Incident Command for Highrise Operations

ICHO-Student Manual

2nd Edition, 4th Printing-December 2006

Homeland Security

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U.S. DEPARTMENT OF HOMELAND SECURITY

PREPAREDNESS DIRECTORATE

UNITED STATES FIRE ADMINISTRATION

NATIONAL FIRE ACADEMY

FOREWORD

The U.S. Fire Administration (USFA), an important component of the Department of Homeland Security (DHS) Preparedness Directorate, 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, Maryland, and includes the National Fire Academy (NFA), National Fire Data Center (NFDC), National Fire Programs (NFP), and the National Preparedness Network (PREPnet). The USFA also provides oversight and management of the Noble Training Center in Anniston, Alabama. 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 its 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 Highrise Operations* (ICHO) course is designed to meet the needs of Command Officers responsible for commanding and operating at highrise 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 NIMS compliant.

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UNIT 1: INTRODUCTION

TERMINAL OBJECTIVE

The students will be able to describe the intent/focus of this course.

ENABLING OBJECTIVES

The students will:

1. *Describe the course goal.*
2. *List unit titles and general content.*
3. *Describe administrative issues relevant to the classroom.*
4. *Explain how their performance will be evaluated.*

INTRODUCTION

Course Goal

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

Target Audience

Fire service officers who have responsibility for managing highrise incidents.

Prerequisites

The students must possess

- Working knowledge of basic Incident Command System (ICS) organization or completion of the National Fire Academy's (NFA) 2-day *Incident Command System* course.
- Working knowledge of strategy and tactics for structural firefighting or completion of the NFA's *Fire Command Operations* (FCO) course.
- Knowledge of building construction features and techniques.

Strongly recommend completion of self-study Web courses:

- Q462 (ICS 100), *Introduction to ICS for Operational First Responders*.

Q463 (ICS 200), *Basic All-Hazards NIMS ICS for Operational First Responders*.

COURSE OVERVIEW

The following units comprise the course:

Unit 1: Introduction.

Unit 2: Highrise Construction.

Unit 3: Highrise Building Systems.

Unit 4: Strategy and Tactics.

Unit 5: Heating, Ventilating, and Air Conditioning Systems.

Unit 6: Basic Organizational Approach.

STUDENT PERFORMANCE EVALUATION

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

COURSE/CLASSROOM LOGISTICS

Your instructor will review any course or classroom logistics pertinent to the facility in which the course is being taught.

UNIT 2: HIGHRISE CONSTRUCTION

TERMINAL OBJECTIVE

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

ENABLING OBJECTIVES

The students will:

1. List building construction features.

2. Explain the characteristics and fire behavior concerns that affect strategy, tactics, and life safety.

HIGHRISE CONSTRUCTION

Highrise Definition

A highrise 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 highrise do not have all the fire protection and life safety features of a building that meets a highrise code.

PREFIRE PLANNING CONSIDERATIONS

An important point to remember is that all highrise 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 highrise 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;
- stairshaft--exits/termination above grade;
- location of mechanical equipment rooms (MER's);
- heating, ventilating, and air-conditioning (HVAC) zones/return airshafts; and
- standpipe locations.

KNOWLEDGE OF THE BUILDING

Strategy and tactics for highrise 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 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 HIGHRISE CONSTRUCTION VERSUS NEW-STYLE HIGHRISE CONSTRUCTION

Old-Style Highrise Construction

Old-style highrise 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. As the building rose and the upper levels supported less weight, the walls were tapered. These buildings are really the epitome of what fire-resistive construction means.

Old-style highrises have more mass due to their concrete construction. Buildings of this construction type generally have operable windows. The old-style highrise 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.

The symbol of old-style construction is New York City's Empire State Building. 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 highrise buildings have unreinforced masonry (URM) wall construction. The contents of these buildings are prone to destruction during fires as well as in earthquakes.

New-Style Highrise Construction

The modern method of constructing highrise buildings is called "core construction." This method involves erecting a steel skeleton by using a column, girder, and beam system. The elevators, stairshafts, 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. Floors have been known to sag nearly 2 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 coating on support members that assists in maintaining strength when subjected to heat or flames.

Some modern highrise 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.

Table 2-1 lists highrise structural features and components. This table provides a comparison of features found in old- and new-style highrise buildings.

Table 2-1
Highrise 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		✓	
Scissors		✓	
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		✓	
Large open areas		✓	
Large open areas		✓	

Feature/Component	Found in Old Style	Found in New Style	Found in Both Styles
Ceiling assemblies			
Plaster or drywall	✓		
Steel wire attached to grid of metal channels (with plenum area)			✓
Electrical systems			
Standard system			✓
Emergency generator(s)			✓
Elevators			
Multiple			✓
Low, medium, highrise 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	✓		
Sometimes on basement level		✓	

STRUCTURAL FEATURES

Structural Framing Systems

The structural frame of a highrise 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 highrise 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. 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 highrise 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 resistivity. However, a number of structural stability concerns for fire personnel exist during fire conditions.

- 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, since 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.)

To achieve the fire protection required by building codes for Type I (fire-resistive) construction, steel-frame members in highrise 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 effect 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 highrise buildings to withstand moderate earthquakes has been proved in many parts of the world in recent years.

Exterior Walls

As stated earlier, the exterior walls of an old-style highrise 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) highrise buildings commonly are prefabricated and typically are lighter in weight than those in older buildings. In many cases, these walls are non-

load 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 highrise 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 highrise buildings are required to have at least a 2-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:

- stairshaft exits; and
- other obstructions that would limit certain types of ventilation activities on the roof.

In many cases, not all stairshafts in the building will exit to the roof. Knowing which stairshafts exit to the roof can be critical when moving occupants to the roof for safe refuge or evacuation, and when using stairshafts 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 stairshafts 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 highrise buildings are required to have a minimum of a 2-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 highrise 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.

Stairshaft Systems

If there is one construction component of a highrise building that firefighting personnel don't know enough about, it is stairshaft systems.

Old-style construction provides stairshafts of reinforced concrete, often located on the building's perimeter.

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

Shafts other than the conventional, return type can be found in new-style highrise buildings. The building may contain pressurized or smoke-proof stairshafts. Activation of special equipment can provide a smoke-free atmosphere within these stairshafts. In many cases, however, even though the building has multiple stairshafts, only one stairshaft may be designed to provide this smoke-free environment. Some highrise buildings feature stairshafts referred to as smoke towers. These are either fully or partially open to the outside atmosphere to prevent smoke from filling the stairshaft.

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

Many newly constructed highrise buildings have scissors stairshafts that 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.

Doors that provide access to the stairshaft from individual floors often are locked from the stairshaft side. This requires firefighting personnel to have a key to provide immediate access to the floors from the stairshaft. 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 poke a hole through the wall and reach inside to open the door.

As a rule, stairshaft systems in highrise 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 usable stairshafts 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 highrise 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 (such as police, floor wardens, or building security) must remain along the route to prevent panic.

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

Floors

Floors in highrise buildings also are required to have a minimum of a 2-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, if not sealed properly around the bored holes, can seriously diminish the floor's 2-hour fire resistivity.

While most recent codes require that poke-through openings be sealed with a material that reestablishes 2-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 highrise buildings. They are referred to as "compartmentation" and "open space." Compartmentation in highrise 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 highrise 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 highrise 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 highrise 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. Highrise 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 highrise 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.

Activity 2.1

Building Construction

Purpose

To understand how building construction affects strategy, tactics, and life safety.

Directions

1. Your instructor will divide the class into four work groups, and will assign your group **one** of the following categories:

   a. New-style construction.

   b. Old-style construction.

2. Your group should elect a recorder and spokesperson.

3. Those groups assigned new-style construction will use the floor plan of a new-style, office occupancy, highrise building (on a following page of this SM). This floor plan will show a fire situation in the building.

4. Groups assigned old-style construction will use the floor plan of an old-style, residential occupancy, highrise building (on a following page of this SM). This building also has a fire situation.

5. Given the fire situation presented and the style of construction assigned to your group, respond briefly to the following questions:

   a. In this circumstance, what effect do the following factors have on building stability and fire?

      - Structural framing system.
      - Exterior walls.
      - Floor configuration.

   b. In this circumstance, what effect do the following factors have on heat and smoke extension?

      - Structural framing system.
      - Exterior walls.
      - Floor configuration.

6. Your group will have 30 minutes to respond to these questions.

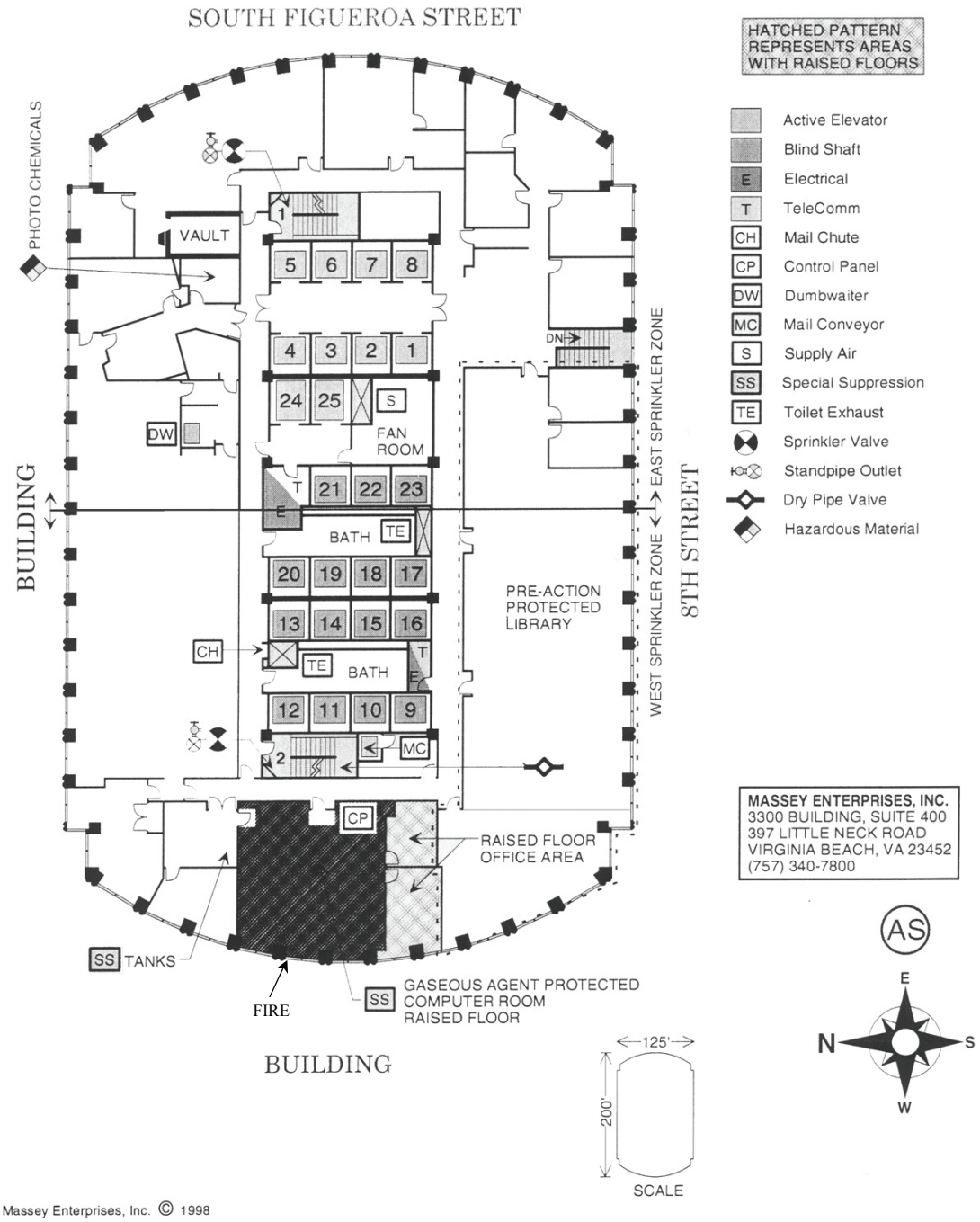
7. Record your answers on an easel pad.

