exchange, and medical care.**
- **Should be a priority:**
  – Established by a first-alarm unit.
  – Normally located two floors below fire floor.
  – Another floor may be chosen due to conditions, etc.

Slide 5-10

Slide 5-11

STAGING (cont'd)

- **Primary point for fire department personnel entering or leaving fire area**
- **Assembly point for reserve personnel and equipment**

Slide 5-11

Slide 5-12

STAGING MANAGER

- **Maintains and provides:**
  – Stockpiles of reserve and expended equipment.
  – Reserve force.
  – Medical treatment station.
- **Dispatches resources at direction of IC.**
- **Requests additional resources.**

Slide 5-12

Slide 5-13

STAGING FUNCTIONS

- **Verify location with IC and Operations.**
- **Maintain record of resources.**
- **Control stairwell access.**
- **Establish communications with IC, Logistics, Lobby Control, and Base.**

Slide 5-13

Slide 5-14

STAGING FUNCTIONS (cont'd)

- **Plan layout of Staging.**
- **Maintain stockpile of reserve and expended equipment.**
- **Develop an equipment inventory.**

Slide 5-14

Slide 5-15

STAGING FUNCTIONS (cont'd)

- **Provide a medical capability to:**
  - **Observe personnel.**
  - **Evaluate personnel.**
- **Medical treatment area may be located at Staging.**

Slide 5-15

Slide 5-16

What items normally would be stockpiled at Staging?

Slide 5-16

Slide 5-17

STAGING (cont'd)

- **Companies arriving at Staging must bring additional supplies from Base/Lobby.**
- **Provides backup lighting.**
- **Manager works to anticipate future needs.**
- **Requests for additional personnel via IC/ Operations.**
- **Uses a check-off sheet (to assist in carrying out functions).**

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Slide 5-18

What needs on our list are handled by Staging?

Slide 5-18

Slide 5-19

INITIAL FIRST-ALARM COMMITMENT

Slide 5-19

Slide 5-20

INITIAL FIRST-ALARM

- **Commitment of resources is critical.**
- **High potential for loss of life.**
- **Need to arrive on scene quickly.**

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Slide 5-21

INITIAL FIRST-ALARM (cont'd)

- **Most departments do not dispatch enough first-alarm resources to handle the full potential of the incident.**
- **Departments need to increase the number of units dispatched initially.**

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Slide 5-22

INITIAL FIRST-ALARM (cont'd)

- **Resources to support initial operations:**
  – Attack, Lobby Control, Staging, Base (ALSBASE)
  – Large number of personnel required

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Slide 5-23

INITIAL FIRST-ALARM (cont'd)

- **Resources should be sufficient to:**
  – Provide prompt investigation and location of fire.
  – Start initial fire attack.
  – Sustain an effective fire attack.
  – Handle immediate support functions.

Slide 5-23

Slide 5-24

INITIAL FIRST-ALARM (cont'd)

- **Resources dispatched should be standard.**
- **Additional resources should be called when first-arriving company has indication of working fire.**

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Slide 5-25

INITIAL FIRST-ALARM (cont'd)

- **This early call minimizes lead time.**
- **Additional resources should be directed to Base area.**
- **Base should be located in close proximity to the incident.**

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RESOURCE REQUIREMENTS

Slide 5-26

Slide 5-27

RESOURCE REQUIREMENTS EXAMPLE

- **This example uses four-person staffing at a working high-rise fire.**
- **Number of personnel is critical, not the number of fire department apparatus.**

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HYPOTHETICAL FIRE SITUATION

- **Fire is on 12th floor.**
- **Potential exists for fire extension to 13th.**
- **Elevators cannot be used.**
- **Ventilation problems exist on two floors.**
- **Rescue and evacuation procedures are needed.**

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Slide 5-29

BASIC FUNCTIONAL ORGANIZATION

Twelfth floor fire attack	**Three companies**
Thirteenth floor	**One company**
Lobby Control and Base	**One company (divided)**
Staging (10th floor)	**One company (initial Rapid Intervention Crew (RIC))**
Total basic commitment	**Six companies**

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Slide 5-30

ADDITIONAL RESOURCES CALLED

Rescue/Evacuation	**Two companies**
Ventilation	**One company**
Ground Support	**One company**
Total resources for basic working fire	**Ten companies**

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Slide 5-31

RESOURCE ALLOCATION

- **Seven companies are assigned to attack.**
- **Three companies set up support operations.**

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RESOURCE REQUIREMENTS

- **A moderate high-rise fire requires a minimum of 10 four-person companies (40 personnel).**
- **The type of fire illustrated may require up to 100 personnel.**
- **Additional chief officers should be dispatched to manage ICS functions.**

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RESOURCE REQUIREMENTS (cont'd)

- **Prolonged fire:**
  – Three companies for each hoseline or tactical operation.
  – Additional companies needed.

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RESOURCE REQUIREMENTS (cont'd)

- **Departments with limited resources must have functional mutual- or automatic-aid agreements:**
  – Train with their departments.
  – Assist in understanding high-rise operations.
  – Ensure equipment compatibility.

Slide 5-34

Slide 5-35

RELIEF CYCLE

- **Objective is to maintain constant water on the fire.**
- **Based on the use of three companies:**
  – One on the line.
  – One in stair shaft.
  – One at Staging.

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Slide 5-36

RELIEF CYCLE (cont'd)

- **Fire floor division supervisor coordinates company movement.**
- **Staging Manager must be aware of relief cycle.**

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Slide 5-37

AIR CYLINDERS

- **High heat and humidity limits attack time.**
- **Thirty-minute self-contained breathing apparatus (SCBA) will last 15 minutes.**
- **Two to three minutes travel time.**
- **Nine to 10 minutes at the nozzle.**
- **A new crew must be moving toward the nozzle every nine to 10 minutes.**

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FATIGUE FACTOR

Impact on firefighters:

- **Limited to two bottles (after which they must have rehab).**
- **Rested before returning to tactical activities.**

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FIRST-ARRIVING UNIT RESPONSIBILITIES

Slide 5-39

Slide 5-40

No single company should go above the main floor/lobby or grade entrance to make the initial investigation.

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Slide 5-41

INITIAL INVESTIGATION

- **An engine company should wait for a second unit, preferably a truck company.**
- **If two engine companies ascend, the second engine must include the proper forcible entry tools.**

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Slide 5-42

FIRST-ARRIVING UNIT

- **In order to achieve the goals of ICS, the first-arriving unit must create a foundation to support the incident.**
  - **Initial size-up/radio report.**
  - **Information gathering.**
  - **Initial duty assignments.**

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FIRST-ARRIVING UNIT (cont'd)

- **Perform an initial size-up:**
  - **Don't be fooled by lack of smoke on building exterior.**
  - **If smoke shows on exterior, call for additional resources immediately.**

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FIRST-ARRIVING UNIT (cont'd)

- **Perform an initial size-up:**
  - **Check annunciator panel.**
  - **Check elevators.**
  - **Seek information from building personnel/occupants.**

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FIRST-ARRIVING UNIT (cont'd)

- **Give additional radio report of:**
  - **Building size.**
  - **Occupancy type.**
  - **Obvious conditions.**
  - **Safety concerns.**
  - **Actions being taken.**

Slide 5-45

Slide 5-46

FIRST-ARRIVING UNIT (cont'd)

- **Assume Command.**
- **Request additional resources.**
- **Decide which first-alarm companies will supply standpipe/sprinkler systems.**
- **Obtain building keys.**
- **Remain in Command until a proper transfer.**

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FIRST-ARRIVING UNIT (cont'd)

- **Determine fire and/or emergency location:**
  - **Monitor annunciator panel.**
  - **Gather information from building engineer and occupants.**
  - **Act on visual observation.**

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FIRST-ARRIVING UNIT (cont'd)

- **Determine current occupant status:**
  - **On fire floor.**
  - **Above fire floor.**
  - **Below fire floor.**
- **Begin informational announcement.**

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FIRST-ARRIVING UNIT (cont'd)

- **All elevator cars should be:**
  - **Controlled.**
  - **Returned to ground level.**
  - **Placed in Firefighter Service Mode.**
- **Locate stairwells/exterior fire escapes.**

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ADDITIONAL CONSIDERATIONS

- **When sufficient personnel are available, obtain:**
  - **Lobby and fire control room telephone numbers.**
  - **Building information.**

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INCIDENT COMMANDER DUTIES

Slide 5-51

Slide 5-52

WARNING

No single company should go above the main floor/lobby or grade entrance to make the initial investigation.

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Slide 5-53

INITIAL INVESTIGATION

- **Where the arrival of a truck company may be delayed, two engine companies may have to ascend together.**
- **Designate a member to bring the necessary forcible entry tank to begin the investigation.**

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INCIDENT COMMANDER

- **First-arriving officer remaining at ground level assumes position.**
- **This position *must* remain at ground level.**
- **The Command Post (CP) may be located:**
  - **In the lobby.**
  - **On the building's exterior.**

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Slide 5-55

COMPANY OFFICER

- **Assume or transfer command:**
  - **Confirm/Announce transfer of Command.**
  - **Announce CP location.**
  - **Brief incoming Chief Officer.**
  - **Rejoin company or other assignment.**

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Slide 5-56

COMPANY OFFICER (cont'd)

- **Size up and report conditions.**
- **Confirm Staging floor and Base location:**
  - **Establish resources for the floor.**
  - **Announce location.**

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Slide 5-57

COMPANY OFFICER (cont'd)

- **Determine initial strategy/tactics/ additional assignments.**
- **Evaluate/Anticipate resource needs.**

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CHIEF OFFICER

- **Determines overall strategy/tactics, assigns resources, gets progress reports.**
- **Assigns personnel to Planning Section to maintain:**
  - **Resource.**
  - **Situation.**

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CHIEF OFFICER (cont'd)

- **Provides for safety, accountability and welfare of personnel.**
- **This priority is ongoing throughout the incident.**
- **Coordinates and controls the incident by expanding the ICS as necessary.**

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FIRST-ASCENDING OFFICER DUTIES

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FIRST-ASCENDING OFFICER (cont'd)

- **Companies need to ascend safely to the fire floor as soon as possible.**
- **Gather as much information before ascending.**
- **Determine the fire floor.**

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FIRST-ASCENDING OFFICER (cont'd)

- **This may not necessarily be the first company to arrive on scene.**
- **The actions of this company are critical to incident outcome.**
- **Confinement and extinguishment should be started.**

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FIRST-ASCENDING OFFICER (cont'd)

- **Valuable fire condition information is obtained from this officer.**
- **The fire department must have standard operating guidelines (SOGs) regarding use of:**
  - **Stair shafts.**
  - **Elevators.**
  - **Combinations of the above.**

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FIRST-ASCENDING OFFICER (cont'd)

- **The safest method of ascending to upper floors is to use a stair shaft.**

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FIRST-ASCENDING OFFICER (cont'd)

- **Stair shafts are not always practical.**
- **Elevators may be necessary.**
- **Decision made by IC.**

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Slide 5-66

RESPONSIBILITIES

- **Determine floor configuration.**
- **Critical to fire attack.**
- **Use preincident plans.**
- **Check lower floors on the way up.**
- **Assess fire floor.**

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RESPONSIBILITIES (cont'd)

- **Perform brief initial report during ascent.**
- **Check floors below fire floor.**
- **Check standpipe valves.**
- **Determine floor suitable for Staging.**
- **Notify IC of Staging floor location/layout.**

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RESPONSIBILITIES (cont'd)

Report information from fire floor.

- **Floor number**
- **Occupancy type**
- **Smoke and fire conditions**
- **Fire attack/ evacuation**
- **Rescue problems**
- **Specific problems**
- **Company's position/action**
- **Additional company needs and purpose**

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RESPONSIBILITIES (cont'd)

- **Initiate initial fire floor operations:**
  - **Determine fire attack/evacuation stairs.**
  - **Communicate information.**
  - **Conduct primary search.**

Slide 5-69

Slide 5-70

RESPONSIBILITIES (cont'd)

- Begin initial fire attack.
- Check floor above fire floor.
- Provide information.

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Slide 5-71

BASE

- Serves as assembly/deployment area.
- Primary point to which responding resources are dispatched.
- Works in coordination with Lobby Control.

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INCIDENT COMMANDER

- Determines needs and location of Base.
- Determines level of resources required.
- Direct Base to contact Dispatch directly (to replenish resources).

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BASE MANAGER

- Reports to Logistics (or to IC if Logistics is not staffed).
- Verifies location of Base with IC.
- Assures that location is more than 200 feet from the base of the building.
- Determines route to Base.

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BASE MANAGER (cont'd)

- Establishes one or more safe routes to fire building.
- Maintains log of apparatus, equipment and personnel at Base.
- Coordinates equipment and resource movement through Lobby Control.

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BASE MANAGER (cont'd)

- Establishes equipment pools.
- Assures resources are requested before they are needed.
- Assures security of Base.

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What needs are handled by the Base Manager?

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Slide 5-77

LOBBY CONTROL

Slide 5-77

Slide 5-78

LOBBY CONTROL (cont'd)

- **Should be a priority**
- **Reports to Logistics Chief or IC if Logistics is not staffed**

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LOBBY CONTROL MANAGER

Reports:
- **Number of floors in the building (based on elevator indicators).**
- **Whether all elevators have been returned to the ground floor.**
- **Which elevators are placed in Firefighter Service Mode.**

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LOBBY CONTROL MANAGER (cont'd)

- **Controls fire department personnel and civilians entering and exiting the building.**
- **Directs personnel to correct stairwell(s).**

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LOBBY CONTROL MANAGER (cont'd)

- **Keeps log:**
  – Personnel and companies ascending and leaving.
  – Their destinations and times.
- **Companies carry additional equipment to upper floors.**

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ELEVATORS DETERMINED SAFE

Lobby Control:

- **Designates specific elevators.**
- **Assigns an elevator operator (fire department staff).**
- **Places elevators without Firefighter Service Mode out of service.**

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What needs are handled by the Lobby Control Manager?