8. At the conclusion of the allotted time, your instructor will reconvene the class.

9. Your spokesperson will be called upon to make an informal, 5-minute report that reviews your group's findings.

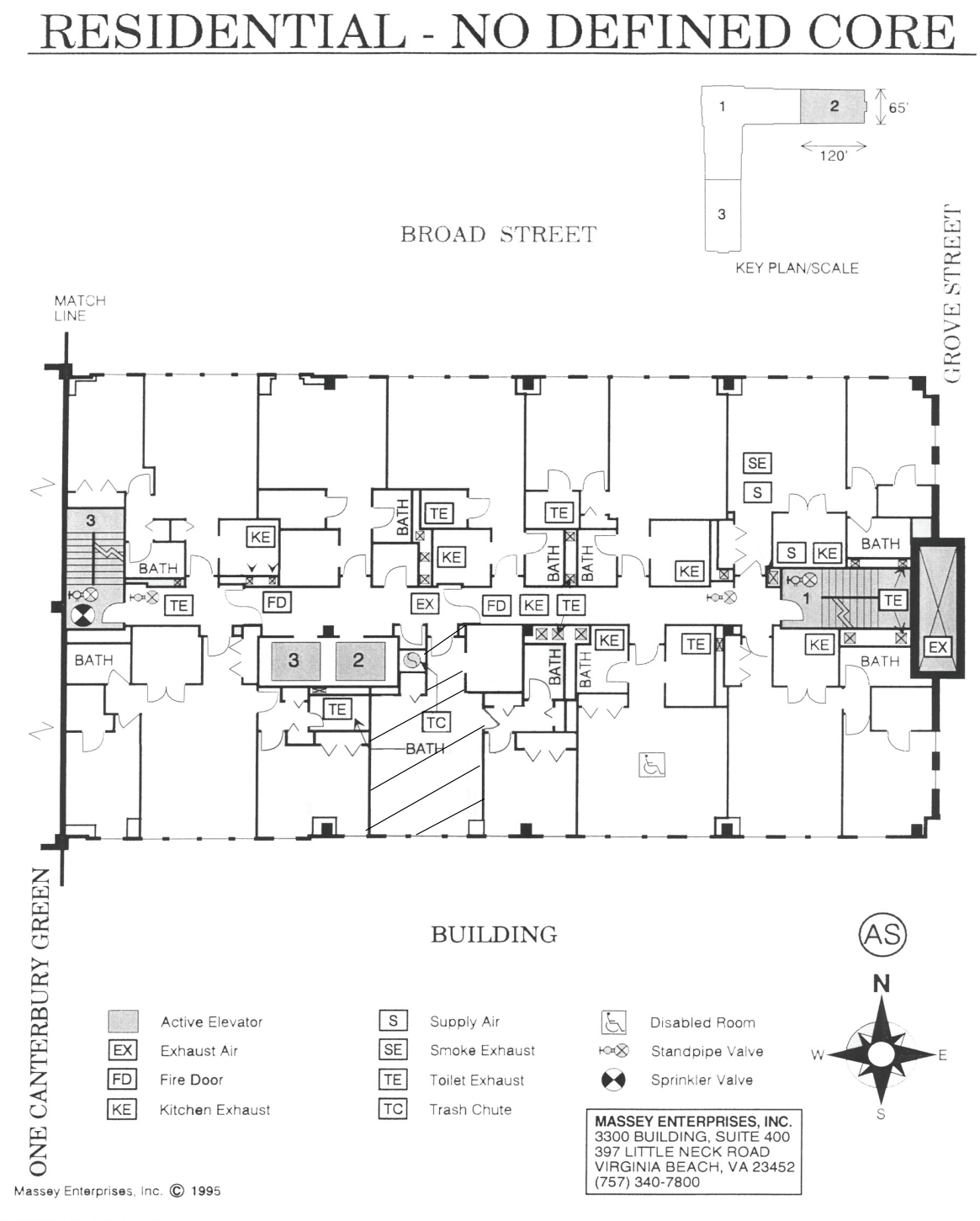
Activity 2.1 (cont'd)

New-Style Office Occupancy Building



Activity 2.1 (cont'd)

Old-Style Residential Occupancy Building



UNIT 3: HIGHRISE BUILDING SYSTEMS

TERMINAL OBJECTIVE

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

ENABLING OBJECTIVES

The students will:

1. *List building system features.*

2. *Explain the characteristics and fire behavior concerns that affect strategy, tactics, and life safety.*

ELECTRICAL SYSTEMS

Electrical systems in highrise 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 is likely to be located in the basement of the building. This makes it 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.

- 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 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 highrise 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 switch(es)). 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 highrise 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. 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 how elevators work.
- 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 (SOG's) 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 highrise buildings are equipped with low-, medium-, and highrise 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 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 highrise 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.

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

Firefighter Service Mode during Fire Operations

Whenever possible, elevators equipped with Firefighter Service mode should be used for fire operations. The following guidelines should be followed 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 so arranged 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 highrise 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, stairshafts should be used. **Note:** When available, use a fire tower to ascend.

The decision to use elevators during a fire in a highrise 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 firefighter lives. Therefore, using stairshafts 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 SOG's. 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 stairshaft to the fire floor. Progress up the stairshaft, and check the floor two floors below the reported fire floor for use by Staging.

Information on the Staging floor and stairshaft 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.

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 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 SOG's.

- Only use an elevator car with the Firefighter Service feature that allows for emergency control of the elevator car. (Note: In older highrise 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 highrise fires, there must be training on elevators and procedures. It is not enough simply to have procedures in local SOG's!**

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 necessary, open the top emergency exit (if available) to relieve smoke in the car. Try to keep low in the car, and don your self-contained breathing apparatus (SCBA) facepiece if necessary. Remember, it is important to conserve air. Communicate the situation to your supervisor.

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 highrise 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.

- Conduct fire department operations using elevators that have been placed in "Manual mode" if Firefighter-Service-mode-equipped elevators have not been installed in the building.

- 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.

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 exit 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

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

Highrise **residential** buildings normally have operable windows made from regular plate glass. In addition, many highrise apartment buildings have large sliding glass doors that open onto balcony areas. Windows in highrise **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.

SMOKE-CONTROL SYSTEMS

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. Highrise 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 highrise building include stack effect, expansion, wind, and heating, ventilating, and air conditioning (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 highrise 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 highrise 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

- a given number of floors;
- a stairway pressurization system (often accomplished by having fans in all or certain stairshafts);
- 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. In the event of adverse effects, the system should be shut down immediately, if it adversely affects operations.

HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

Central and zoned systems normally are present in new-style construction. Depending on the year built, they may be found in old-style construction.

HVAC systems are designed to provide conditioned air throughout the structure by means of a ductwork system. For reasons of economy and efficiency, these systems operate on the concept of recirculating most of the air within the building. Under fire conditions, smoke or heat can enter the system at fire floors and quickly fill other parts of the building with contaminated air. When smoke and heat are pumped through the building in this manner, many occupants can be exposed to highly toxic gases and are placed in serious jeopardy (even though they may be on floors remote from the fire). In a highrise building with a recirculating air-handling system, the fire may be small, but smoke spread can be a major problem.

The air-handling system in most new highrise buildings is required by code to have dampers in the system. These dampers are smoke activated and control the spread of fire products from the area of origin to other parts of the building. Don't rely totally on these dampers. In many cases, however, the building may not have dampers installed or these dampers may not function properly.

Since the spread of fire products throughout the building is critical in life safety terms, **the best approach is to shut down the system when there is any doubt or concern that it may be contributing to the spread**. Once the fire is controlled and the safety of building occupants has been ensured, the system can be reactivated (if it has the capability of exhausting smoke from the building).

Methods of shutting down the HVAC system vary depending on the particular building. In some buildings (especially older ones) it may be necessary to close switches that control system air intake fans. Many times these switches are located in mechanical equipment rooms (MER's) on upper floors of the building, or they may be located on the roof of the building. In many newer buildings, and in some older buildings that have been modified, the air handling system will shut down automatically under fire conditions. In some cases, they will provide exhaust capability on the fire floor and pressurization of the floors above and below the fire floor.

Information about the air-handling system in a highrise building should be a critical part of prefire planning inspections. This includes how the system operates under fire conditions and where and how the system can be deactivated if necessary. When the building engineer is available, it is imperative to use his/her assistance with the HVAC system.

HIGHRISE WATER SUPPLY

A variety of different water supply systems can be found in highrise buildings. They may include

- 1-1/2-inch wet standpipe systems--old-style buildings;
- 2-1/2-inch dry standpipe systems--old-style buildings;
- 2-1/2-inch wet standpipe systems--both old- and new-style buildings;
- sprinkler systems--new-style buildings, unless there are retrofit laws; and
- combination of 1-3/4 inch or 2-1/2 inch on floor.

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 highrise 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 highrise 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.

1-1/2-Inch Wet Standpipe Systems

For many years, 1-1/2-inch wet standpipe systems have been used in highrise 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. If the 1-1/2-inch system is used for initial attack, any attached hose or nozzles should be replaced with standard fire department equipment.

2-1/2-Inch Dry Standpipe Systems

The 2-1/2-inch dry standpipe system is used in many older highrise 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.

Since 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.

2-1/2-Inch Wet Standpipe Systems

The 2-1/2-inch wet standpipe system is required by code in all new highrise 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 highrise 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 highrise buildings,

the water flow capacity in gallons per minute (gpm) (liters per minute) 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.

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 (PRV's) 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). PRV's on each floor should be checked for proper operating pressure and flow before the floor is occupied. PRV's 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 effect 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.

NFPA Standards 14 and 25

NFPA Standards 14 and 25 were changed after the 1 Meridian Plaza fire in Philadelphia.

The previous Standards required an outlet pressure of at least 65 psi minimum. Standard 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 highrise buildings now are required by code in virtually every area of the country. However, there are many older highrise buildings (perhaps some in your jurisdiction) that still do not contain sprinkler systems. Most highrise 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 highrise buildings. In some cases, retroactive legislation, enacted as the result of tragic highrise fires, has mandated that older highrise buildings be fully sprinklered. However, these cases are the exception rather than the rule. Preincident planning inspections should take particular note of sprinkler systems when present, what areas they serve, and how they can be supplemented.

SOG's require initial response units to supplement any built-in water supply system in a highrise 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 SOG's for connecting to and supplying the highrise 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, *Guide for Fire Department Operations in Properties Protected by Sprinkler and Standpipe Systems*) should be referenced.

COMMUNICATIONS

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

It is a known fact that portable fire department communications equipment can be ineffective or even completely unusable in a highrise. There are locations inside highrise 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 VHF band are very ineffective. Those in the UHF band are fairly effective in most situations. Those in the 800-megahertz 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 highrise buildings (and a number of older ones that have been retrofitted) have built-in emergency communications systems. These hardwired 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 highrise 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.

DETECTION AND ALARM SYSTEMS

There are three basic types of detection and alarm systems:

1. Smoke/Heat detectors.

2. Annunciator panels.

3. Manual fire alarm stations.

Smoke/Heat detectors in a highrise 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 highrise fire through preplanning (obtaining knowledge of these types of building characteristics) is necessary for effective decisionmaking.

It is important to know of the existence/location of any annunciator panel(s) in the building. Annunciator panels are found in both 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 highrise. 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 styles of construction.

FIRE CONTROL STATIONS/ROOMS

Most current codes require that newly constructed highrise 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
- the 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 communications 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 highrise 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 preincident planning.

LIFE SAFETY

Large numbers of people can be exposed to potential danger during a highrise 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 highrise fire.

- 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 highrise fire is **largely unpredictable**.
- If occupants are going to be evacuated from the building, it is critical that they use stairshafts that are not contaminated with smoke and heat.

FIRE BEHAVIOR AND SPREAD

The following fire behavior and fire spread phenomena must be considered by all Command Officers and operating forces at highrise fires.

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

Stack Effect

Normally, we perceive smoke as being heated and, therefore, lighter than the air surrounding it. Thus, when we cut a hole in the roof of a small structure that is on fire, the hot smoke and gases easily exit the structure. However, this is not so simple when we are dealing with a fire in a highrise building. Vertical shafts in a tall building tend to act as a chimney or smokestack by channeling heat, smoke, and other products of combustion upward because of convection. As this process occurs, a stratification process also takes place in which hotter smoke moves toward the roof and the cooler smoke stays lower. As long as the air inside the building is hotter than the atmospheric air outside the building, ventilation will occur by having fresh air drawn in through lower building openings and discharged through the top. This is considered the "normal" stack effect.

Negative Stack Effect

When the outside air temperature is higher than the inside air temperature (at the building's upper levels) a negative stack effect may take place. Such a condition is more likely to occur in warm climates. As the smoke leaves the fire area (usually by way of the stairshafts and other vertical openings), it cools. This effect pushes the smoke **down** the vertical shafts, or it settles to floors **below** the fire. This situation may cause Staging to be relocated farther from the fire, or cause firefighters trying to reach the fire floor to use SCBA earlier than desired.

Vertical Extension

Typical construction methods for highrise buildings provide common avenues through which fire may extend vertically. Three common methods of fire extension in highrise buildings include

- autoextension;
- curtain wall extension; and
- vertical shaft extension.

Autoextension 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 highrise 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 curtain wall extension.

The following features incorporated into highrise design and construction contribute to vertical fire extension.

- stairshafts;
- elevator shafts;
- electrical chaseways;
- plumbing/electrical/data cable "poke-throughs" (holes created through floors for cable or piping distribution);
- air-conditioning 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 highrise 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 stairshaft 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 place and operating in the opposite direction to protect the advancing crew(s).

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 highrise 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 is critical.

Activity 3.1

Building Systems

Purpose

To understand how building systems affect strategy, tactics, and life safety.

Directions

1. Reassemble in the same work groups that you were in for Activity 2.1.

2. Elect a new recorder and spokesperson.

3. If your group was assigned the category of new-style construction in Activity 2.1, adopt the category of old-style construction (and vice versa).

4. Groups with **new-style construction** will use the floor plan on the following pages that represents a fire situation in a new-style, office occupancy, highrise building.

5. Groups that have the category of **old-style construction** will use the floor plan on the following pages that represents a fire situation in an old-style, residential occupancy, highrise building.

6. Given the fire situation presented and the style of construction assigned, respond briefly to the following question:

   In this circumstance, what impact on life safety does each of the following items have?

   a. HVAC systems.

   b. Sprinkler systems.

   c. Water supply.

7. Your group will have 30 minutes to respond to this question.

8. Record your answers on an easel pad.

9. Your instructor will reconvene the class at the conclusion of the allotted time.

10. Your spokesperson will be called upon to make an informal, 5-minute report that reviews your group's findings.

Activity 3.1 (cont'd)

Highrise Checklist

FIRE LOCATIONS AND CONDITIONS

FIRE LOCATION _____
FIRE CONDITIONS HEAVY ( ) MED ( ) LT ( )
SMOKE COND. HEAVY ( ) MED ( ) LT ( )
HEAT COND. HEAVY ( ) MED ( ) LT ( )

LIFE HAZARD

	YES	NO
TRAPPED--LOCATIONS _____	( )	( )
FIRE FLOOR EVAC.	( )	( )
FLOOR ABOVE EVAC.	( )	( )
PRIMARY SEARCH COMPLETED	( )	( )
SECONDARY SEARCH COMP.	( )	( )
ELEVATORS SEARCHED	( )	( )

ELEVATORS

	YES	NO
ELEVATORS DOWN	( )	( )
FIREFIGHTER SERVICE	( )	( )

NO. OF CARS FOR FF USE _____
LOW _____ MED _____ HIGH _____
FLOORS SERVED

HVAC

	YES	NO
SHUTDOWN	( )	( )

MER _____ FLOOR--SERVES _____ TO _____
MER _____ FLOOR--SERVES _____ TO _____
MER _____ FLOOR--SERVES _____ TO _____
NUMBER OF ZONES _____
MER--MECHANICAL EQUIPMENT ROOM

BUILDING INFORMATION

	YES	NO
SPRINKLERED	( )	( )
FLOOR PLANS	( )	( )
STAIR RE-ENTRY KEYS	( )	( )
WINDOW KEYS	( )	( )
OCCUPANCY KEYS	( )	( )
ACCESS STAIRS--FIRE OCC.	( )	( )
FLOOR SETBACKS _____	( )	( )

STAIRS IDENTIFICATION

LETTER	FLOORS SERVED	S.P.	EVAC	F.A.
_____	_____	____	_____	____
_____	_____	____	_____	____
_____	_____	____	_____	____
_____	_____	____	_____	____
_____	_____	____	_____	____

SCISSOR STAIRS YES ( ) NO ( )
S.P.--Standpipe F.A.--Fire Attack

COMMUNICATIONS

	YES	NO
INDIVIDUAL FLOORS	( )	( )
PUBLIC ADDRESS	( )	( )
SOUND POWERED	( )	( )
TO FAN ROOMS	( )	( )
TO ENGINEERS ROOM	( )	( )

PUBLIC PHONE NUMBER _____

ALARM SYSTEM OFF	( )	( )

WATER SUPPLY

	YES	NO
STANDPIPE FED	( )	( )
SPRINKLER FED	( )	( )
BLDG FIRE PUMPS ON	( )	( )

UNITS FEEDING STANDPIPE _____
PRESSURES REQUIRED:

1-10 (150#)	10-20 (200#)	20-30 (250#)
30-40 (300#)	40-50 (350#)	50-60 (400#)