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Slide 5-84

GROUND SUPPORT

Slide 5-84

Slide 5-85

GROUND SUPPORT (cont'd)

- **Move equipment.**
- **Additional water is needed.**
- **Can consume large numbers of personnel:**
  - **Initial setup.**
  - **Relief personnel.**

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Slide 5-86

GROUND SUPPORT (cont'd)

- **Reports to Logistics Chief.**
- **Reports to IC if Logistics is not staffed.**
- **The function formerly known as "Stairwell Support" is now a function of Ground Support.**

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GROUND SUPPORT (cont'd)

- **Delivers required equipment to Staging area.**
- **Remove excess equipment at ground level.**

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Slide 5-88

GROUND SUPPORT (cont'd)

- **Additional water supply lines will be provided by Ground Support.**
- **A hoseline always should be placed in the stairwell to protect personnel working above the fire.**

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STRATEGIES

- **Determine number of personnel needed.**
- **Provide a separate radio for Ground Support.**
- **Officers must remain mobile and supervise the operation.**
- **Officers must monitor personnel for fatigue and arrange for relief.**

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Slide 5-90

STRATEGIES (cont'd)

- **When operating in stairwells:**
  – Assign two-person teams (so that equipment carrying can be alternated).
- **Adjust assignments based on:**
  – Stair type.
  – Long (or crossover) hallways.

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STRATEGIES (cont'd)

- **Personnel operating in stairwells should have proper PPE with them.**
- **Does not have to be worn while carrying equipment.**
- **Personnel should have street shoes to be worn if assigned to this function.**

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What needs are handled by the Ground Support?

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COMMUNICATIONS UNIT

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COMMUNICATIONS UNIT (cont'd)

- **Unit Leader reports to Logistics Chief.**
- **Unit ensures effective communications between IC and incident personnel.**
- **Unit Leader coordinates communication needs of outside agencies.**

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Slide 5-95

COMMUNICATIONS UNIT (cont'd)

Handles:
- **Portable radios**
- **Spare batteries**
- **Cellular phones**

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What needs are handled by the Communications Unit Leader?

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SYSTEMS UNIT

Slide 5-97

Slide 5-98

SYSTEMS UNIT (cont'd)

- **Operate, support or augment building systems**
- **Support building prefire plan**
- **Respond directly to requests from the OSC**

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SYSTEMS UNIT LEADER

- **Monitors and maintains built-in fire control, life safety, environmental control, communications, and elevator systems.**
- **Reports to Logistics Chief.**
- **Establishes a close liaison with building engineer, utility company representatives, and other Technical Specialists.**

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Slide 5-100

SYSTEMS UNIT LEADER RESPONSIBILITIES

- **Obtain briefing from Logistics Chief and building staff.**
- **Assess current situation.**
- **Request necessary personnel and resources.**

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SYSTEMS UNIT LEADER RESPONSIBILITIES (cont'd)

- **Requests response from building engineer, utility representatives, elevator service company representative, and others.**
- **Anticipates failure of building systems.**
- **Appoints personnel to monitor and/or operate system display and control panels.**

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SYSTEMS UNIT LEADER RESPONSIBILITIES (cont'd)

- **Evaluates status and operation of fire and domestic water pumps/supply.**
- **Monitors heating, ventilating, and air conditioning (HVAC) and smoke removal and stairwell systems.**
- **Evaluates, supports, and controls the building electrical system and emergency power.**

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SYSTEMS UNIT LEADER RESPONSIBILITIES (cont'd)

- **Evaluate, support and secure building communications systems.**
- **Secure operations and demobilizing.**

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What needs are handled by the Systems Unit Leader?

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PERSONNEL ACCOUNTABILITY

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PERSONNEL ACCOUNTABILITY (cont'd)

- **Difficult under even the best conditions.**
- **Turnover and relief is almost continuous.**
- **At ground level, only units dispatched and those that have arrived are tracked.**

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PERSONNEL ACCOUNTABILITY (cont'd)

- **List maintained by:**
  - **Base Manager.**
  - **Lobby Control Unit.**
  - **Staging.**
- **Planning and Logistics Section Chiefs keep records.**

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PERSONNEL ACCOUNTABILITY (cont'd)

- **Operations tracks companies sent to them for assignment.**
- **Division and group supervisors track companies.**
- **Getting a Personnel Accountability Report (PAR) requires a report from all elements of the organization.**

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PERSONNEL ACCOUNTABILITY (cont'd)

- **Command directs all requests for PARs to appropriate Section Chief.**
- **When a PAR is received, ground-level tracking updates company locations.**
  – **Is a "snapshot" of personnel accountability for that point in time.**

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PERSONNEL ACCOUNTABILITY (cont'd)

PARs conducted too:

- **Frequently, uses a large amount of radio time.**
- **Infrequently, leaves Command without knowledge of where companies are operating.**

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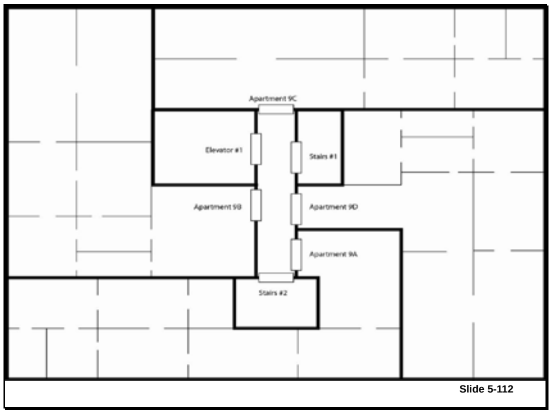
Activity 5.1
High-Rise Incident Management Team Functions

Slide 5-111

Slide 5-112



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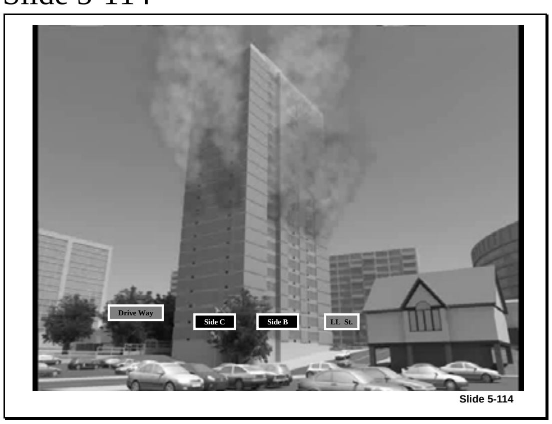

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Activity 5.2
High-Rise Simulation

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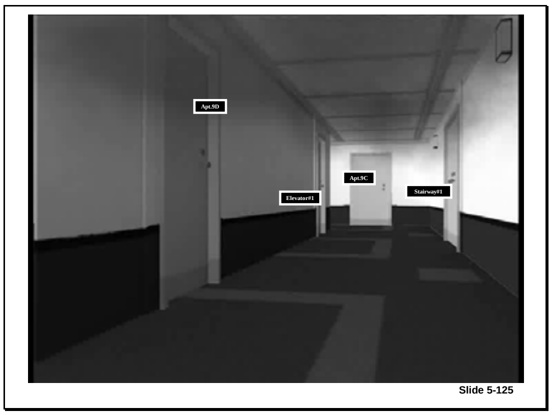

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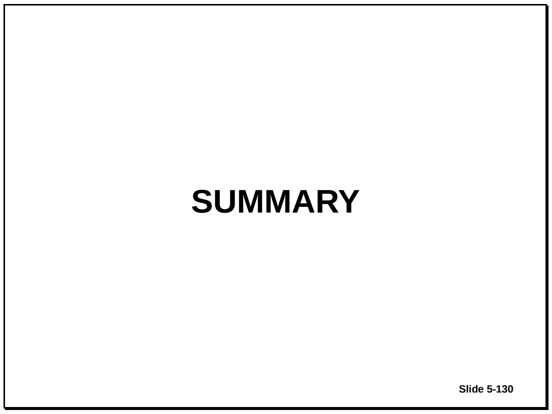

APPENDIX A
THE INCIDENT COMMAND SYSTEM

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COMMAND PROCEDURES — PURPOSE

Fire departments respond to a wide range of emergency incidents. This appendix identifies standard operating guidelines (SOGs) that can be employed in establishing Command. The system provides for effective management of personnel and resources for the safety and welfare of personnel. It also establishes procedures for implementation of all components of the Incident Command System (ICS) for high-rise fire operations.

Command procedures are designed to:

- fix the responsibility for Command on a specific individual through a standard identification system (depending on the arrival sequence of members, companies, and chief officers);
- ensure that a strong, direct, and visible Command will be established from the onset of the incident;
- establish an effective incident organization (which involves defining the activities and responsibilities assigned to the Incident Commander (IC) and to other individuals operating within the ICS);
- provide a system to process information (to support incident Command, planning, and decision making); and
- provide a system for the orderly transfer of Command (to subsequent arriving officers).

RESPONSIBILITIES OF COMMAND

The IC is responsible for the completion of tactical priorities. Tactical priorities consist of:

- removal of endangered occupants and treatment of the injured;
- stabilization of the incident and provision for life safety;
- conservation of property; and
- provision of safety, accountability, and welfare of personnel (ongoing throughout the incident).

The ICS is used to facilitate the completion of tactical priorities. The IC is the person who drives the ICS toward that end. The IC is responsible for building a Command structure that matches the organizational needs of the incident (in order to achieve completion of the tactical priorities for the incident). The functions of Command define standard activities performed by the IC to achieve the tactical priorities.

FUNCTIONS OF COMMAND

Functions of Command include

- assuming (and announcing) Command and establishing an effective operating position (Command Post (CP));

- rapidly evaluating the situation (sizeup);
- initiating, maintaining, and controlling the communications process;
- identifying the overall strategy, developing an Incident Action Plan (IAP), and assigning companies and personnel consistent with plans and SOGs;
- developing an effective incident Command organization;
- providing tactical objectives;
- reviewing, evaluating, and revising the IAP (as needed); and
- providing for the continuity, transfer, and termination of Command.

The IC is responsible for all of these functions. As Command is transferred, so is the responsibility for these functions. The first five functions must be addressed immediately from the initial assumption of Command.

ESTABLISHING COMMAND

The first fire department member or unit to arrive at the scene shall assume Command of the incident. The initial IC shall remain in Command until Command is transferred or until the incident is stabilized and terminated.

- The first unit or member on the scene must initiate whatever parts of the ICS are needed to manage the scene effectively.

- A single-company incident (trash fires, single-patient Emergency Medical Services (EMS) incidents, etc.) may require only that the company or unit acknowledge its arrival on the scene.

- For incidents that require the commitment of multiple companies or units, the first unit or member on the scene must establish and announce “Command,” then develop an incident Command structure appropriate for the incident.

The first-arriving fire department unit activates the Command process by giving an initial radio report.

The radio report should include the following eight elements:

1. Unit designation (of the unit arriving on scene).

2. A brief description of the incident situation (i.e., building size, occupancy, hazardous materials (haz mat) release, multivehicle accident, etc.).

3. Obvious conditions (working fire, hazmat spill, multiple patients, etc.).

4. Brief description of action(s) taken.

5. Declaration of strategy (this applies to structure fires).

6. Obvious safety concerns.

7. Assumption, identification, and location of Command.

8. Request or release of resources as required.

Examples

For an offensive structure fire
"Engine 11 is on the scene of a 10-story building with a working fire on the second floor. Engine 11 is laying a supply line and going in with a handline to the second floor for search and rescue. This is an offensive fire attack. Engine 11 will be 7th Street Command."

For a defensive structure fire
"Engine 1 is on the scene of a six-story carpet mill fully involved with exposures to the east. Engine 1 is laying a supply line and attacking the fire with a master stream and a handline to the exposure for search and rescue and fire attack. This is a defensive fire. Engine 1 will be Buckeye Command."

For an EMS incident
"Ladder 11 is on the scene with a multivehicle accident. Give me the balance of a first alarm medical assignment with three ambulances. Ladder 11 will be Parkway Command."

For a single company incident
"Engine 6 is on the scene of a dumpster fire with no exposures. Engine 6 can handle."

Radio Designation

The radio designation "Command" will be used along with the geographical location of the incident (i.e., "7th Street Command," "Metro Center Command"). This designation will not change throughout the duration of the incident. he designation of "Command" will remain with the officer currently in Command of the incident throughout the event.

COMMAND OPTIONS

The responsibility of the first-arriving unit or member to assume Command of the incident presents several Command options. Selection of an option depends upon the situation. If a chief officer, member, or unit without tactical capabilities (i.e., staff vehicle, no equipment, etc.) initiates Command, the establishment of a CP should be a top priority. At most incidents, the initial IC will be a Company Officer (CO). The following three Command options define the CO's direct involvement in tactical activities and the modes of Command that may be used.

Command Option 1: Nothing-Showing Mode

These situations generally require investigation by the initial arriving company while other units remain in a staged mode. The officer should go with the company to investigate while using a portable radio to Command the incident.

Command Option 2: Fast-Attack Mode

This is used when the CO's direct involvement is required to take an immediate action that will stabilize the incident. In these situations, the CO goes with the crew to provide the appropriate level of supervision. Examples of these situations include

- offensive fire attacks (especially in marginal situations);
- critical life safety situations (e.g., rescue) that must be achieved in a compressed time;
- any incident where the safety and welfare of firefighters are of major concern; and
- obvious working incidents that require further investigation by the CO.

Where fast intervention is critical, use of the portable radio will permit CO involvement in the attack without neglecting Command responsibilities. The fast-attack mode should not last more than a few minutes, and will end with one of the following results:

- The situation is stabilized.

- The situation is not stabilized and the CO must withdraw to the exterior and establish a CP. At some point, the CO must decide whether or not to withdraw the remainder of the crew — based on the crew's capabilities and experience, safety issues, and the ability to communicate with the crew. **No crew should remain in a hazardous area without radio communication capabilities.**

- Command is transferred to a higher ranking officer. When a chief officer is assuming Command, the chief officer may opt to return the CO to his/her crew, or assign him/her to a subordinate position.