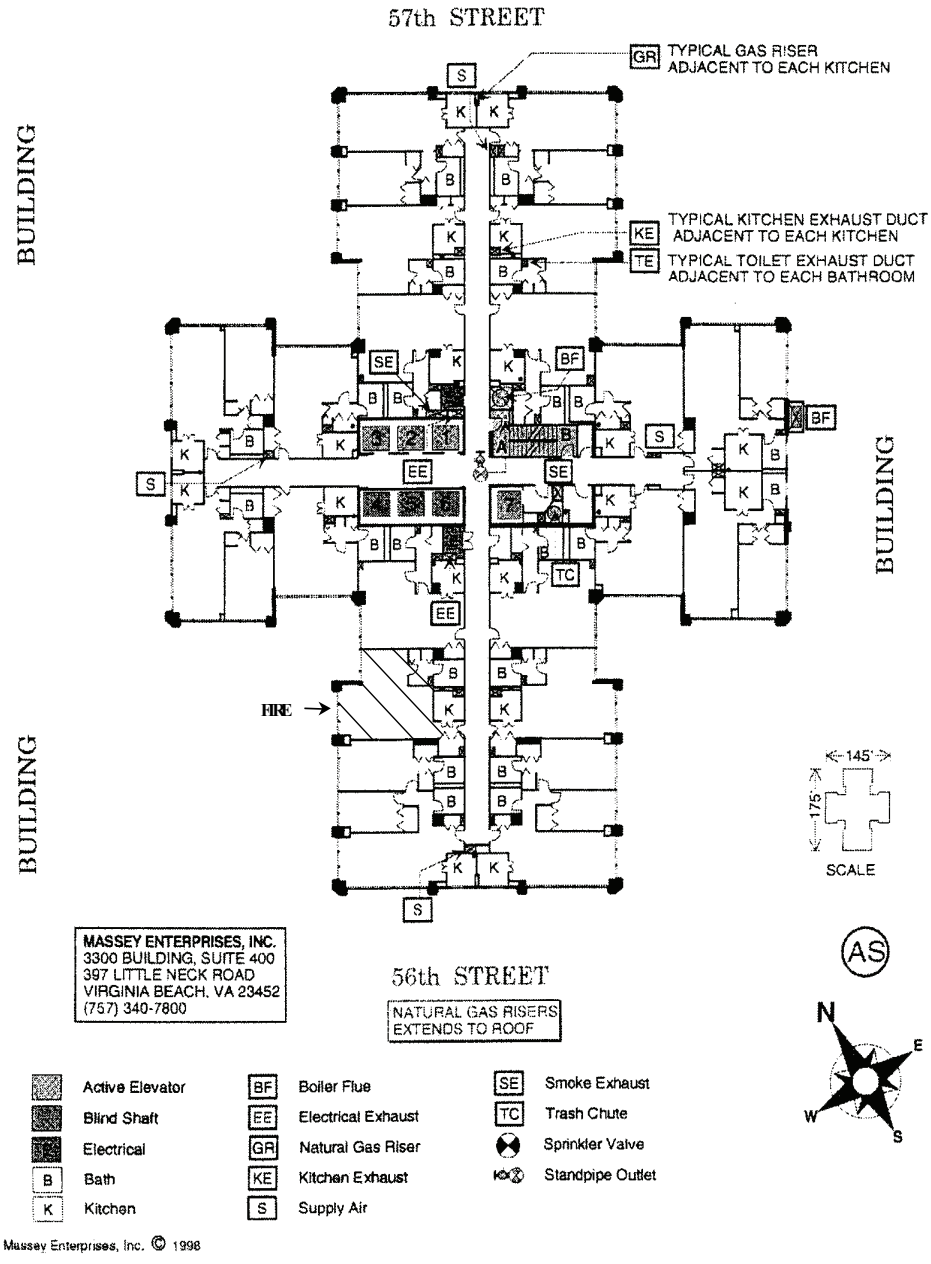
UNIT LOCATIONS

1ST ENG.ELEV._____ FLR____ STAIR _____
2ND ENG.ELEV._____ FLR____ STAIR _____
3RD ENG.ELEV._____ FLR____ STAIR _____
4TH ENG.ELEV._____ FLR____ STAIR _____
2ND B/C ELEV. _____ FLR____ STAIR _____
3RD B/C ASSIGNMENT _____
4TH B/C ASSIGNMENT _____

1ST LADDER ELEV.____ FLR ____ STAIR ___
2ND LADDER ELEV.____ FLR ____ STAIR ___
3RD LADDER ELEV.____ FLR ____ STAIR ___
4TH LADDER ELEV.____ FLR ____ STAIR ___
RESCUE ASSIGNMENT _____

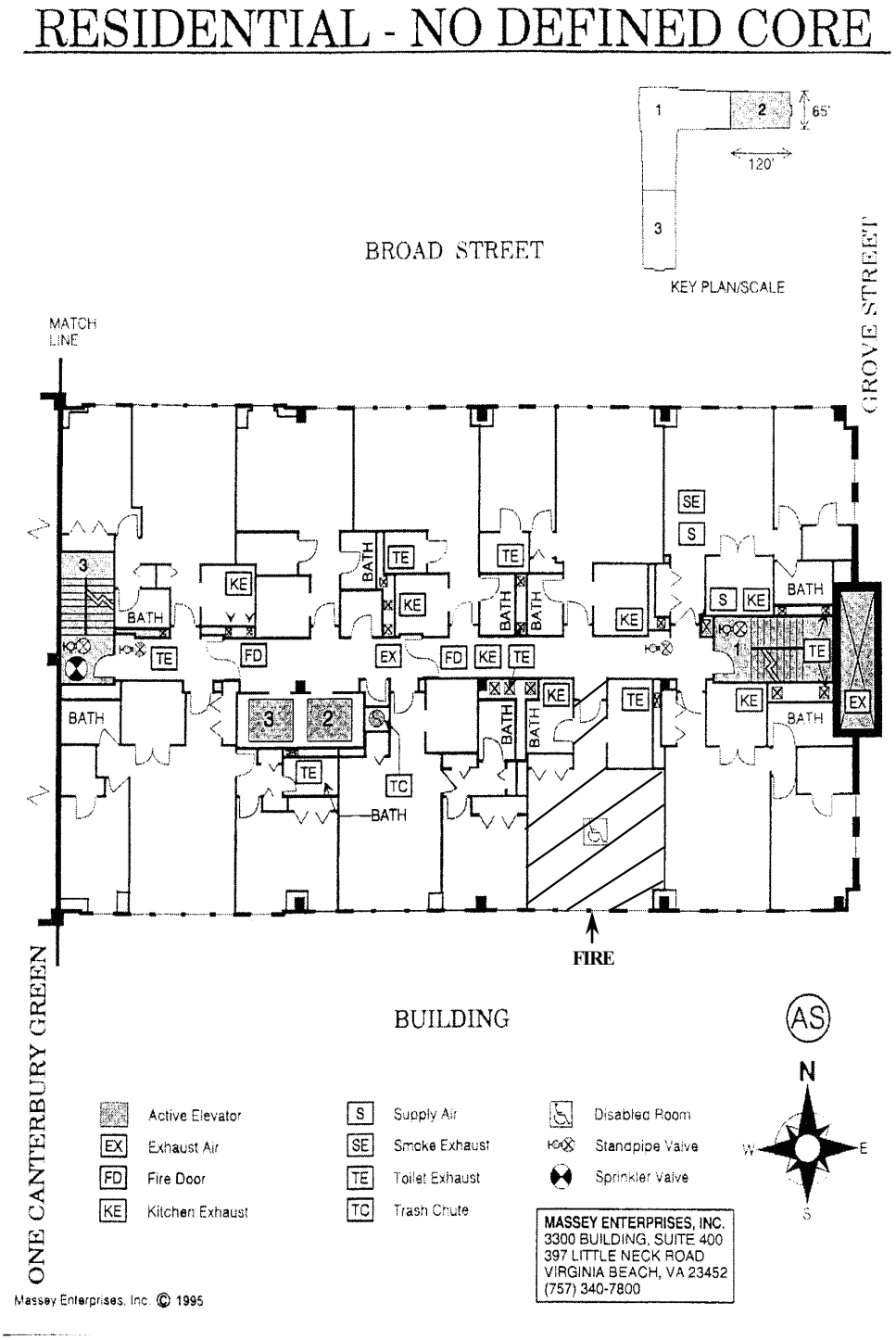
Activity 3.1 (cont'd)

New-Style Residential Occupancy Building



Activity 3.1 (cont'd)

Old-Style Residential Occupancy Building



UNIT 4: STRATEGY AND TACTICS

TERMINAL OBJECTIVE

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

ENABLING OBJECTIVES

The students will:

1. *Identify the highrise fire Strategic Operating Guidelines (SOG's).*
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.*

INTRODUCTION

Firefighting concerns in highrise buildings are more complex than those in smaller structures. The safety of occupants and confining the fire are paramount. These two missions are accomplished with diligent search operations and aggressive fire attack. Extinguishing highrise fires requires aggressive firefighters advancing 1-3/4-inch to 2-1/2-inch (45 mm to 65 mm) handlines. Highrise fires are extremely labor intensive and provide many obstacles that prevent rapid extinguishment. Strategic and tactical considerations for fighting highrise 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 at 10 minutes, with the loss of elevators typically occurring 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 highrise 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 highrise 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, and unreliable water supply, and inexperience with highrise fires dramatically increase operational problems in highrise buildings. The fire environment is severely affected by:

- slab construction;
- heavy, sealed windows;
- intense heat and smoke;
- 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. We are at the mercy of elevators and face the probability that they will not operate properly during fire operations. The task of multifloor ascent via stairwells slows operations down considerably.

STRATEGIC OPERATING GUIDELINES

The following are suggested basic Strategic Operating Guidelines (SOG's) that may be used at a highrise fire. These strategies are listed in order of importance.

Guideline Item #1: 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.

Guideline Item #2: Simultaneously (or as Soon as Possible) Begin the Process of Controlling Evacuation

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 stairshafts 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. Utilize all building communications systems.

Guideline Item #3: Gain Control of Building Systems

These systems include

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

Guideline Item #4: 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 logistic problems and the need for frequent relief of personnel. Placement of hose streams will facilitate fire control and rescue of occupants. Companies must be knowledgeable regarding highrise 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 on the fire floor.

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

Guideline Item #5: Deploy Lines (on the Floor Above the Fire) to Control Extension

Controlling 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 highrise 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 should be considered. Companies operating in tandem will facilitate hose stretching and relief for personnel operating hoselines.

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, and using personnel from more than one company in order to advance the first hoseline.

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 already burned. Stretch a hoseline from the standpipe outlet on the floor below the fire.

Severe fire, heat, and smoke conditions may stop the advance of a single handline. When two handlines operating from the same stairwell are necessary, the second line should hook up to the outlet on the fire floor.

When unable to determine the fire section on a floor, 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);
- firefighters to assist occupants (if the assigned stairwell is an evacuation stair) and ensure that the stairwell door remains closed;
- 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-pronged 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 highrise 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/Stairwell 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 highrise fire:

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

- Conduct a primary search of the fire floor.

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

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

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

- Determine attack stairs.

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

- 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.

  - The presence of stairs (down to fire floor or upward to floor above).

- Examine all stairways for occupants and smoke conditions.

- 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.)

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

- Determine which elevator provides the safest access to the roof.

  - If the fire is on a floor that is serviced by a **highrise bank** of elevators:

    -- Proceed to a location below the fire floor.
    -- Use a low- or mid-rise elevator bank.
    -- Then use a stairway (other than the attack stairway) to proceed to the roof.

  - If the fire is on a floor that is serviced by a **mid-rise bank** of elevators:

    -- Proceed to a location below the fire floor.
    -- Use a low- or mid-rise elevator bank.
    -- Then use a stairway (other than the attack stairway) to proceed to the roof.
    -- Use a highrise bank to pass the fire floor.

  - If the fire is on a floor that is serviced by a **low-rise bank** of elevators:

    -- Use a stairway (other than the attack stairway) to proceed to the roof.
    -- Use a highrise bank to pass the fire floor.