The fast-attack mode will be applicable only in high-rise incidents when the incident is fairly close to the ground on a lower floor (the third floor or lower). For operations above the third floor, it will take time to get resources into the attack and to provide adequate support for those resources.

Command Option 3: Command Mode

Certain incidents (by virtue of their size, complexity, or potential for rapid expansion) require immediate strong, direct, overall Command. In such cases the CO initially will assume an exterior, safe, and effective Command position, and maintain it until relieved by a higher ranking officer. On high-rise fires, the IC may establish the CP in the building lobby, or 200 feet from the building. **A tactical worksheet should be initiated and used to assist in managing this type of incident.**

If the CO selects the Command mode, the following options are available regarding the assignment of remaining crew members.

- The officer may "move up" within the company and place the company into action with the remaining members. **One of the crew members will serve as the acting CO and should be provided with a portable radio.** The collective and individual capabilities and experience of the crew will regulate this action.

- The officer may assign crew members to work under the supervision of another CO. In such cases, the officer assuming Command must communicate with the officer of the other company and indicate the assignment of personnel.

- The officer may elect to assign the crew members to perform staff functions to assist Command.

A CO assuming Command has a choice of modes and degrees of personal involvement in the tactical activities but continues to be fully responsible for Command functions. The initiative and judgment of the officer are of great importance. The modes identified are guidelines to assist the officer in planning appropriate actions. The actions initiated should conform to one of the above-mentioned modes of operation.

PASSING COMMAND

In certain situations, it may be advantageous for a first-arriving CO to pass Command to the next company on the scene. This is indicated when the initial commitment of the first-arriving company requires a full crew (i.e., highrise or an immediate rescue situation) and another company is on the scene.

"Passing Command" to a unit that is not on the scene can create a gap in the Command process and compromise incident Command. **To prevent this "gap," Command shall not be assumed by an officer who is not on the scene.** Command can be passed to an incoming unit, but cannot be assumed until that arriving officer contacts the original officer and then assumes Command.

When a chief officer arrives at the scene at the same time as the initial arriving company, the chief officer should assume Command of the incident.

Should a situation occur where a later-arriving company (or chief officer) cannot locate or communicate with Command (after several radio attempts), they will assume and announce their assumption of Command, and initiate whatever actions are necessary to confirm the safety of the missing crew.

TRANSFER OF COMMAND

Command is transferred to improve the quality of the Command organization. The following guidelines outline the transfer of Command process. The transfer of Command through various ranking officers must be predetermined by local departments. An example of transfer of Command is presented below.

- The first fire department member arriving on the scene will automatically assume Command. This will normally be a CO, but it could be any fire department member up to and including the fire chief.
- The first-arriving CO will assume Command after transfer of Command procedures have been completed (assuming that an equal or higher ranking officer has not assumed Command already).
- The first-arriving chief officer should assume Command of the incident following transfer of Command procedures.
- The second-arriving chief officer should report to the CP for assignment.
- Later-arriving, higher ranking chief officers may choose to assume Command (or assume advisor positions).
- Assumption of Command is discretionary for assistant chiefs and the fire chief.

Within the chain of Command, the actual transfer of Command will be regulated by the following procedure:

- The officer assuming Command will communicate by radio or face-to-face with the person being relieved. Face-to-face is the preferred method to transfer Command.
- The person being relieved will brief the officer assuming Command. They will review the following minimum information:

  - Incident conditions (fire location and extent, hazmat spill or release, number of patients, etc.).

  - IAP.

  - Progress toward completion of tactical objectives.

- Safety considerations.

- Deployment and assignment of operating companies and personnel (from the Tactical Worksheet).

- Appraisal of need for additional resources.

- The person being relieved of Command should review the tactical worksheet with the officer assuming Command. This sheet provides the most effective framework for Command transfer. This is because the sheet outlines the location and status of personnel and resources in a standard form (that all members should be familiar with).

The person being relieved of Command will be reassigned (based on the needs of the incident) by the officer assuming Command.

GENERAL CONSIDERATIONS

The response and arrival of additional ranking officers on the incident scene strengthens the overall Command function. As the incident escalates, the IC should use these subordinate officers as needed.

A fire department's communications procedures should include communications necessary to gather and analyze information to plan, issue orders, and supervise operations. The following information should be relayed by the Tactical Officers (to their supervisor):

- assignment completed;
- additional resources required;
- unable to complete the assignment; and
- special information (partial collapse, haz mats in area, etc.).

The arrival of a ranking officer on the incident scene **does not** automatically mean that Command has been transferred to that officer. Command is transferred only when the outlined transfer of Command process has been completed. Chief officers and staff personnel should report directly to a designated location for assignment by the IC.

When time and circumstances allow, the officer who will be assuming Command should endeavor to perform his/her own sizeup (prior to assuming Command). This gives him/her an opportunity to see where companies are operating and an idea of their effectiveness. It also gives the officer an opportunity to establish his/her own perspective and understanding of the scope and magnitude of the incident. By doing this prior to assuming Command, the officer can gain some understanding of the current action plan and ease the transition from one IC to another. The officer should announce his/her onscene arrival to the IC, and advise that he/she will be doing the sizeup. Until the officer completes the sizeup and the formal transfer of Command process has taken place, the current IC maintains Command of the incident.

The IC has the overall responsibility for managing an incident. Simply stated, the IC has complete authority and responsibility for the incident. If a higher ranking officer wants to effect a change in the Command of an incident, he/she first must be on the scene of the incident, then use the transfer of Command procedure.

In extreme and life-threatening situations that affect personnel safety, anyone can effect change by initiating corrective action and notifying Command.

COMMAND STRUCTURE

It will be the responsibility of the IC to develop an organizational structure using SOGs. This structure should be developed as soon as possible after arrival and implementation of initial tactical control measures. The size and complexity of the organizational structure obviously will be determined by the scope of the emergency and availability of resources.

Incident Command System Operations

The ICS should be considered the basic command system to be used on any size or kind of incident. The only change seen in using the ICS for a very large incident (versus a small incident) is the method of growth of the basic emergency command organization to meet increased needs. Thus, the full establishment of the ICS should be viewed as an extension of the existing incident organization. The decision to expand the organization will be made by Command and will be done when determination is made that the initial attack or reinforced attack will be insufficient. This determination will be made by the IC at the scene.

Incident Command System Organizational Development

Figure 1-1 (Basic Incident Command System Organization and its Relationship to Incidents of Varying Size) shows how ICS organization applies to incidents of differing size.

Initial Response	**1 to 5 Increments/1st Alarm**
Reinforced Response	**Greater Alarm/Mutual Aid**

Figure 1-1
Basic Incident Command System Organization and its Relationship to Incidents of Varying Size

Initial Response

The first-arriving unit or officer will assume Command until arrival of a higher ranking officer. On arrival of a higher ranking officer, he/she will be briefed by the onscene IC. The higher ranking officer then will assume Command. This transfer of Command is to be announced. The officer being relieved of Command responsibilities will be reassigned by the new IC.

Reinforced Response

A reinforced response will be initiated when the onscene IC determines that the initial response resources will be insufficient to deal with the size or complexity of the incident.

COMMAND ORGANIZATION

The Command organization must develop at a pace that stays ahead of tactical deployment of personnel and resources. In order for the IC to manage the incident, he/she must first be able to direct, control, and track the positions and functions of all operating companies. Building a Command organization is the best support mechanism that the IC can use to achieve harmonious balance between managing personnel and incident needs. This is illustrated in Figure 1-2, which follows.

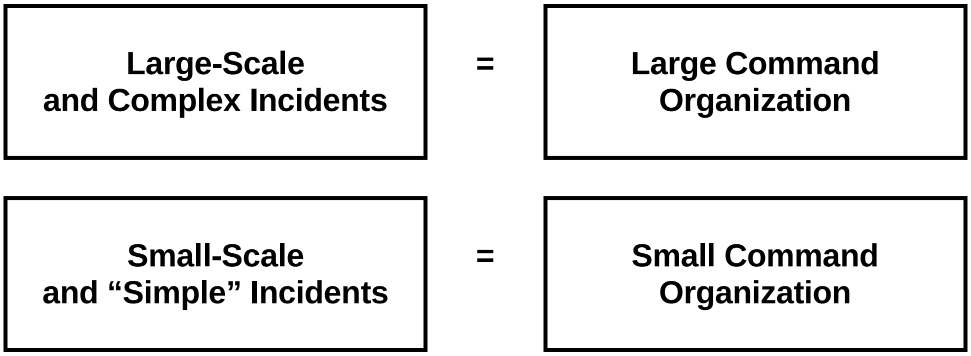

Figure 1-2
The Incident Command System: Large Versus Small Organization and Incidents

It is important to note that the IC should have more people working than Commanding.

Levels of Command

The basic configuration of Command includes three levels. These levels are shown in Figure 1-3, below.

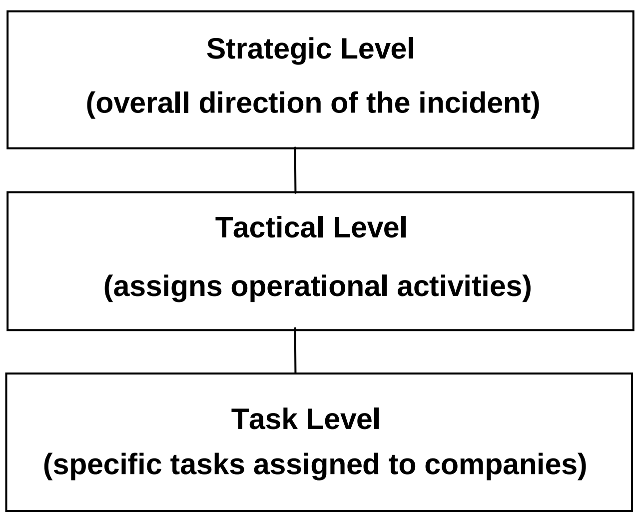

Figure 1-3
Basic Configuration of Command

Strategic Level

The strategic level involves the overall Command of the incident. The IC is responsible for the strategic level of the Command structure. The IAP should cover all strategic responsibilities, all tactical objectives, and all support activities needed during the entire operational period. The action plan defines where and when resources will be assigned to the incident to control the situation. This plan is the basis for developing a Command organization, assigning all resources, and establishing tactical objectives.

The strategic level responsibilities include

- determining whether offensive or defensive (these should be well defined in SOGs);
- determining appropriate strategy;
- establishing overall incident objectives;
- setting priorities;
- developing an action plan;
- obtaining and assigning resources;
- predicting outcomes and planning; and
- assigning specific objectives to tactical level units.

Tactical Level

Branches, divisions, and groups direct operational activities toward specific objectives. Branches, divisions, and groups are responsible for specific geographic areas or functions and supervising assigned personnel. A tactical-level assignment comes with the authority to make decisions and assignments within the boundaries of the overall plan and safety conditions. The accumulated achievements of tactical objectives should accomplish the strategy as outlined in the action plan.

The strategic level of Command refers to the overall, or global, plan that will be used to bring a resolution to the problems facing the IC. The IC is responsible for determining what the overall plan is and in what order those elements will be accomplished. In structural firefighting, the normal strategies are rescue, exposure protection, confinement, extinguishment, and overhaul. These five are in priority order and may be accompanied as needed by ventilation and salvage. These are the “what” of the solution.

For example, in a two-story dwelling fire with fire on the first floor and a person leaning from a second floor window, the IC will process the data and determine that the strategies for the **first-in** companies are rescue, ventilation, confinement, and extinguishment.

The tactical level involves the “how” of the solution. From the example above, the IC would direct companies to:

1. Rescue the person at the window and do a primary search of the dwelling.

2. Confine the fire to the first floor while protecting the interior stairs to the second floor.

3. Extinguish the fire on the first floor and check for extension, especially on the floor above.

4. Provide ventilation to support rescue, then to support fire confinement.

While both the strategic and tactical levels may be accomplished by the IC, when there is an Operations Section Chief, the strategic level is done by the IC and tactical level is done by the Operations Section Chief.

<u>Task Level</u>

The task level refers to those activities normally accomplished by individual companies or specific personnel. The task level is where the work is actually done. Task-level activities are routinely supervised by COs. The accumulated achievements of task-level activities should accomplish tactical objectives.

COMMAND STRUCTURE

Basic Organization

The most basic structure combines all three levels of the Command structure. As illustrated in Figure 1-4 (below) the CO on a single-engine response to a dumpster fire determines the strategy and tactics and supervises the crew doing the task.

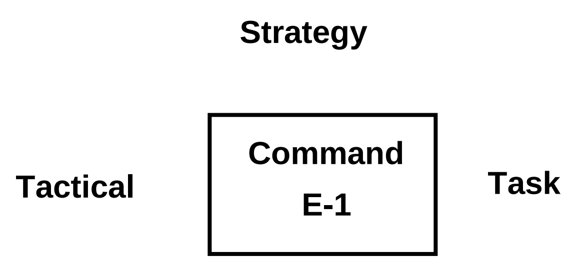

Figure 1-4
Basic Structure: Single Unit Response

The basic structure for a routine incident, involving a small number of companies, requires only two levels of the Command structure. As shown in Figure 1-5, the role of Command combines the strategic and tactical levels. Companies report directly to Command, and operate at the task level.

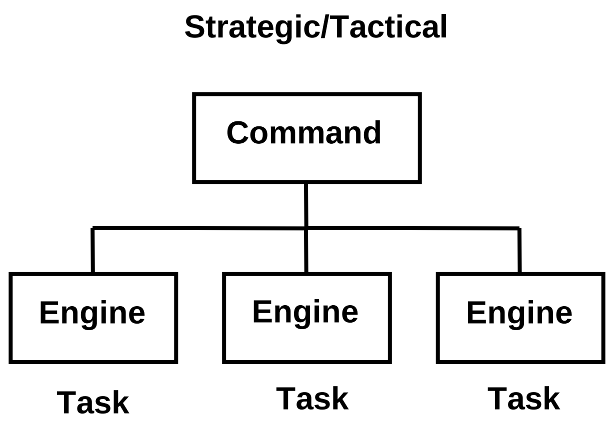

Figure 1-5
Basic Structure: Multiunit Response

Divisions and Groups

Divisions represent geographic operations and groups represent functional operations.