- Upon arrival at the roof area, 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.

- All means available for roof ventilation, especially over the stairways and elevator shafts.

- What is on the roof.

- Any unusual conditions.

- Fire or occupants seen at windows.

Sending personnel into a stairshaft 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 stairshaft terminates. If the upper termination point is not known by the officer directing companies into the stairshaft, the result may be serious injury or death of company personnel. Personnel entering a stairshaft (to reach these upper floors or roof) always should carry an extra self-contained breathing apparatus (SCBA) bottle. Personnel ascending stairshafts also should be aware of the "point of no return" (which usually is dictated by the amount of air remaining in their SCBA).

Other 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);
- removing 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 onscene personnel, regardless of the status of truck companies in a community. Truck companies also can be used to set up Base, Lobby, Staging, or Stairwell 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 (PPV) can be very effective tactics.

The IC should designate an attack stairshaft for use by operating companies. Access to the fire floor by operating companies should be done by this stairshaft. Smoke will enter the stairshaft during the attack operations. This phenomenon should be expected and measures taken to ventilate the stairshaft. Fire attack may have to be delayed until the attack stairshaft 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 stairshaft should be dedicated to occupant traffic--it is called the "evacuation stairs." You may be able to use the building communications 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 shaft.

A highrise 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 task).

A safe area of refuge for the relocation of occupants should be at least three floors below, or three floors above, the fire floor. In most cases, we can secure sufficient safety and fire department access by clearing five floors. 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 stairshafts. You should take action with sufficient resources to gain control of self-evacuation as soon as possible after arrival. The IC will determine what stairs should be used for fire attack. All other stairs may be used for occupant evacuation.

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 stairshaft due to self-evacuation of occupants.
- In order to gain control, the IC may elect to have an evacuation group delivered to the roof and have it work its way down the stairshaft. This top-down method may be effective in establishing stairshaft control.
- Once firefighters control evacuation stairshafts:

  - Occupants should be removed first from the fire floor and from the two floors above the fire.

- Occupants three 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 stairshaft).

- 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 (e.g., medical resources).

RAPID INTERVENTION CREW

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 Programs* (required by 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 required at a highrise incident. RIC's **often** are placed at Staging under the direction of the Operations Section Chief. (This is due to the fact that equipment is kept in Staging, making appropriate item selection, based on current conditions, easier for the RIC.)

The composition and placement of a RIC is normally agency specific. It is important that each agency have SOG's for the RIC at highrise incidents. Guidelines should contain evacuation signals. Remember--air horn warnings do not work for highrise 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 RIC's in cooperation with mutual-aid companies that may respond to your highrise incidents.

A RIC is composed of a **minimum** of two, fully equipped personnel (with appropriate clothing, SCBA's, portable radios, and the necessary tools to be effective). A highrise RIC should have a **minimum** of four personnel as soon as it can be assembled. The RIC should monitor the tactical channel to gain an understanding of the operation in general.

Do not confuse RIC's with the minimum crew size for interior operations. RIC's must be in place when crews are operating in the IDLH.

RESPONDER REHABILITATION

Responder rehabilitation (rehab) is considered necessary when climatic or environmental conditions dictate (i.e., high temperature and humidity). When an incident is large, complex, long in duration, and/or labor intensive, responder rehab should be initiated.

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 3 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 Responder 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 ºF (38.1 ºC), he/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 Responder Rehab Manager. Rehabilitation 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 tags);
- control of tags 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 RIC's.

Accountability at a highrise 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 checkin/checkout sheets. Each division and group supervisor must have a full account of companies assigned to them and where their companies are working.

The Operations Section Chief'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. When a PAR is done too often, it will interfere with the ability to pass critical information along 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 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.

Activity 4.1

Determining Tactical Resources

Purpose

To demonstrate the ability to deploy highrise operational resources and apply tactical considerations.

Directions

1. Your instructor will divide the class into four work groups.

2. Each group will elect a recorder and spokesperson.

3. Review the following scenario:

   A fire is located in an apartment on the 15th floor of a 20-story new-style highrise residential complex. The fire has flashed over, and one entire room is engulfed. The fire occurred at 2200 hours on a Tuesday night. The building has smoke detectors connected to a fire control station in the lobby. The structure has a 2-1/2-inch wet standpipe serving each floor in one stairshaft. There is a building communications system that has speakers in the corridor on each floor. The communications system is controlled from the fire control station.

4. Review the floor plan.

5. Your instructor will assign your group **one** of the following questions to complete.

   a. How would you locate the fire and identify its extent? What resources would you require?

   b. How would you begin the process of controlling evacuation? What number of resources would you need to accomplish this action?

   c. How would you gain control of the building systems, and what resources would you need to accomplish this task?

   d. How would you confine and extinguish the fire, and what number of resources and hoselines would you assign?

   e. How would you deploy lines on the floor above the fire to control extension?

6. Record your answers on an easel pad.

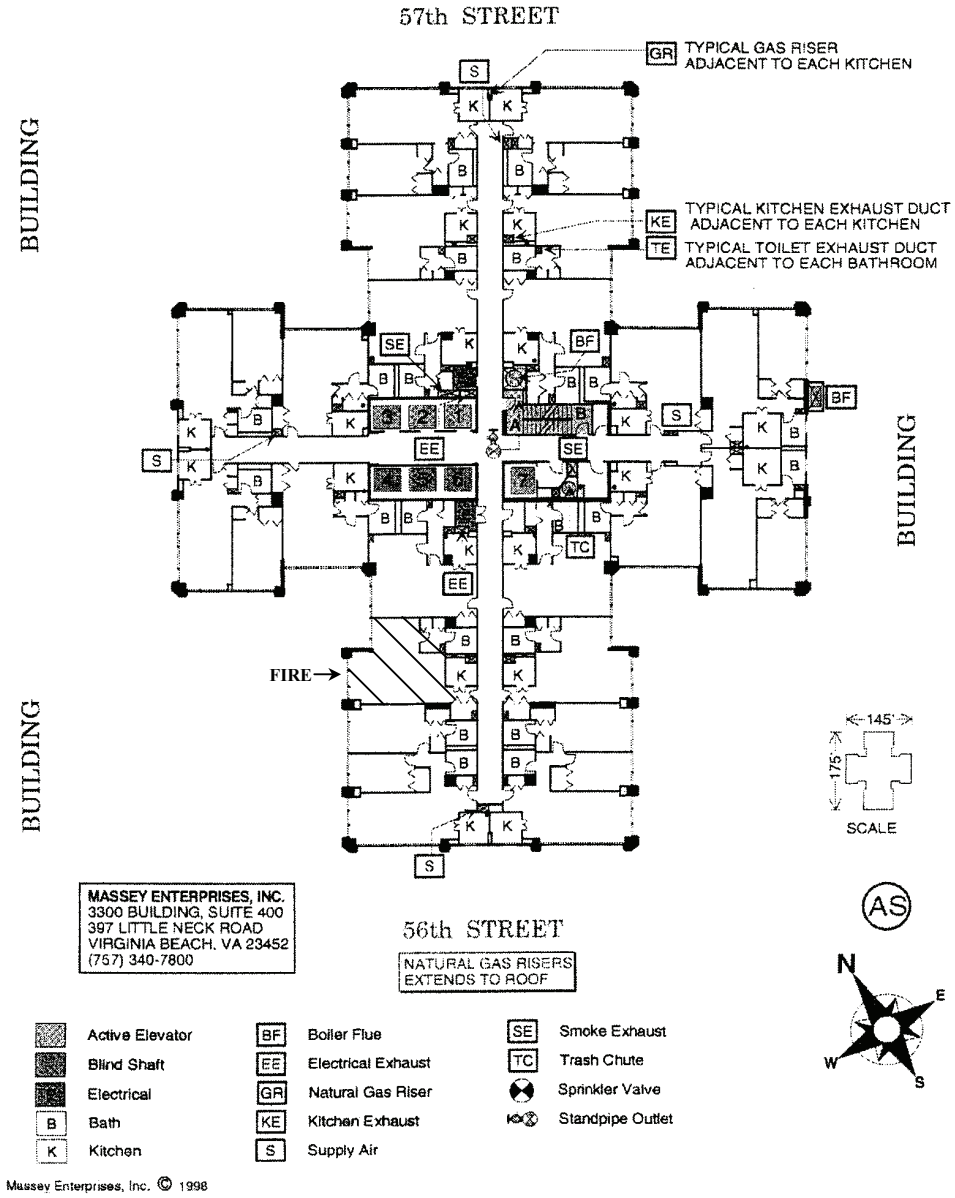
7. Your group will have 15 minutes to develop a response to your assigned question.

8. Your instructor will reconvene the class at the conclusion of the allotted time.

9. Your group spokesperson will be called upon to report your findings informally.

Activity 4.1 (cont'd)

Floor Plan
New-Style Highrise, Residential Complex



UNIT 5: HEATING, VENTILATING, AND AIR CONDITIONING SYSTEMS

TERMINAL OBJECTIVE

The students will be able to describe the application of proper ventilation techniques used in highrise operations.

ENABLING OBJECTIVES

The students will:

1. *Explain the fundamental operation of a heating, ventilating, and air conditioning (HVAC) system.*
2. *Explain the impact of the HVAC system on ventilation efforts.*
3. *Explain fire department ventilation techniques at highrise incidents.*

INTRODUCTION

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

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

GOALS OF EFFECTIVE HEATING, VENTILATING, AND AIR CONDITIONING MANAGEMENT

The fire department's goals for effective use of a highrise building's HVAC system should include the following:

- To use the HVAC system to limit the spread of smoke and heat from the origin and into building egress corridors, passageways, and exits.
- To prevent the HVAC system from intensifying the fire and spreading it beyond the initial area of involvement.
- To provide the fire attack crews the greatest assistance in reaching the seat of the fire.
- To provide fresh air to occupants who may be trapped within the building or who are still evacuating the building.
- To 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 highrise buildings fall into two categories: 1) central air-conditioning systems (where the processing equipment supplies air to more than one floor), and 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 (MER's) are located. The following equipment for the processing of the air should be found in the MER:

- outside air-supply dampers;
- equipment for the heating, cooling, filtering, and humidifying of 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.

Fire Dampers

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

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 Damper

These are designed to solve both functions of a fire and smoke damper when the location lends itself to multiple required functions. Example--a smoke-control system that is part of a building HVAC system that connects to a 2-hour rated mechanical shaft.

MER Air-Processing System Components, Figure 5-1, illustrates these items.

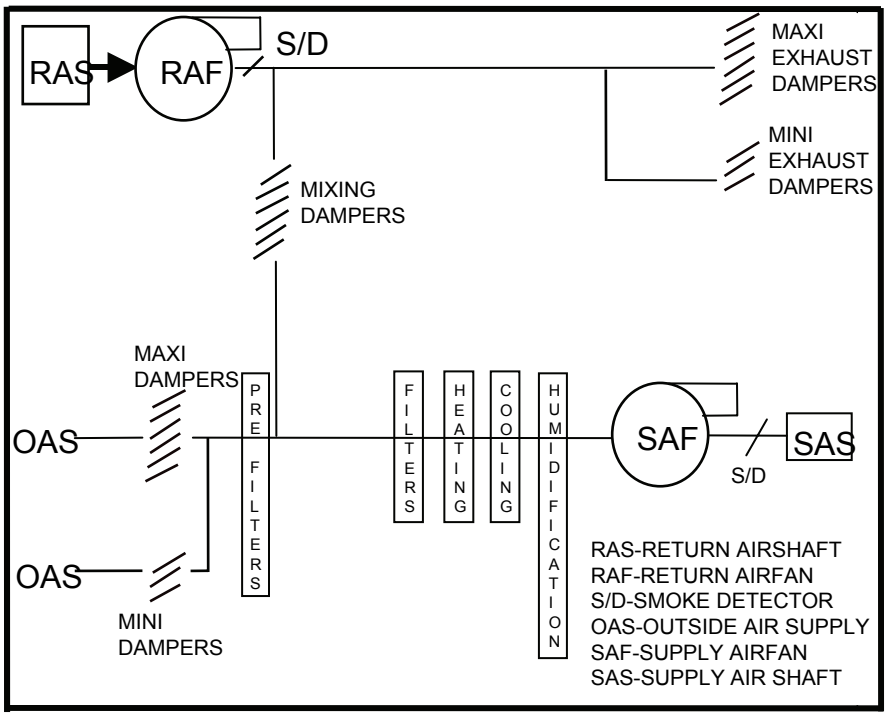


Figure 5-1
MER Air-Processing System Components

The Supply System

Supply system components consist of:

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

Figure 5-2, HVAC System, may be used to trace the path of air through the system.

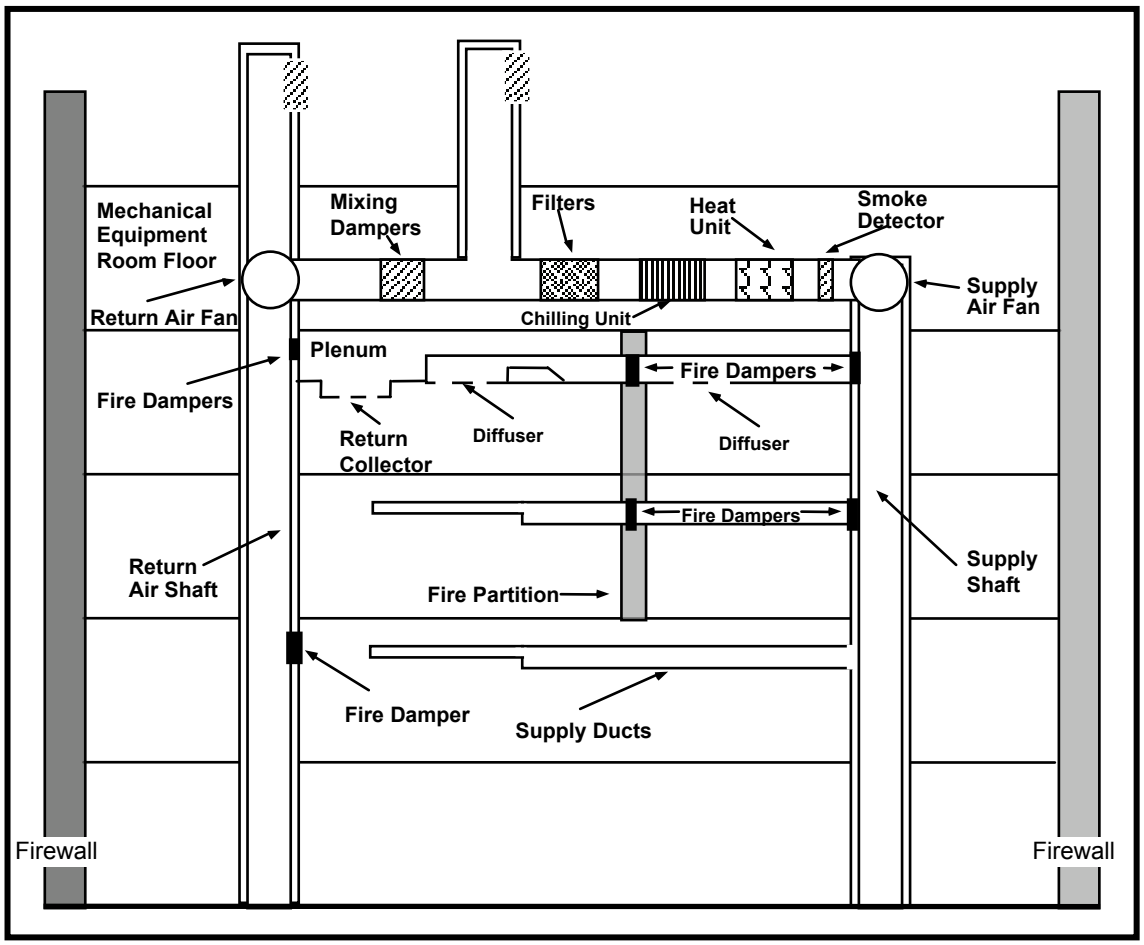


Figure 5-2
HVAC System

The Return System

Figure 5-2 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 highrise 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, 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 5-3, HVAC Zones, illustrates a typical zoned system.

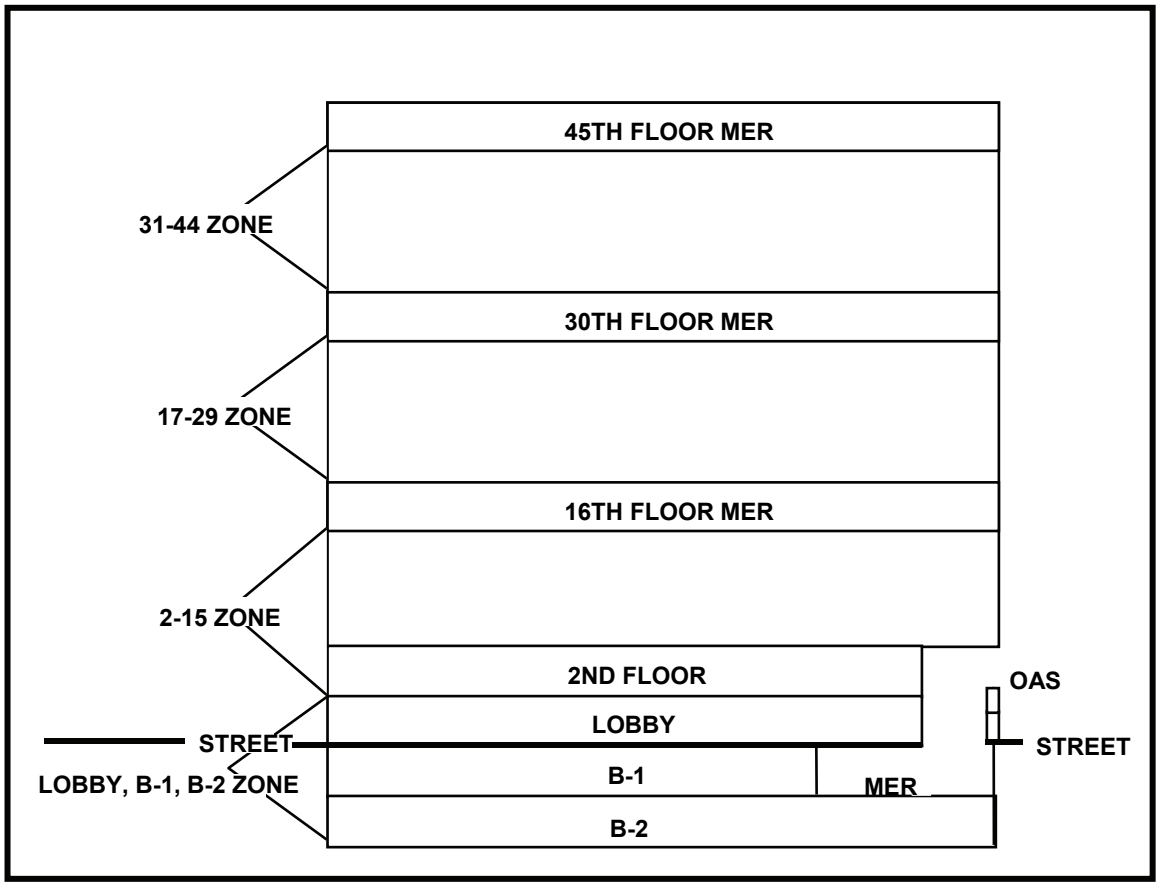


Figure 5-3
HVAC Zones

HVAC System Air Flow

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

Air Flow Through Processing Equipment

(Reference Figure 5-4, HVAC Zones.)

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 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).

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 air shaft to the occupancy areas.