As an incident escalates, the IC should group companies to work in divisions and groups. A division is the organizational level having responsibility for operations within a defined geographic area. In order to use division and group terminology effectively, a department must have a designated method of dividing an incident scene.

Division Designation

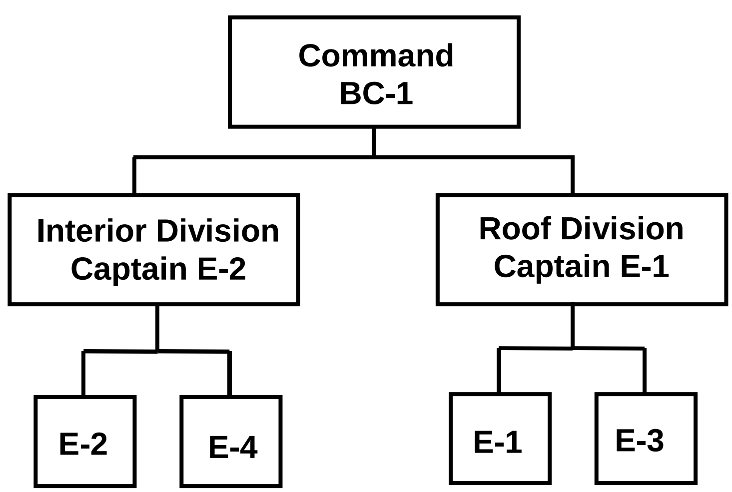

Figure 1-6
Division Designation

Tactical Assignments for a Multistory Incident Division Designation

As shown in Figure 1-7, when working with multistory occupancies, divisions usually will be indicated by floor number (Division 6 indicates sixth floor). When operating in levels below grade, such as basements, the use of subdivisions is appropriate.

Division 6 = 6th floor
Division 5 = 5th floor
Division 4 = 4th floor
Division 3 = 3rd floor
Division 2 = 2nd floor
Division 1 = 1st floor
Subdivision 1 = below grade
Subdivision 2 = below grade

Figure 1-7
Division Designations

Exterior designations are identified by alphabetical letters. The front of the building is designated as "Division A" and the remaining sides of the building are assigned the radio designation "B," "C," or "D" (in a clockwise manner). Division A will always be the front (or address) side of the building. Figure 1-8, Exterior Designations, illustrates this process.

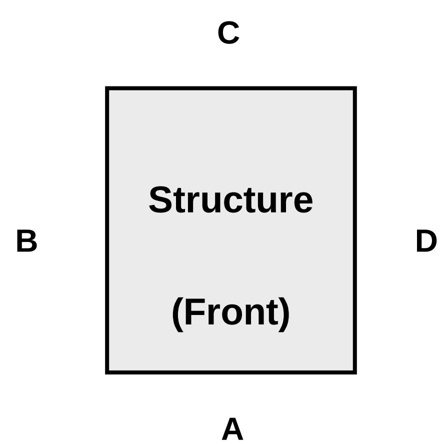

Figure 1-8
Exterior Designations

Note that for clarity of purpose during radio communications, the phonetic designations of “Alpha,” “Bravo,” “Charlie,” and “Delta” are suggested. (For example: “Command from Division Delta.”)

A division is that organizational level having responsibility for operations within a defined geographic area. The division level is organizational between single resources, task force, or the strike team and the branch.

Group Designation

Groups are an organizational level responsible for a specific functional assignment at an incident. Examples are Salvage Group, Search Group, Rescue Group, Haz mat Group, and Medical Group.

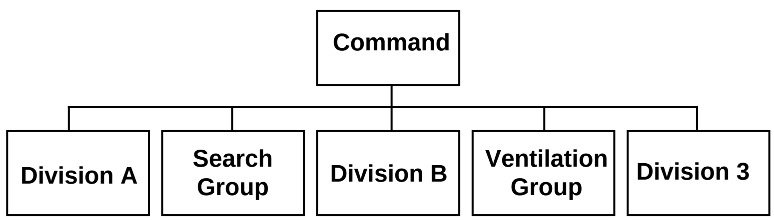

Figure 1-9
Division/Group Designation

Basic Operational Approach

The use of divisions and groups in the Command organization provides a standard system to divide the incident scene into smaller, subordinate Command units or areas.

Complex emergency situations often exceed the capability of one officer to manage the entire operation effectively. Divisions and groups reduce the span of control to more manageable, smaller units. Divisions and groups allow the IC to communicate principally with these organizational levels (rather than multiple individual COs), thus providing an effective Command structure and incident scene organization. Generally, division and group responsibilities should be assigned early in the incident, **typically to the first company assigned to a geographic area or function.** This early establishment of divisions and groups provides an effective incident command organization framework on which the operation can be built and expanded.

The number of divisions and groups that can be managed effectively by the IC varies. Normal span of control is three to seven. In fast-moving, complex operations a span of control of no more than five divisions and groups is indicated. In slower moving, less complex operations the IC may manage more divisions and groups effectively.

Where the number of divisions and groups exceeds the span of control that the IC can manage effectively, the incident organization can be expanded to meet incident needs by the assignment of a branch director. Each branch is responsible for several of these divisions and groups and should be assigned a separate radio channel, if available.

The division and group procedures provide an array of major functions that may be implemented selectively according to the needs of a particular situation. This places responsibility for the details and execution of each particular function on a division and group.

When effective divisions and groups have been established, the IC can concentrate on overall strategy and resource assignments. This allows the divisions and groups to manage their assigned units. The IC determines strategy and assigns tactical objectives and resources to each division and group. Each division and group supervisor is responsible for the tactical deployment of the resources at his/her disposal in order to complete the tactical objectives assigned by the IC. Division and group supervisors also are responsible for communicating their needs and progress to Command.

Divisions and groups reduce the overall amount of radio communications. Most routine communications within a division and group should be conducted face-to-face between COs and their supervisor. This process reduces unnecessary radio traffic and increases the ability to transmit critical radio communications.

The safety of firefighting personnel represents the major reason for establishing divisions and groups. Each division and group supervisor must maintain communication with assigned companies to control both their position and function. This supervisor must monitor all hazardous situations and risks to personnel constantly. The division and group supervisor must take appropriate action to ensure that companies are operating in a safe and effective manner.

The IC should begin the assignment of divisions and groups based on the following factors:

- Situations that will involve a number of companies or functions beyond Command's span of control. Command should assign initial responsibility for division and group operations to the first CO assigned to a geographic area or function. As additional chief officers become available, they may be assigned to relieve the CO of responsibility for the area or function.

- When companies are involved in complex operations (large interior or geographic area, hazardous materials operations, technical rescues, high-rise fires, etc.).

- When companies are operating from tactical positions that Command has little or no direct control over (i.e., they are out of Command's sight).

- When the situation presents special hazards and close control is required over operating companies (i.e., unstable structural conditions, heavy fire load, marginal offensive situations, etc.).

When establishing divisions and groups, the IC will assign/advise each unit of the following items:

- tactical objectives to be accomplished;
- radio designation (Ventilation Group, Division "A");
- identity of resources assigned to the specific division and group; and
- the importance of coordinating/communicating their actions to adjacent division and group supervisors (prior to starting an activity).

Guidelines

Divisions and groups will be regulated by the following guidelines:

- It will be the ongoing responsibility of Command to assign divisions and groups as required for effective emergency operations. This assignment will relate to both geographic and functional tactical assignments.

- Command shall advise each division and group of specific tactical objectives. The overall strategy and plan will and should be provided if time permits. This is so supervisors of the divisions and groups have some idea of what is going on and how their assignment fits into the overall plan.

- The number of companies assigned to a division and group will depend on conditions within that area of responsibility. Command will be aware of the number of companies operating within a division and group and the capability of that specific division and group to direct operations effectively. If a division or group cannot control the resources within the division or group, it should notify the IC so that responsibilities can be split or other corrective action taken. In most cases three to seven companies represent the maximum span of control for a division or group.

- The incident scene should be subdivided in a manner that makes sense. This should be accomplished by assigning divisions to geographic locations (e.g., Roof Division, Division "A") and assigning functional responsibilities to groups (e.g., Ventilation Group, Salvage Group).

Division and group supervisors will use the division/group designation in radio communications (e.g., "Command from Roof Division").

Divisions and groups will be commanded by chief officers, COs, or any other fire department member designated by Command.

The specific guideline for optimum span of control in divisions and groups is five subordinates. This applies to operational divisions and groups. Many of the functional positions (Public Information, Safety, Liaison, etc.) are preassigned to certain individuals and are driven by SOGs.

These types of functional responsibilities should operate automatically, and as such, should not be included in the IC's span of control.

Regular transfer of Command procedures should be followed in transferring division and group responsibility.

In some cases, a supervisor may be assigned initially to an area/function to evaluate and report conditions and advise Command of needed tasks and resources. The assigned officer will proceed to the division or group, evaluate and report conditions to the IC, and assume responsibility for directing resources and operations within his/her assigned area of responsibility.

The division and group supervisor must be in a position to supervise and monitor operations directly. This will require the division and group supervisor to be equipped with appropriate protective clothing and equipment for his/her area of responsibility. Division and group supervisors assigned to operate within the hazard zone must be accompanied by a partner, if they are not in close proximity to operating personnel.

These supervisors will be responsible for, and in control of, all assigned functions within their division and group. This requires each division and group supervisor to:

- complete objectives assigned by Command;
- account for all assigned personnel;
- ensure that operations are conducted safely;
- monitor work progress;
- redirect activities as necessary;
- coordinate actions with related activities and adjacent divisions and groups to ensure the safety of operations and activities (i.e., a search crew may depend upon a division for protection on a floor during their search operation);
- monitor welfare of assigned personnel;
- request additional resources (as needed);
- provide Command with essential and frequent progress reports; and
- redirect or release resources within the division and group.

The division and group supervisor should be readily identifiable and maintain a visible position as much as possible.

The primary function of COs working within a division or group is to direct the operations of their individual crews in performing assigned tasks. COs will advise their division or group supervisor of work progress (preferably face-to-face). All requests for additional resources or assistance within a division or group must be directed to the division or group supervisor. These supervisors will communicate with Command.

Each division and group supervisor will keep Command informed of conditions and progress in his/her division and group through regular progress reports. These supervisors must limit progress reports to essential information only.

Command must be advised immediately of significant changes, particularly those changes involving the ability (or inability) to complete an objective, or of hazardous conditions, accidents, structural collapse, and similar events.

When a company is assigned from Staging to an operating division or group, the company will be told what division and group they will be reporting to and the name of the supervisor. The division or group supervisors will be informed of those companies or units that have been assigned by the IC. It is then the responsibility of these supervisors to contact the assigned company to transmit any instructions relative to the specific action requested.

Division and group supervisors will monitor the condition of the crews operating in their area of responsibility. Relief crews will be requested in a manner that assures the safety of personnel and maintains progress toward the divisions' or groups' objectives.

These supervisors will ensure an orderly and thorough reassignment of crews to incident rehab. Crews must report to the incident rehab intact to facilitate accountability.

EXPANDING THE INCIDENT COMMAND SYSTEM

As a small incident escalates into a major incident, the span of control may become stretched as more tactical-level management units are implemented. In addition, the IC can become overwhelmed and overloaded quickly with tasks such as information management, assigning companies, filling out and updating tactical worksheets, planning, forecasting, requesting additional resources, talking on the radio, and fulfilling all other functions of Command. The immediate need of the IC is support. As additional ranking officers arrive on the scene, the Command organization may be expanded through implementation of branches and sections and the involvement of officers and staff personnel to fill Command and General Staff positions.

Section-level positions can be implemented at any time, based on the needs of the incident. One of the first sections typically implemented is the Operations Section Chief.

Operations Section

The Operations Section is responsible for the direct management of all incident tactical activities, tactical priorities, and the safety and welfare of personnel working in the Operations Section. The Operations Section Chief uses the appropriate radio channel to communicate strategic and specific objectives to the branches and/or divisions and groups.

The Operations Section is implemented most often (staffed) as a span-of-control mechanism. When the number of branches (or divisions and groups) exceeds the capability of the IC to manage effectively, the IC may staff the Operations Section to reduce the span of control (and thus transfer direct management of all tactical activities to the Operations Section Chief). The IC then is able to focus his/her attention on the management of the entire incident rather than concentrating on tactical activities. The Operations Section Chief's responsibilities will be discussed in detail later.

Branches

As previously discussed in this course, divisions and groups identify tactical level assignments in the Command structure. As the span of control begins to become excessive, the incident automatically becomes more complex. Two or more distinctly different operations (i.e., fire, medical, evacuation, etc.) may develop. At this point, the organization can be subdivided further into branches.

Branches may be established during an incident to serve more than one purpose. However, they are not always essential to the organization of the Operations Section.

In general, branches may be established for the following reasons:

- Span of control.
- Functional.
- Multijurisdictional.
- The numbers of divisions and groups exceed the recommended span of control for the Operations Section Chief. (At this point, the IC or Operations Section Chief should designate a multibranch structure and allocate the divisions and groups within those branches.)

In high-rise firefighting, ventilation, medical, search, rescue, and fire attack each could become a branch operation. For example, the Ventilation Branch Director in a 20-story building may have a Roof Division (roof ventilation), a Ventilation Group for floors 16 to 20 (Vent Group 16 to 20), and a Ventilation Group for floor 15 (Vent Group 15 on the fire floor). Based on the type and occupancy of the highrise, there may also be a Police Branch.

In Figure 1-10 (Before Multibranch Structure), one group and four divisions report to the Operations Section Chief. A two-branch organization is formed when two additional divisions and one group are added (as reflected in Figure 1-11 (Two-Branch Organization)).