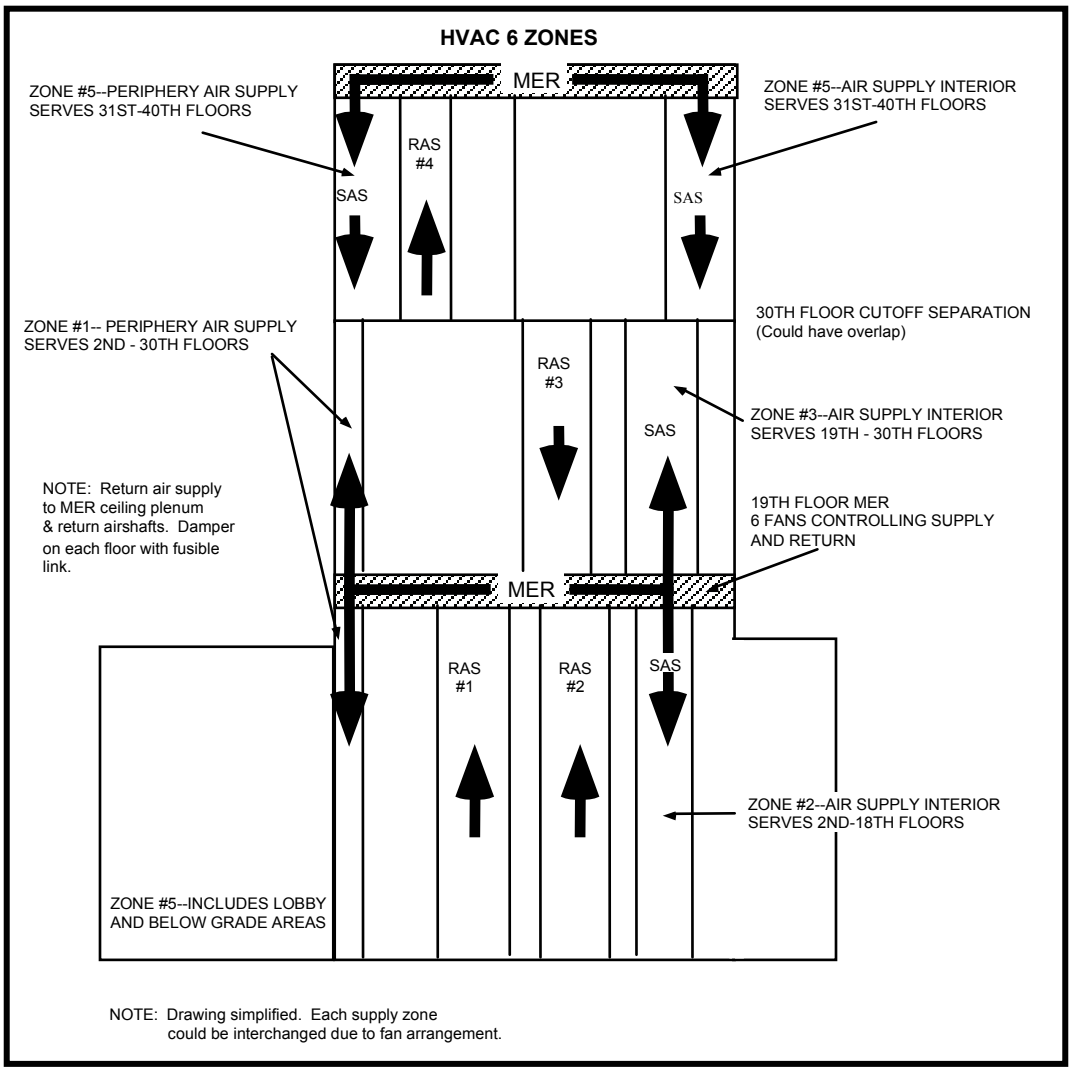


Figure 5-4
Six HVAC Zones

Air Flow Through the Supply System

(Reference Figure 5-2, HVAC System.)

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.

Air Flow Through the Return System

(Reference Figure 5-2, HVAC System.)

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. 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 air shaft. 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 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 highrise 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.

- 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 later in this unit.)

Now that a functional knowledge of the HVAC system exists, we can develop a strategy/plan to achieve the goals that were previously stated. 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 I (Upon Arrival)

- Determine the status of the HVAC systems in the building. Any system that has not been shut down automatically should be manually shut down. 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 accurately determined.

- All HVAC systems in the building should be placed in the non-recirculating 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 accurately determined, 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 systems creates worsening fire conditions, the system should be shut down immediately.***

Phase II

Upon completion of Phase I, 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 ºF (121 to 148.8 ºC).

Note: When heat above 165 ºF (73.8 ºC) is 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/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 ºF)?

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; and
- their use will not cause the fire dampers to close.

Before the IC can implement Phase II, 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 reestablish 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.

Phase III

If the fire was brought under control without the use of the procedures outlined in Phase II, those procedures now should be implemented to assist in complete ventilation of the building.

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 ºF (10 ºC) 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.

Highrise 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.

FIRE DEPARTMENT VENTILATION

Extreme heat buildup and large amounts of smoke will require ventilation on the fire floor(s). To control the fire and perform search and rescue work safely and effectively, it may be necessary to remove smoke and heat from the building first. The difficulty in performing ventilation operations will depend on the type of building.

- A **habitational** highrise (such as an apartment building) usually will have windows that open. These windows can be used to evacuate smoke and heat.

- A sealed office building will have inoperable windows that may need to be broken.

If at all possible, window openings should be made on the leeward side of the building. Openings on the windward side may not be effective in removing large volumes of smoke when the wind is blowing against the building. Cross ventilation provides openings on opposite sides of the building.

In some newer sealed buildings, the air-handling system may be equipped with a smoke removal capability. However, in some cases, the volume of smoke generated by the fire may exceed the capacity of the system to remove it in a timely manner. In these cases, gasoline- or water-driven smoke blowers can be used to help exhaust heat and smoke. Pressurizing floors from stairshaft landings after the window openings have been established is effective. Pressurizing the

stairshafts at street level using gasoline- or water-driven blowers can create a positive pressure that may assist in removing smoke on upper floors. Multiple smoke blowers may be required.

Whenever window openings are used to exhaust smoke products from a building, consider other problems that may be created. Will the smoke reenter the building at some other point, or will fire exiting the window opening cause extension at another location above?

Removing Smoke Via Stairshafts

In some situations, stairshafts can be used to remove smoke from floors of highrise buildings. To be performed effectively, and without endangering occupants, this type of operation requires a very high level of coordination and understanding of the building and its mechanical systems.

A travel path that will channel the smoke from the building without contaminating other areas along the way is a must. Premature opening of doors and windows may create firefighting safety problems. The best way to do this is by using a stairshaft that has a direct opening to the roof. It is important to ensure that all intervening stairshaft doors are kept closed while the operation is in progress. It is critical not to attempt this type of operation until all the occupants have left the building, and firefighting personnel are aware of what will take place beforehand. This type of operation should not be attempted if the building has a smoke control system that incorporates automatic pressurized stairways.

Breaking Glass

Once ventilation is assigned to be accomplished, it is improbable that **all** personnel operating outside the building can be notified of when and where glass will be broken. Breaking window glass for ventilation during highrise fires can be extremely dangerous for those inside and outside the building. Firefighters breaking the glass are in danger from glass that falls inward (especially nontempered glass). If possible, only tempered glass windows should be broken. Many fire departments require that tempered glass windows be placed in each story and marked with an identification symbol (usually a Maltese cross).

Whenever glass is broken (either by the heat from the fire or for ventilation purposes), the window openings should be barricaded. Use whatever material is available (such as furniture, desks, or cabinets) to prevent firefighters from approaching what is a very unsafe area.

People (either civilians or emergency personnel) and equipment outside the building can be in extreme danger if struck by falling glass. Injuries that are caused by falling glass can further complicate an already serious situation. Tests have shown that glass falling from a highrise building may extend to approximately 200 feet from the base of the building. Two hundred and fifty feet or more should be considered the minimum distance for a safety zone. It is best for everyone to operate under the premise that glass can fall at any time.

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 since they can be cut by glass, allowing the hose to be damaged.

UNIT 6: BASIC ORGANIZATIONAL APPROACH

TERMINAL OBJECTIVE

The students will be able to identify roles and responsibilities for command and control procedures for major highrise operations.

ENABLING OBJECTIVES

The students will:

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

INTRODUCTION

The purpose of this unit is to relate the basic organizational approach taken toward highrise 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 highrise incident. There must be a highrise operational plan.

HIGHRISE INCIDENT COMMAND SYSTEM SUPPORT FUNCTIONS

The ICS is used to manage resources at a highrise incident. While a highrise 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 highrise structures.

TIME AND DISTANCE FACTORS

Time factors play an important role in control operations at highrise fires. At any fire, time is needed to transform orders into actions. At a highrise 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 onscene 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 highrise fire. The heat of a highrise 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. Figure 6-1 illustrates this chain of command.

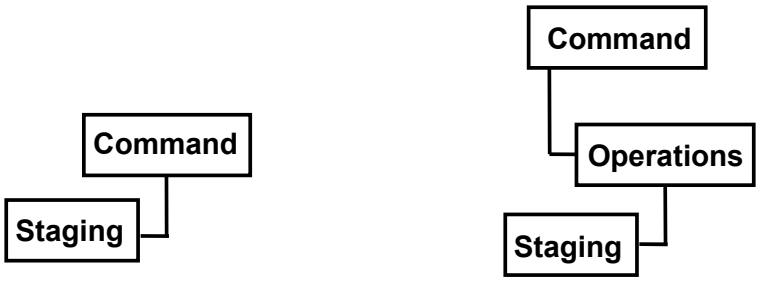


Figure 6-1
How Staging Reports

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 highrise 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 Incident Commander/Operations Chief (IC/Ops) 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. 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/Ops. 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 highrise incident:

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

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/Ops to coordinate personnel deployment, and communicate with the Logistics Section/Base to coordinate equipment movement. Ideally, a separate radio frequency should be used for communications between IC/Ops 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 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

  - SCBA air cylinders;
  - complete SCBA;
  - firehose and fittings;
  - smoke ejectors/fans;
  - forcible entry tools;
  - salvage equipment;
  - ladders;
  - medical supplies; and
  - resuscitators;
  - flashlights/batteries and radios.

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

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. Locate and open restrooms for firefighter use. Secure liquids for firefighters who are in Staging. If available, consider using 5-gallon drinking water bottles on the Staging floor.

The building 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. Plenty 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/Ops. 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 highrise 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 highrise 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 highrise 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 highrise 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 support operations (Base, Staging, Lobby Control, Ground Support/Stairwell Support, Systems, etc.). The need to relieve and/or rehab personnel assigned to tactical operations frequently also must be considered.

First-alarm resources should be sufficient to:

- provide prompt investigation and location of the reported fire;
- start an initial 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 HIGHRISE FIRE

The following **example** reviews how to estimate companies needed at a working highrise 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 highrise 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 working highrise incidents are resource intensive, and the number of personnel is the critical issue, not the number of apparatus.

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 on 10th floor	1 company (initial 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/Stairwell 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/Stairwell Support, and Staging.

Using this example for a moderate fire in a highrise 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 highrise fires, it generally is agreed that a **minimum of 50 personnel** will be required to handle a relatively small working fire in a highrise. These departments place at least this many personnel on scene with the arrival of:

- The first-alarm assignment (24 or more personnel).
- The 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 highrise 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 stairshaft landing, and one company is at the Staging Area.