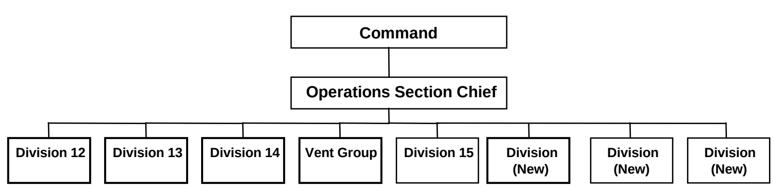

Figure 1-10
Before Multibranch Structure

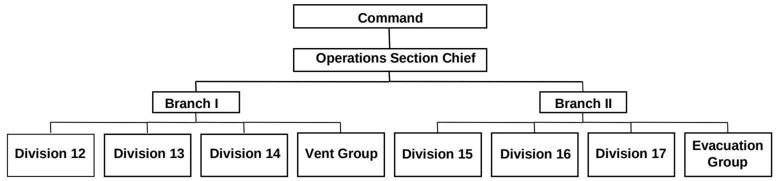

Figure 1-11
Two-Branch Organization

Branches should operate (in their area of responsibility) on separate radio channels. If possible, they should communicate to Operations on a different channel. The radio designation of functional branches should reflect the objective of the branch (i.e., Haz mat Branch, Multicasualty Branch, etc.). Tactical branches may be designated numerically (i.e., Branch I, Branch II, Branch III, etc.). When Operations implements Branch Directors, Division and Group Supervisors **must** be notified of their new supervisor. Notification information should include

- what branch the division or group is assigned currently; and
- the radio channel the division or group is operating on (in the branch).

Radio communications then should be directed from the division or group supervisor to the branches (instead of Command or Operations). Branch Directors will receive direction from Command or Operations, which then will be relayed to the divisions and groups.

In high-rise operations, branches should be located at operational locations. When a high-rise incident encompasses a large geographic area, it is more effective to have branches in tactical locations. When branches are sent to tactical positions, they should implement Command and control procedures within their branch immediately. In these situations, Operations must assign someone to monitor a “Command channel.”

Branches are not limited to Operations. Any Section Chief may recommend the implementation of branches within his/her sections (with approval of the IC).

Figures 1-12 and 1-13 illustrate the expansion from an original (overloaded) organization to an expanded (corrected) organization.

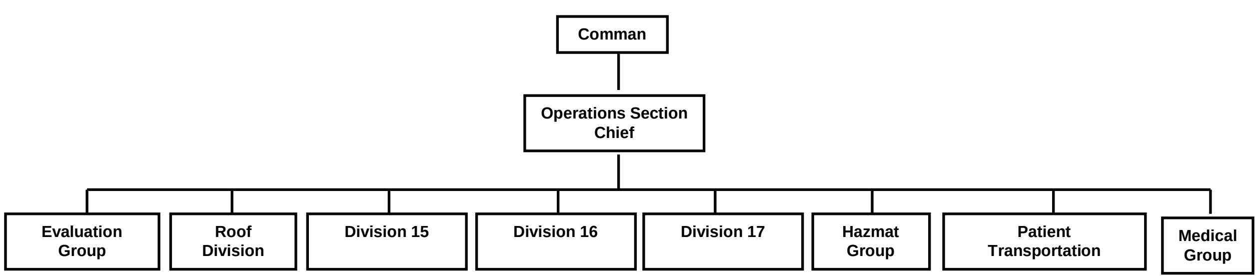

Figure 1-12
“Original” (Overloaded) Organization

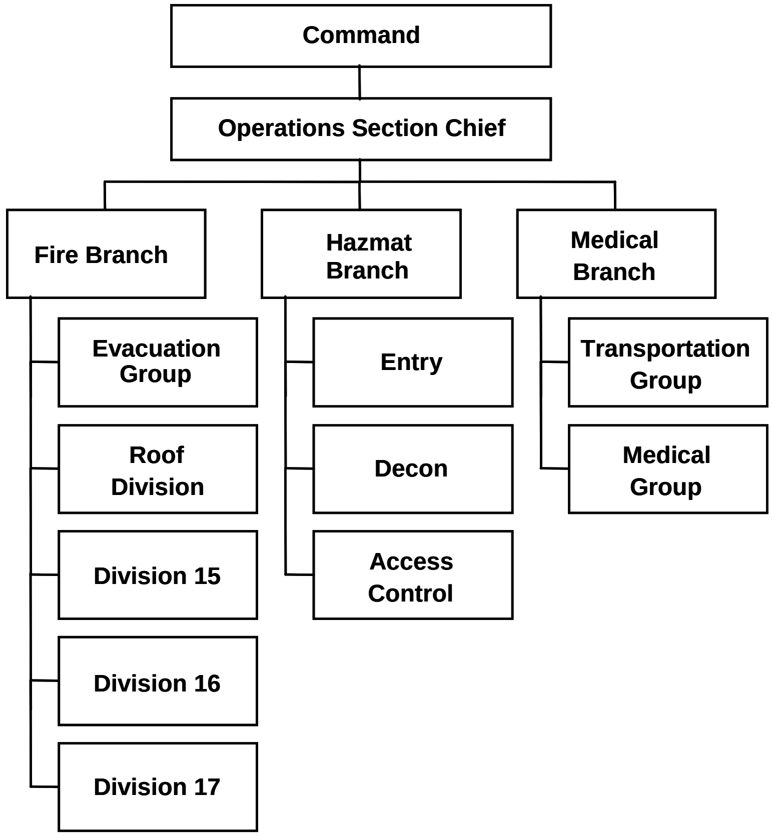

Figure 1-13
"Expanded" (Corrected) Organization

Functional Branch Structure

When the nature of the incident calls for a functional branch structure (such as a major aircraft crash within a jurisdiction), three departments within the jurisdiction (police, fire, and health service) each will have a functional branch operating under the direction of a single Operations Section Chief. In this example, the Operations Section Chief is from the fire department. The Operations Section Chief has deputies from police and health services departments. Other alignments could be made depending upon the jurisdictional plan and the type of emergency. Note that incident Command in this situation could be single or unified depending upon the jurisdiction.

Figure 1-14 illustrates this functional branch structure.

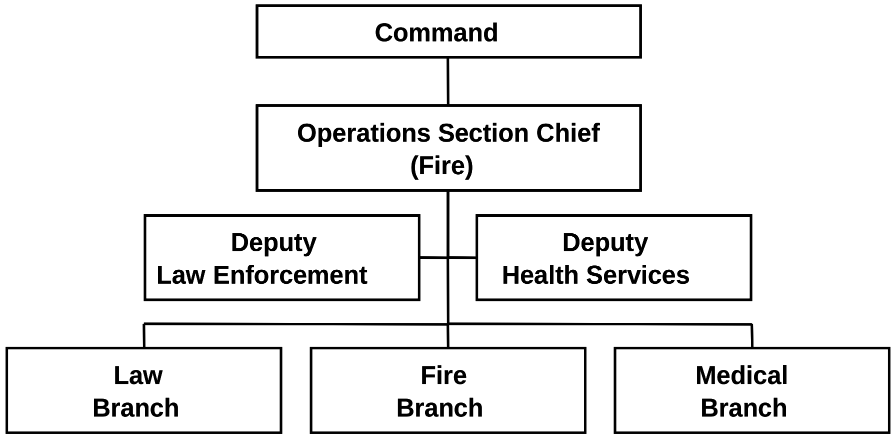

Figure 1-14
Functional Branches Illustrating Three Agencies

Multijurisdictional Incidents

When the incident is multijurisdictional, resources are managed best by the agencies that have normal control over those resources.

Branches should be used at incidents where the span of control with divisions and groups is maximized, or at incidents involving two or more distinctly different management components (e.g., a large fire with a major evacuation, a large fire with a large number of patients). The IC may elect to assign branches to forward positions to manage and coordinate activities, as illustrated in Figure 1-15, below.

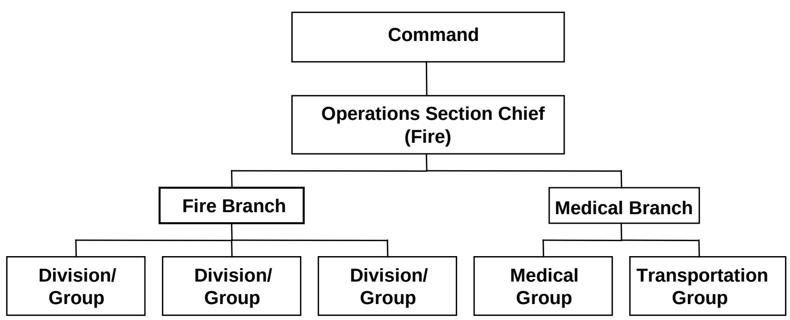

Figure 1-15
Multibranch Organization Under an Operations Chief

When the incident requires the use of aircraft (such as for the transportation of victims from a multicasualty incident, high-rise rooftop rescue, swift water rescue, or wildland fire), the Operations Section Chief should establish an Air Operations organization. Its size, organization, and use will depend primarily upon the nature of the incident and the availability of aircraft. This branch reports to the Operations Section Chief.

Air Operations Branch

It should not be assumed that a helicopter can land on the roof of every high-rise building. In most cases, landing probably cannot be done safely unless the code under which the building was built required a helicopter landing facility on the roof of the building. Obstructions on high-rise building roofs (antennas, machinery rooms, etc.) also can preclude the ability to land a helicopter.

If a helicopter is needed (but one under the control of the fire department is not available), arrangements should be made with another agency to provide the helicopter. Agencies that may be able to provide a helicopter include police, public works departments, news media, and hospitals. It should be understood that helicopters should **not** approach a high-rise building unless ordered to do so by Command officers. The noise and downdraft created by helicopters can interfere with ground operations and communications. Figure 1-16 illustrates the Air Operations Branch under the Operations Section Chief.

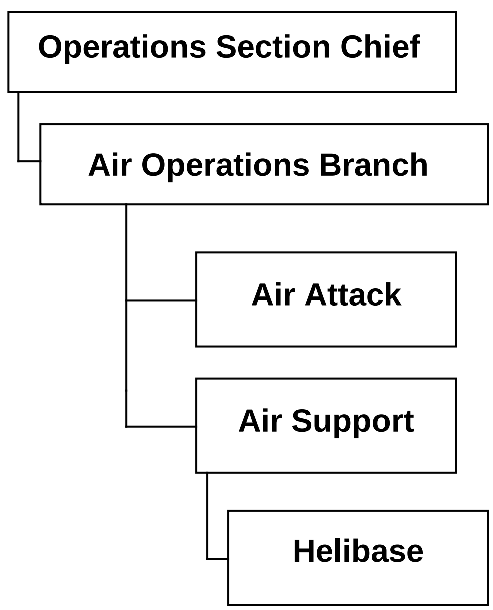

Figure 1-16
Air Operations Branch

EXPANDING THE INCIDENT ORGANIZATION

As the organization expands to deal with a major incident, the IC will, in turn, need additional CP support. The Operations Section Chief is one of the first support positions to be implemented.

The following organization chart (Figure 1-17) illustrates how the ICS can expand to fit the size and complexity of various types of incidents.

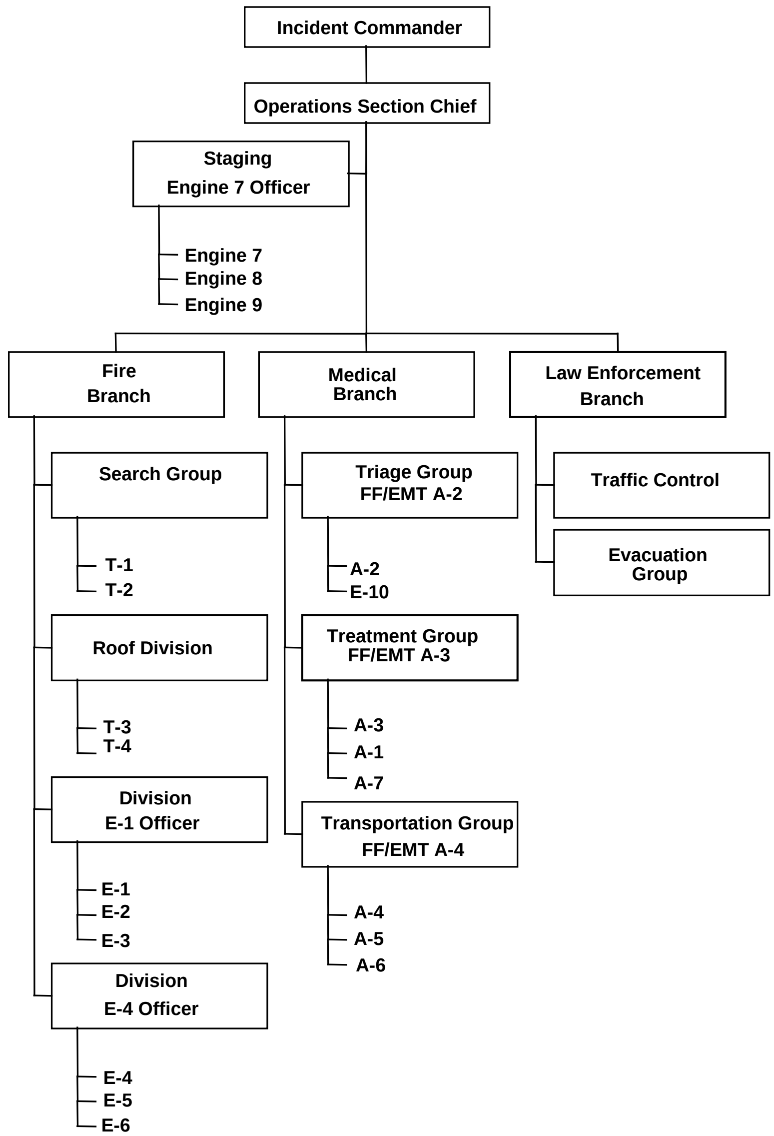

Figure 1-17
Command Procedures:
Expanding the Organization (Structure Fire)

ORGANIZATIONAL HIERARCHY

The ICS organizational structure develops in a modular fashion based upon the type and size of an incident. The organization's staff builds from the top down with responsibility and performance placed initially with the IC. As the need exists, four separate sections can be developed, each with several units that may be established. The specific organizational structure established for any given incident will be based upon the management needs of the incident. No further organization is required if one individual can manage all major functional areas simultaneously. If one or more of the areas requires independent management, an individual is named to be responsible for that area.

For ease of reference and understanding, personnel assigned to manage at each level of the organization will carry one of the following distinctive organizational titles:

- **Command**. Refers to the IC.
- **Officer**. Refers to a member of the Command Staff (Public Information Officer, Safety Officer, Liaison Officer).
- **Section Chief**. Refers to a member of the General Staff (Planning Section Chief, Operations Section Chief, Finance/Administration Section Chief, Logistics Section Chief).
- **Director**. Refers to the positions of Branch Director, which falls within the Operations Section or Logistics Section between the divisions, groups, or units and the Operations Section Chief (Branch Directors, Air Operations Branch Director, Service Branch Director).
- **Supervisor**. Refers to the division and group supervisors (which are in the Operations Section and lie between the Branch Director and Strike Team/Task Force Leader).
- **Unit Leader**. Refers to a position with supervision and management responsibility of either a group of resources or a unit (such as Ground Support, Medical, Supply, Engine 5, etc.).
- **Manager**. Refers to the lowest level of supervision within the Logistics Section (Equipment Manager, Base Manager, Camp Manager). The only exception to this is the Staging Area Manager who reports directly to the Operations Section Chief.
- **Single Resource**. Refers to an engine company or truck company with a CO and crew.

COMMAND STRUCTURE: EXPANDING THE ORGANIZATION — SECTIONS

As previously noted, as a small incident escalates into a major incident, additional organizational support will be required. The IC can become overwhelmed and overloaded quickly with information management, assigning companies, filling out and updating the tactical worksheets, planning, forecasting, requesting additional resources, talking on the radio, and fulfilling all other functions of Command. The immediate need of the IC is support. As additional ranking officers arrive on the scene, the Command organization may be expanded through the involvement of officers and staff personnel to fill Command and General Staff positions.

Section- and unit-level positions within the ICS will be activated only when the corresponding functions are required by the incident.

Until such time as a section or unit is activated, all functions associated with that section or unit will be the responsibility of the IC (or the appropriate Section Chief). It may be necessary that two or more units be combined into a single unit.

The Command structure defines the lines of authority, but it is not intended that the transfer of information within the ICS be restricted to the chain of Command. An individual will receive orders from a superior, but may give information to any position in a different part of the organization within the guidelines specified in the operational procedures for each position.

The majority of positions within the ICS will not be activated until the initial response is determined to be insufficient to handle the situation. Once this occurs, qualified personnel are requested (through normal dispatching procedures) to fill the positions determined to be required for the type of incident in progress. If it is determined later that a specific position is not needed, the request can be canceled. Some agencies have elected to use a modular form of dispatching (such as entire units).

The transition from initial response to a major incident organization will be evolutionary. Positions will be filled as the corresponding tasks are required.

During the initial phases of the incident, the IC normally carries out the following four section functions:

1. Operations.

2. Planning.

3. Logistics.

4. Finance/Administration.

These functions comprise the General Staff within a fully expanded incident organizational structure.

Section-level positions can be implemented at any time. Implementation is based on the needs of the incident. One of the first sections typically implemented is the Operations Section Chief.

Operations Section

The Operations Section is responsible for the direct management of all incident tactical activities, tactical priorities, and the safety and welfare of personnel working in the Operations Section. The Operations Section Chief uses the appropriate radio channel to communicate strategic and specific objectives to the branches and/or divisions and groups.

The Operations Section is implemented (staffed) most often as a span-of-control mechanism. When the number of branches or divisions and groups exceeds the IC's management capability, the IC then may staff the Operations Section. This is done to reduce their span of control and thus transfer direct management of all tactical activities to the Operations Section Chief. The IC then is able to focus his/her attention on management of the **entire** incident rather than concentrating on tactical activities.

Operations Section Chief

The Operations Section Chief is responsible for the direct management of all incident tactical activities and should have direct involvement in the preparation of the action plan for the period of responsibility.

Operations Section Chief responsibilities may be summarized as follows:

- manages incident tactical activities;
- coordinates activities with the IC;
- implements the action plan;
- assigns resources to tactical level areas (based on tactical objectives and priorities);
- builds an effective organizational structure (through the use of branches and tactical level management units);
- provides tactical objectives for the tactical level management units;
- controls Staging and air operations;
- provides for life safety;
- determines needs and requests additional resources; and
- consults with and informs other sections and the incident command staff (as needed).

Figure 1-18 illustrates the types of functions generally seen in the Operations Section.

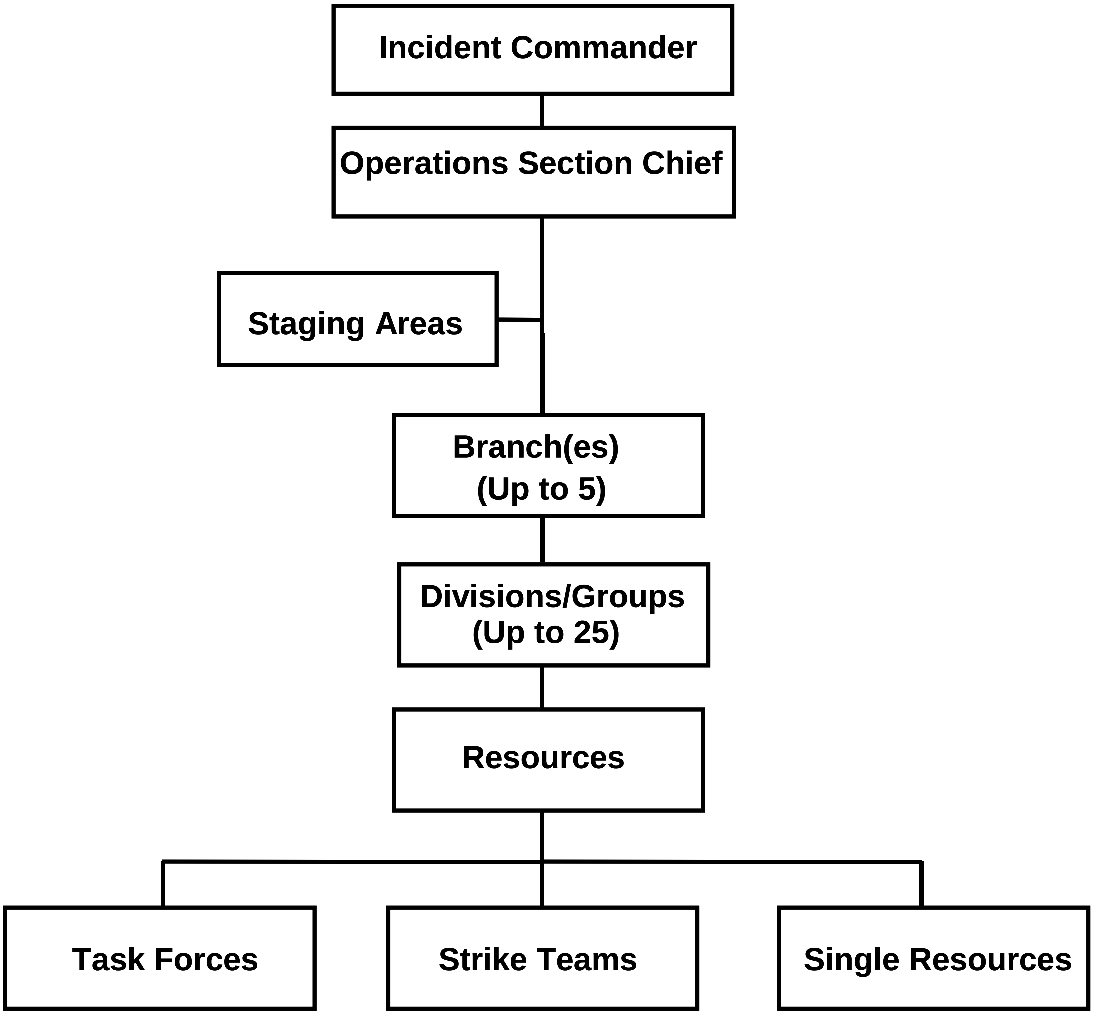

Figure 1-18
Operations Section/Functions

Staging Areas

The incident scene can become congested with emergency equipment quickly if this equipment is not managed effectively. Staging Areas are locations designated within the incident area that are used to temporarily locate resources available for immediate assignment. For major or complex operations the IC should establish a central Staging Area early (and place an officer in charge of Staging). A radio designation of "Staging" should be used.

In this expanded organizational structure, the Staging Area Manager reports to the Operations Section Chief. The Operations Section Chief may establish, move, and discontinue the use of Staging Areas as needed. All resources within designated Staging Areas are under the direct control of the Operations Section Chief, and should be available immediately. Staging will request logistical support (e.g., food, fuel, and sanitation) from the Logistics Section.

Figure 1-19 shows where the Staging Area falls within the ICS hierarchy.

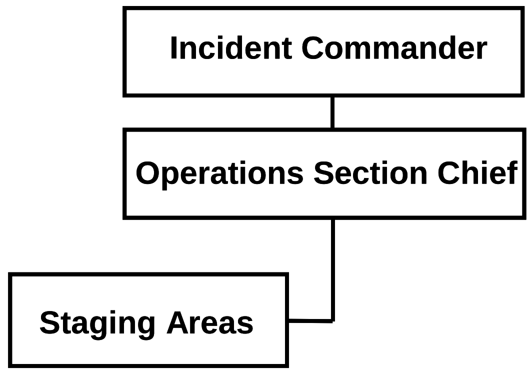

Figure 1-19
Staging Area

Planning Section

The Planning Section is responsible for gathering, assimilating, analyzing, and processing information needed for effective decision making. Information management is a full-time task at large and complex incidents. The Planning Section serves as the IC clearinghouse for information. This allows the IC staff to actually provide information versus having to deal with dozens of information sources in order to find needed information. Critical information should be forwarded immediately to Command (or whoever needs it). Information also should be used to make long-range plans. The Planning Section Chief’s goal is to plan ahead of current events and to identify the need for resources before they are needed.

Figure 1-20 shows the Planning Section and those units that fall beneath it.

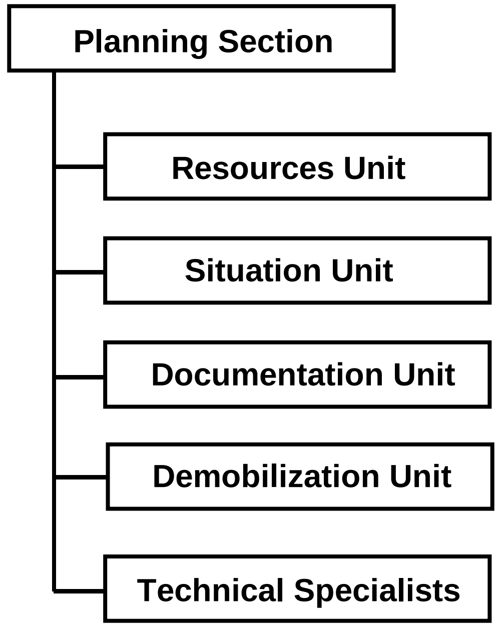

Figure 1-20
Planning Section

The responsibilities of the Planning Section Chief may be summarized as follows:

- evaluates current strategy and plan with the IC;
- maintains resource status and personnel accountability;
- refines and recommends needed changes to plan (with Operations Section input);
- evaluates incident organization and span of control;
- forecasts possible outcome(s);
- evaluates future resource requirements;
- uses technical assistance (as needed);
- evaluates tactical priorities, specific critical factors, and safety;
- gathers, updates, improves, and manages situation status with a standard systematic approach;
- coordinates planning needs with available outside agencies;
- plans for incident demobilization; and
- maintains incident records.

Logistics Section

The Logistics Section is the support mechanism for the organization. Logistics provides services and support systems to all organizational components involved in the incident (including facilities, base, transportation, supplies, equipment maintenance, fueling, feeding, communications, and medical services, including responder rehabilitation).

Figure 1-21 reviews possible Logistics Section components.

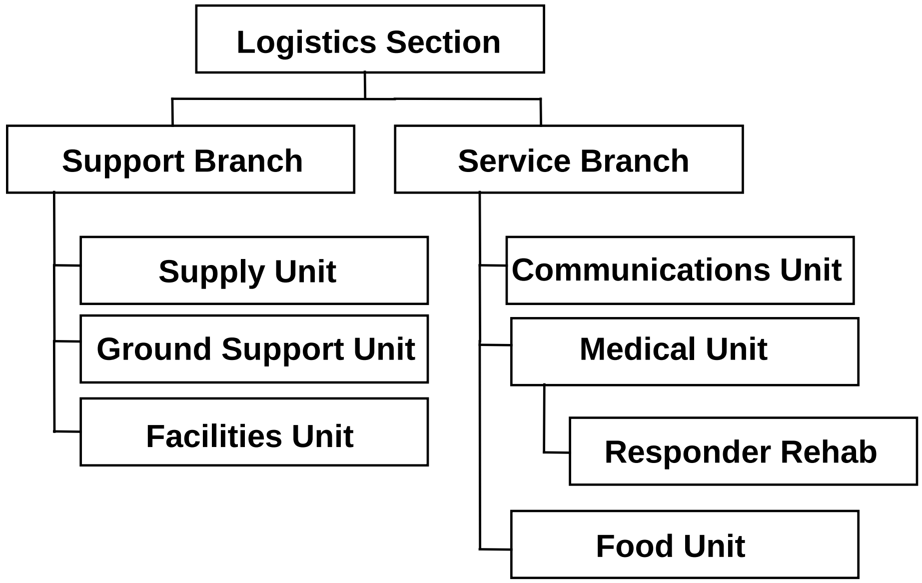

Figure 1-21
Logistics Section

The responsibilities of the Logistics Section Chief may be summarized as follows:

- provides for medical aid for response personnel and manages responder rehabilitation;
- coordinates immediate critical incident stress debriefing function;
- provides and manages needed supplies or equipment;
- forecasts and obtains future resource needs (coordinates with Planning Section);
- provides for communications plan and needed communications equipment;
- provides fuel and needed repairs for equipment;
- obtains specialized equipment or expertise (per Command);
- provides food and associated supplies;
- secures needed fixed or portable facilities;
- provides other logistical needs (as requested by Command); and
- supervises assigned personnel.

Finance/Administration Section

The Finance/Administration Section is established for incidents when agencies involved have a specific need for financial services. Not all agencies will require the establishment of a separate Finance/Administration Section. In cases where only one specific function is required (such as cost analysis), that position could be established as a Technical Specialist in the Planning Section.

Figure 1-22 illustrates the Finance/Administration Section.

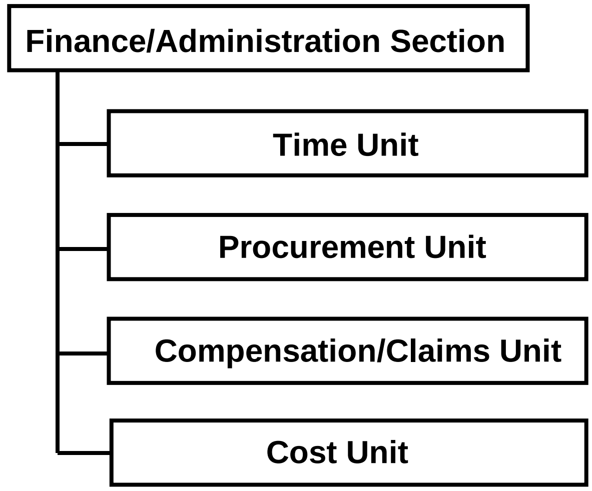

Figure 1-22
Finance/Administration Section

The responsibilities of the Finance/Administration Section Chief may be summarized as follows:

- procures services and/or supplies (from sources within and outside the fire department or city as requested by Command (coordinates with Logistics));
- documents all financial costs of the incident;
- documents for possible cost recovery of services and/or supplies;
- analyzes and manages legal risk for incidents (e.g., hazardous materials cleanup);
- documents for compensation and injury claims;
- obtains any and all needed incident documentation for potential cost recovery efforts; and
- is responsible for all legal aspects of the incident.

THE INCIDENT COMMANDER (ROLES AND RESPONSIBILITIES AFTER ACTIVATION OF THE OPERATIONS SECTION CHIEF)

Once the Operations Section is in place and functioning, the IC's focus should be on strategic issues, overall strategic planning, and other incident components. Their focus is to look at the "big picture" — the impact of the incident from a broad perspective. The IC should provide direction, advice, and guidance to the Command and General Staff in directing the tactical aspects of the incident.

The responsibilities of the IC (after activation of an Operations Section Chief) may be summarized as follows:

- reviews and evaluates the plan and initiates needed changes;
- provides an ongoing review of the overall incident (the "big picture");
- selects priorities;
- provides direction to Command and General Staff officers;
- reviews the organizational structure and initiates change (or expansion) to meet incident needs;
- stages Command and General Staff functions (as necessary); and
- establishes liaison with other internal agencies and officials, outside agencies, and property owners and/or tenants.

COMMAND STAFF

Command Staff positions are established to assume responsibility for key activities that are not a part of the line organization. Three specific Staff positions exist:

1. Public Information Officer.

2. Safety Officer.

3. Liaison Officer.

Figure 1-23 illustrates these three staff positions and how they relate to the IC.

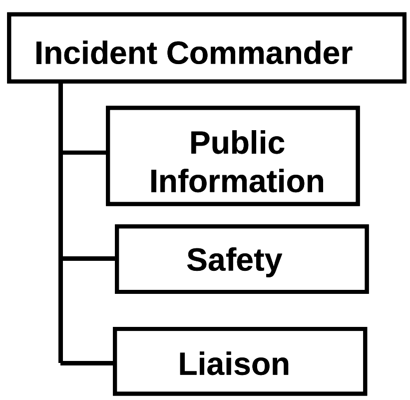

Figure 1-23
Command Staff

Additional positions might be required — depending upon the nature and location of the incident or requirements established by the IC.

Public Information Officer

The Public Information Officer's (PIO's) function is to develop accurate and complete information regarding incident cause, size, current situation, resources committed, and other matters of general interest. The PIO normally will be the point of contact for the media and governmental agencies desiring information. Only one PIO would be designated for a single or Unified Command structure. Assistants may be assigned from other involved agencies or departments.

Provide a "media area" away from the CP where all the media representatives are directed to report. Try to keep an Assistant PIO with the media **at all times**.

A high-rise incident in your community **will** be a media event. Print, radio, and television media will be present. All press will be seeking information. Print and television media will want incident photographs. The PIO probably will need a few assistants to handle the needs of the media. Frequent briefings are important in order to maintain control of media representatives, satisfy their need for information, and maintain our need for good, effective public relations.

Safety Officer

The Safety Officer's function at the incident is to assess hazardous and unsafe situations and develop measures for assuring personnel safety. The Safety Officer has emergency authority to stop and/or prevent unsafe acts. A single Safety Officer would be designated in a Unified Command structure. Assistants may be required and may be assigned from other agencies or departments making up the Unified Command. The Safety Officer also is responsible for assessing responder rehabilitation needs.

Liaison Officer

The Liaison Officer's function is to be a point of contact for representatives from other agencies. In a single Command structure, assisting agency representatives would coordinate through the Liaison Officer. Under a Unified Command structure, representatives from agencies not involved in the Unified Command would coordinate through the Liaison Officer. Agency representatives assigned to an incident should have authority to speak on all matters for their agency.

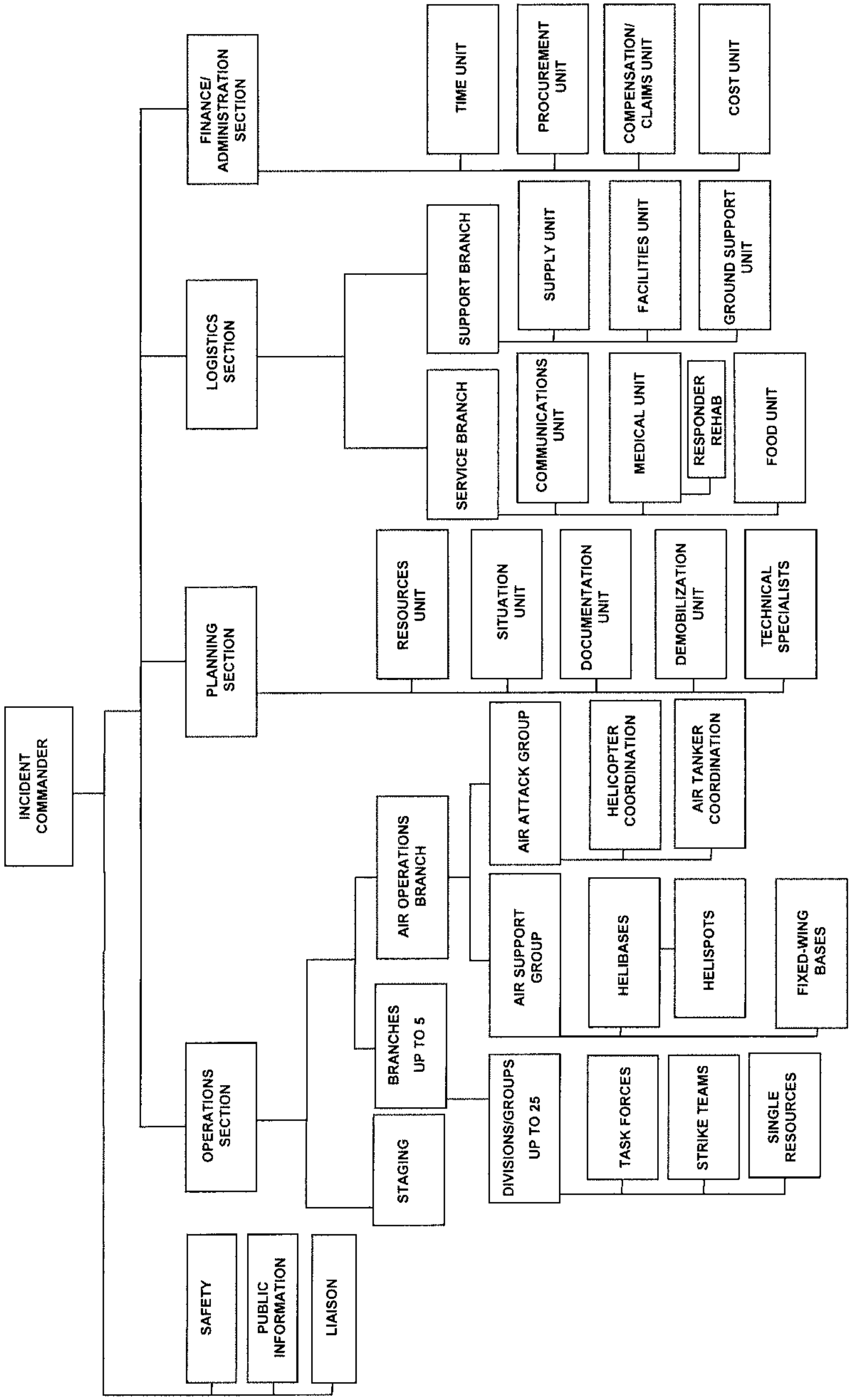

Figure 1-24
Fully Expanded Incident Command System Structure

APPENDIX B
GLOSSARY

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GLOSSARY

Action Plan (See Incident Action Plan.)

Agency An agency is a division of government with a specific function, or private organization that offers a specific type of assistance. Agencies are defined as jurisdictional (directly responsible for incident) or assisting and/or cooperating (providing resources and/or assistance). (See Assisting Agency, Cooperating Agency and Multiagency.)

Annunciator Panel Found in both old- and new-style construction depending on the built-in protection.

Assigned Resources Resources checked in and assigned work tasks at an incident.

Assignments Tasks given to resources to perform within a given operational period, based upon tactical objectives in the Incident Action Plan.

Assistant Title for subordinates of the Command Staff positions. The title indicates a level of technical capability, qualifications and responsibility subordinate to the primary positions. Assistants may also be used to supervise unit activities.

Available Resources Incident-based resources that are ready for deployment.

Base The location at which primary logistics functions for an incident are coordinated and administered. There is only one Base per incident. (Incident name or other designator will be added to the term Base.) The Incident Command Post may be co-located with the Base. The Base Manager reports to Logistics or the Incident Commander (if Logistics is not yet staffed).

Branch The organizational level having functional or geographic responsibility for major parts of incident operations. The Branch level is organizationally between Section and Division/Group in the Operations Section, and between Section and Units in the Logistics Section. Branches are identified by the use of Roman numerals or by functional name (e.g., medical, security, etc.).

Chain of Command A series of management positions in order of authority.

Check-In	The process whereby resources first report to an incident. Check-in locations include: Incident Command Post (Resources Unit), Incident Base, Camps, Staging Areas, Helibases, Helispots, and Division Supervisors (for direct line assignments).
Chief	The individuals responsible for Command of functional sections: Operations, Planning, Logistics, and Finance/Administration.
Clear Text	The use of plain English in radio communications transmissions. No Ten Codes or agency-specific codes are used when using clear text.
Command	The act of directing and/or controlling resources by virtue of explicit legal, agency or delegated authority; also may refer to the Incident Commander.
Command Post (CP)	(See Incident Command Post.)
Command Staff	The Command Staff consists of the Public Information Officer, Safety Officer and Liaison Officer. They report directly to the Incident Commander. They may have an assistant or assistants, as needed.
Communications Unit	An organizational unit in the Logistics Section responsible for providing communication services at an incident. A Communications Unit may also be a facility (e.g., a trailer or mobile van) used to provide the major part of an Incident Communications Center.
Compartmentation	Small, protected areas separated from others that tend to burn out and are not extended easily to other areas. Typically seen in residential designs, it is an essential design consideration in limiting fire size.
Crew	(See Single Resource.)
Curtain Wall	A nonload-bearing wall. It can consist of a panel with a finished surface and a means of attachment to the structure. A curtain wall can be constructed offsite, brought to the building, and bolted on.
Delegation of Authority	A statement provided to the Incident Commander by the Agency Executive delegating authority and assigning responsibility. The Delegation of Authority can include objectives, priorities, expectations, constraints and other considerations or guidelines as needed. Many agencies require a written Delegation of Authority to be given to Incident Commanders prior to their assuming Command of larger incidents.

Deputy — A fully qualified individual who, in the absence of a superior, could be delegated the authority to manage a functional operation or perform a specific task. In some cases, a Deputy could act as relief for a superior and therefore must be fully qualified in the position. Deputies can be assigned to the Incident Commander, General Staff and Branch Directors.

Director — Individual responsible for supervision of a Branch.

Division — Divisions are used to divide an incident into geographic areas of operation. A Division is located between the Branch and the Task Force/Strike Team. (See Group.) Divisions are identified by alphabetic characters for horizontal applications and, often, by floor numbers when used in buildings.

Event — A planned, nonemergency activity that can be used as the management system for a wide range of events (e.g., parades, concerts or sporting events).

Facilities Unit — Functional unit within the Support Branch of the Logistics Section that provides fixed facilities for the incident. These facilities may include the Incident Base, feeding areas, sleeping areas, sanitary facilities, etc.

Food Unit — Functional unit within the Service Branch of the Logistics Section responsible for providing meals for incident personnel.

Function — Refers to the five major activities — Command, Operations, Planning, Logistics, and Finance/Administration. The term function is also used when describing the activity involved (e.g., the planning function).

General Staff — The group of incident management personnel reporting to the Incident Commander. They may each have a deputy, as needed. The General Staff consists of the following:

- Operations Section Chief;
- Planning Section Chief;
- Logistics Section Chief; and
- Finance/Administration Section Chief.

Glass — Window glass types fall into two categories:

- plate (used most often): broken produces large shards; and
- tempered: generally located in each corner of a structure; designated by a special marking; shatters in small pieces.

Ground Support Unit	Functional unit within the Support Branch of the Logistics Section responsible for the fueling, maintaining, and repairing of vehicles, and the transportation of personnel and supplies.
Group	Groups are established to divide the incident into functional areas of operation. Groups are composed of resources assembled to perform a special function not necessarily within a single geographic division. (See Division.) Groups are located between Branches (when activated) and Resources in the Operations Section.
Helibase	The main location for parking, fueling, maintenance and loading of helicopters operating in support of an incident. It is usually located at or near the Incident Base.
Helispot	Any designated location where a helicopter can safely take off and land. Some helispots may be used for loading of supplies, equipment or personnel.
Hierarchy of Command	(See Chain of Command.)
High-rise	A structure that is 75 feet or more in height above ground.
Hoistways	The vertical shafts in which elevator cars travel. Buildings with multiple cars usually have one hoistway. “Split-bank” hoistways each serve a specific number of floors in the high-rise, but no elevator car serves all floors.
Incident	An occurrence, caused either by human action or natural phenomena, that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.
Incident Action Plan (IAP)	Contains objectives reflecting the overall incident strategy and specific tactical actions and supporting information for the next operational period. The plan may be oral or written. When written, the plan may have a number of forms as attachments (e.g., traffic plan, safety plan, communications plan, map, etc.).
Incident Base	(See Base.)
Incident Commander (IC)	The individual responsible for the management of all incident operations at the incident site.
Incident Command	The location at which the primary Command functions are executed.

Incident Command Post (ICP)	The ICP may be co-located with the Incident Base or other incident facilities.
Incident Command System (ICS)	A geographic area under the Command of a Division Supervisor. A standardized on-scene emergency management concept specifically designed to allow its user(s) to adopt an integrated organizational structure equal to the complexity and demands of single or multiple incidents, without being hindered by jurisdictional boundaries.
Incident Communication Center	The location of the Communications Unit and the Message Center.
Incident Management Team (IMT)	The Incident Commander and appropriate Command and General Staff personnel assigned to an incident.
Incident Objectives	Statements of guidance and direction necessary for the selection of appropriate strategy or strategies and the tactical direction of resources. Incident objectives are based on realistic expectations of what can be accomplished when all allocated resources have been deployed effectively. Incident objectives must be achievable and measurable, yet flexible enough to allow for strategic and tactical alternatives.
Incident Support Organization	Includes any off-incident support provided to an incident. Examples would be agency dispatch centers, airports, mobilization centers, etc.
Initial Action	The actions taken by resources that are the first to arrive at an incident.
Initial Response	Resources initially committed to an incident.
Jurisdiction	The range or sphere of authority. Public agencies have jurisdiction at an incident related to their legal responsibilities and authority for incident mitigation. Jurisdictional authority at an incident can be political/geographic (e.g., city, county, state or federal boundary lines) or functional (e.g., police department, health department, etc.). (See Multijurisdiction.)
Jurisdictional Agency	The agency having jurisdiction and responsibility for a specific geographical area, or a mandated function.
Kind	Resources described by function (e.g., a patrol car or a bulldozer).

Landing Zone (See Helispot.)

Lapping Fire extending upward by traveling outside the building to the floor above.

LCES Lookouts, communications, escape routes, and safety zones:

- Lookouts: know where the fire is, where it's going, what areas are dangerous;
- Communications: know who is operating above, below and adjacent and what their functions are; be able to communicate with them;
- Escape Routes: know more than one way out of the area or operating site; and
- Safety Zones: know where to go for safe refuge.

Leader The individual responsible for a Task Force, Strike Team or functional unit.

Liaison Officer A member of the Command Staff responsible for coordinating with representatives from cooperating and assisting agencies.

Life Safety The joint consideration of both the life and physical well-being of individuals.

Logistics Section The Section responsible for providing facilities, services and materials for the incident.

Management by Objectives A top-down management activity that involves a three-step process to achieve the incident goal. The steps are establishing the incident objectives, selection of appropriate strategy(ies) to achieve the objectives, and the tactical direction associated with the selected strategy. Tactical direction includes selection of tactics, selection of resources, resource assignments, and performance monitoring.

Managers Individuals within organizational units who are assigned specific managerial responsibilities (e.g., Staging Area Manager).

Medical Unit Functional unit responsible for the development of the Medical Emergency Plan and for providing emergency medical treatment of incident personnel.

Message Center The Message Center is part of the Incident Communications Center and is co-located or placed adjacent to it. It receives, records and routes information about resources reporting to the incident, resource status, and administrative and tactical traffic.

Mobilization — The process and procedures used by all organizations — federal, state and local — for activating, assembling and transporting all resources that have been requested to respond to or support an incident.

Mobilization Center — An off-incident location at which emergency service personnel and equipment are temporarily located pending assignment, release or reassignment.

Multiagency Coordination (MAC) — A generalized term that describes the functions and activities of representatives of involved agencies and/or jurisdictions who come together to make decisions regarding the prioritizing of incidents and the sharing and use of critical resources.

Multiagency Coordination System (MACS) — The combination of personnel, facilities, equipment, procedures and communications integrated into a common system. When activated, MACS has the responsibility for coordination of assisting agency resources and support in a multiagency or multijurisdictional environment. A MAC Group functions within the MACS.

Multiagency Incident — An incident where one or more agencies assists a jurisdictional agency or agencies. May be single or Unified Command.

Multijurisdiction Incident — An incident requiring action from multiple agencies that have a statutory responsibility for incident mitigation, generally managed under Unified Command.

Mutual-Aid Agreement — Written agreement between agencies and/or jurisdictions in which they agree to assist one another upon request by furnishing personnel and equipment.

National Incident Management System (NIMS) — NIMS is a core set of doctrine, concepts, principals, terminology and organizational processes. It is comprised of six components:

- Command Management;
- Preparedness — necessary components of operational preparedness systems;
- Resource Management Mutual Aid — standardized procedures for resource management processes;
- Communication and Information Management — establishing common operating framework, accessibility and interoperability;
- Supporting Technologies — research and development, technology supporting interoperability, and compatibility; and
- Ongoing NIMS Management and Maintenance — NIMS Integration Center.

National Response Framework (NRF)

The NRF consolidates individual federal agency response plans into a single comprehensive approach to the management of federal resources and specifies how federal resources will work in concert with state, local, tribal governments, and the private sector in response to incidents of national significance. The NRF is predicated on the concepts of the NIMS.

Negative Stack Effect

The air outside of a building is at a higher (warmer) temperature than the air inside. This may cause Staging to be set up several floors lower than normal (two floors below the fire).

New-Style Construction

A high-rise construction style using core construction (either in the center of the building (center core) or side of the building (side core)) and having the following characteristics:

- erection of a steel skeleton using a column, beam and girder system;
- elevators, stair and utility shafts are placed in a core area;
- less mass than old-style construction; and
- lighter weight, commonly prefabricated exterior walls.

Officer

The personnel responsible for the Command Staff positions of Safety, Liaison and Information.

Old-Style Construction

A high-rise construction style with the following characteristics:

- masonry bearing walls — top of walls are thin, bottom of walls are thick;
- large mass and operable windows;
- high degree of compartmentalization; and
- poured-in-place concrete exterior walls.

Open Space

A building area where lack of barriers allows fire to spread rapidly around the core. It is a characteristic of high-rise office buildings, allowing unrestricted movement of employees. If the space is partitioned, the partition often goes to the level of the suspended ceiling.

Operational Period

The period of time scheduled for execution of a given set of operation actions as specified in the Incident Action Plan. Operational periods can be of various lengths, although usually not over 24 hours.

Operations Section	The Section responsible for all tactical operations at the incident. Includes Branches, Divisions and/or Groups, Task Forces, Strike Teams, Single Resources, and Staging Areas.
Out-of-Service Resources	Resources assigned to an incident but unable to respond for mechanical, rest or personnel reasons.
Overhead Personnel	Personnel who are assigned to supervisory positions which include Incident Commander, Command Staff, General Staff, Directors, Supervisors, and Unit Leaders.
Planning Meeting	A meeting held as needed throughout the duration of an incident to select specific strategies and tactics for incident control operations and for service and support planning. In larger incidents, the Planning Meeting is a major element in the development of the Incident Action Plan.
Planning Section	Responsible for the collection, evaluation, and dissemination of tactical information related to the incident, and for preparation and documentation of Incident Action Plans. The Planning Section also maintains information on the current and forecasted situation and on the status of resources assigned to the incident. Includes the Situation, Resource, Documentation, and Demobilization Units, as well as Technical Specialists.
Plenum Area	An open space between ceiling tiles and the floor above, generally used for air return, plumbing lines, and electrical conduits.
Public Information Officer (PIO)	A member of the Command Staff responsible for interfacing with the public and media or with other agencies requiring information directly from the incident. There is only one PIO per incident. The PIO may have assistants.
Radio Cache	A supply of radios stored in a predetermined location for assignment to incidents.
Rapid Intervention Crew (RIC)	Identify activity risks and often are placed at Staging. Recommended by the National Fire Protection Association (NFPA) and required for Occupational Safety and Health Administration (OSHA) states. They are often agency-specific.
Recorders	Individuals responsible for recording information. Recorders may be found in Planning, Logistics, and Finance/Administration Sections.
Reinforced Response	Those resources requested in addition to the initial response.

Reporting Locations Location or facilities where incoming resources can check in at the incident. (See Check-In.)

Resources Personnel and equipment available, or potentially available, for assignment to incidents. Resources are described by kind and type (e.g., ground, water, air, etc.) and may be used in tactical support or overhead capacities at an incident.

Resources Unit Functional unit within the Planning Section responsible for recording the status of resources committed to the incident. The Resources Unit also evaluates resources currently committed to the incident, the impact that additional responding resources will have on the incident, and anticipated resource needs.

Safe Refuge An area at least three floors above or below the fire floor.

Safety Officer A member of the Command Staff responsible for monitoring and assessing safety hazards or unsafe situations and for developing measures for ensuring personnel safety. The Safety Officer may have assistants.

Scissor Stair Shafts Two sets of stairs in one shaft that exit at a different point on each floor, generally found in new-style construction, never in old-style construction.

Section The organizational level with responsibility for a major functional area of the incident (e.g., Operations, Planning, Logistics, Finance/Administration). The Section is organizationally between Branch and Incident Commander.

Section Chief A member of the General Staff (Planning Section Chief, Operations Section Chief, Finance/Administration Chief, Logistics Section Chief).

Sector Term used in some applications to describe an organizational level similar to a Division or Group.

Segment A geographic area in which a Task Force/Strike Team Leader or Supervisor of a single resource is assigned authority and responsibility for the coordination of resources and implementation of planned tactics. A segment may be a portion of a Division or an area inside or outside the perimeter of an incident. Segments are identified with Arabic numbers.

Service Branch A Branch responsible for service activities at the incident. Includes the Communications, Medical and Food Units.

Single Resource	An engine company or a truck company with a Company Officer and a crew, or an individual, a piece of equipment, and its personnel complement.
Situation Unit	Functional unit within the Planning Section responsible for the collection, organization and analysis of incident status information, and for analysis of the situation as it progresses. Reports to the Planning Section Chief.
Span of Control	The supervisory ratio of from three to seven individuals, with five-to-one being optimum.
Staging Area	Staging Areas are locations set up at an incident where resources can be placed while awaiting a tactical assignment. Staging Areas are equipped and staffed to provide food, water and medical facilities to incident personnel. Staging is under the direction of the Operations Section Chief.
Strategy	The general plan or direction selected to accomplish incident objectives.
Strike Team	Specified combinations of the same kind and type of resources with common communications and a leader.
Structural Framing Systems	The skeleton of a building; they support the building's dead and live loads (building contents/occupants).
Supervisor	The individual responsible for Command of a Division or Group.
Supporting Branch	A Branch within the Logistics Section responsible for providing personnel, equipment and supplies to support incident operations. Includes the Supply, Facilities and Ground Support Units.
Supporting Materials	Refers to the several attachments that may be included with an Incident Action Plan (e.g., communications plan, map, safety plan, traffic plan, and medical plan).
Support Resources	Nontactical resources under the supervision of the Logistics, Planning, Finance/Administration Sections, or the Command Staff.
Tactical Direction	Direction given by the Operations Section Chief which includes the tactics appropriate for the selected strategy, the selection and assignment of resources, tactics implementation, and performance monitoring for each operational period.
Task Force	A combination of single resources assembled for a particular tactical need with common communications and a leader.

Team	(See Single Resource.)
Technical Specialists	Personnel with special skills that can be used anywhere.
Temporary Flight Restriction (TFR)	Temporary airspace restrictions for nonemergency aircraft in the incident area. TFRs are established by the Federal Aviation Administration (FAA) to ensure aircraft safety and normally are limited to a five-nautical-mile radius and 2,000 feet in altitude.
Type	Refers to resource capability. A Type 1 resource provides a greater overall capability because of power, size, capacity, etc., than would be found in a Type 2 resource. Resource typing provides managers with additional information in selecting the best resource for the task.
Unified Area Command	A Unified Area Command is established when incidents under an Area Command are multijurisdictional. (See Area Command and Unified Command.)
Unified Command (UC)	A unified team effort that allows all agencies with responsibility for the incident, either geographic or functional, to manage an incident by establishing a common set of incident objectives and strategies. This is accomplished without losing or abdicating agency authority, responsibility or accountability.
Unit	The organizational element having functional responsibility for a specific incident Planning, Logistics or Finance/Administration activity.
Unit Leader	Individual responsible for supervision and management of either a group of resources or a unit.
Unity of Command	The concept by which each person within an organization reports to only one designated person.