- The company at the stairshaft 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 stairshaft 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/Ops 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 highrise 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 2 or 3 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 fire and the debilitating effect 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

There are certain tasks required of the first-arriving unit at a highrise fire. Whether it is an engine company or a truck company, the tasks described below must be addressed. If the first-arriving unit is an engine company, it also is normal for that company to be the first unit that ascends to the fire floor.

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

- **Perform an initial sizeup--rapidly evaluate the situation.** There are a number of considerations that the first-arriving CO should keep in mind when doing the initial sizeup. 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. 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 initial 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 6-2 illustrates the ICS organization for initial arriving (once Command is established).

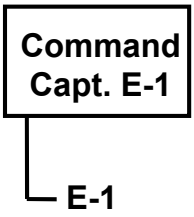


Figure 6-2
ICS Organization for Initial Arriving

The first-arriving CO should assume initial incident command. This will allow the IC to assign companies and personnel consistent with Standard Operating Guidelines (SOG's). 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:**

  - use 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.**

- **Control the elevators.**

  - All cars should be returned to the ground level.

  - Cars are placed in Firefighter Service mode.

Additional Considerations

There are a number of other functions that can be performed if sufficient personnel are available, e.g., obtaining the telephone number for a lobby telephone. This telephone can be used if communications become disabled or distorted. 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), or reading onsite building diagrams.

INCIDENT COMMANDER DUTIES

The officer of the first company remaining at ground level will assume Command or relieve the officer of the first-ascending unit. 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; others prefer an exterior position located 200 feet (60 meters) from the building. The first IC to stay at ground level may be a CO. That officer should perform the following functions:

- **assume or transfer command:**

  - obtain briefing from person being relieved,
  - confirm and announce the transfer of command, and
  - announce the location of the Command Post (CP) (if being changed);

- **size up and report conditions (as they are on assumption of Command):**

Figure 6-3 illustrates the ICS organization for an incident where the first IC is a CO.

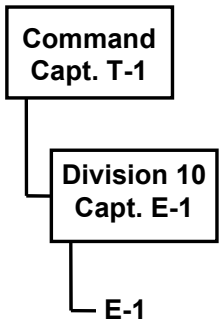


Figure 6-3
Company Officer as the Incident Commander

- **confirm the Staging floor and base location:**

  - establish resources on this floor (include personnel, equipment, etc.), and
  - announce location;

- **determine initial strategy and tactics:**

  - develop the initial incident strategy, and
  - 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** (This priority is ongoing throughout the incident.); and
- **expand the ICS to include the necessary functions to gain control of the incident.**

Figure 6-4 shows the incident's ICS organization when a chief officer arrives before a CO.

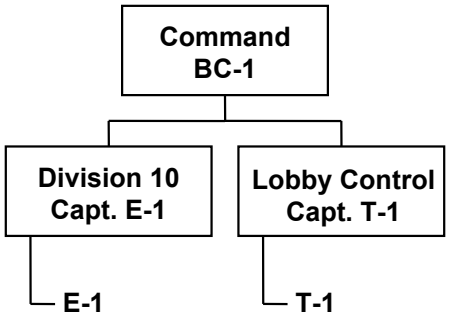


Figure 6-4
Chief Officer as the Incident Commander

FIRST-ASCENDING OFFICER DUTIES

It is imperative that a company ascend to the fire floor as quickly as possible. Based on local SOG's, the company performing this task may or may not be the first company to arrive on the scene.

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

The fire department must have SOG's regarding the use of elevators, stairshafts, or combinations of both when ascending to the upper floors during highrise fire (or reported fire) operations. The safest method of ascending to the fire floor is to use a stairshaft 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 stairshaft for fire attack should pace itself while ascending. Personnel should take aloft necessary equipment only (i.e., SCBA, highrise hose packs with nozzles, forcible entry tools, radios, and stairshaft 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;
- percentage of involvement and conditions;
- rescue problems;
- other specific problems;
- what your company is doing; and
- additional company needed (and for what purpose).

For example, "Engine 14 has reached the 20th floor. This is an office occupancy. I have about 10 percent of the total floor involved with possible extension to the offices on each side. There is no obvious rescue; we will perform a primary search. Engine 14 is connecting to the standpipe and moving to attack the fire. I will need two additional engines and one truck company to my location. Companies need to be sent to the floors above."

Initiating Initial Fire Floor Operations

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

- determine fire attack 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.

Figure 6-5 illustrates the first-ascending officer (Division 10, Captain E-1) and his/her place in the organization (at this time).

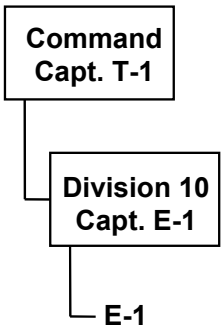


Figure 6-5
First-Ascending Officer (Captain Engine 1)

BASE, LOBBY CONTROL, GROUND SUPPORT/STAIRWELL SUPPORT, COMMUNICATIONS, AND SYSTEMS UNIT

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

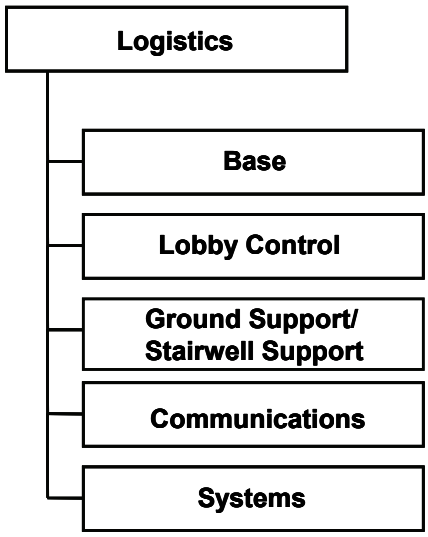


Figure 6-6
Base, Lobby, Control, Ground Support/Stairwell Support, Communications, and Systems

Base

The Base area of a highrise 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 or to the IC if the Logistics Section has not been activated.

The IC will determine the need/location for Base at any highrise 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 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 highrise, normally 200 feet (60 meters) or more from the structure.
- Determines and advises dispatch center (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.
- Assures the security of Base (uses police if necessary).
- Delivers supplies to the bottom stairs/lobby (for use by Ground Support/Stairwell Support).

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.

Make sure that the apparatus driver(s) remain with their vehicle(s) so that their vehicles can be moved when other apparatus need to pass.

The Base Manager should establish safe traffic flow routes that will ensure the effective movement of personnel and equipment into and out of the highrise. 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 highrise incident are extensive. Like Staging, Lobby Control should be a priority. It is recommended that Lobby Control be established on all working highrise incidents from the first-alarm assignment. As shown in Figure 6-7, the Lobby Control Manager reports to the Logistics Section Chief (or the IC if the Logistics position has not been established).

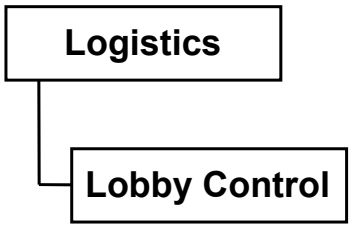


Figure 6-7
Lobby Control

The Lobby Control Manager should report (to Logistics/IC) the number of floors in the building (based on 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 a fire department elevator operator. Any car not equipped with Firefighter Service mode should be placed out of service.

The responsibilities of the Lobby Control Manager include

- controlling fire department and civilian personnel entering and exiting the building;
- ensuring that companies who are directed to upper floors carry equipment with them;
- designating which elevators will be used by personnel (and assigning an elevator operator);
- placing cars without Firefighter Service mode out of service; and
- pressurizing the stairwell with fans (when the building HVAC system cannot be used for this purpose).

Ground Support/Stairwell Support

The Ground Support/Stairwell Support function is implemented when equipment cannot be moved to Staging by elevator or when an 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 6-8, the Ground Support/Stairwell Support Unit Leader reports to the Logistics Section Chief (or the IC if the Logistics Section has not been activated).

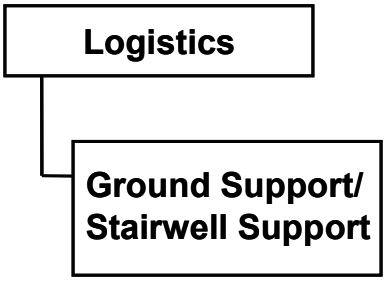


Figure 6-8
Ground Support/Stairwell Support

The responsibility of Ground Support/Stairwell Support is the priority transportation of equipment by way of a stairwell to the Staging floor. If equipment is delivered to the roof by helicopter, Ground Support/Stairwell Support will handle equipment movement down the stairwell to Staging. If an auxiliary water supply is required by way of the stairwell, the officer in charge of Ground Support/Stairwell Support will coordinate and supervise the effort. In this situation, a request should be made for Base to provide a water supply line to the stairwell entrance.

The following strategies will be helpful in performing Ground Support/Stairwell 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/Stairwell Support.
- Officers must remain mobile to supervise the operation. Ground Support/Stairwell 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).
- Lobby Control or Base will deliver equipment to the stairwell entrance at ground level.

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/Stairwell 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 6-9, the Communications Unit Leader reports to the Logistics Section Chief. 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.

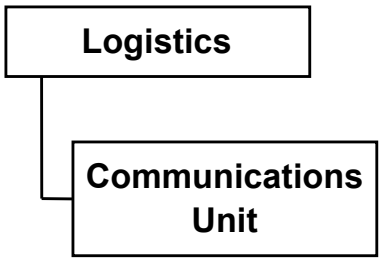


Figure 6-9
Communications Unit

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 IAP.

As derived from Figure 6-10, the System Unit Leader reports to the Logistics Section Chief or the IC (if the Logistics Section Chief has not been staffed). This unit may respond to direct requests from the Operations Section Chief.

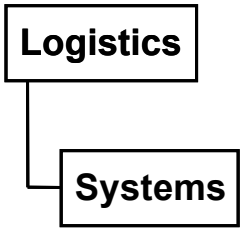


Figure 6-10
Systems Unit

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 Logistics Section Chief or the IC and building staff;
- assess the current situation and request needed personnel and resources;
- request response of, 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;
- evaluate and operate (as required) the HVAC and smoke removal and stairwell protection systems;
- evaluate, support, and control the building electrical system and emergency power plant;
- evaluate and support the public address, telephone, emergency telephone, and other building communications systems; and
- secure operations and demobilize personnel (as determined by the demobilization plan).

PERSONNEL ACCOUNTABILITY

Tracking the location and movement of personnel during highrise incidents is difficult even under the best conditions. The turnover and relief of personnel at a working highrise 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).

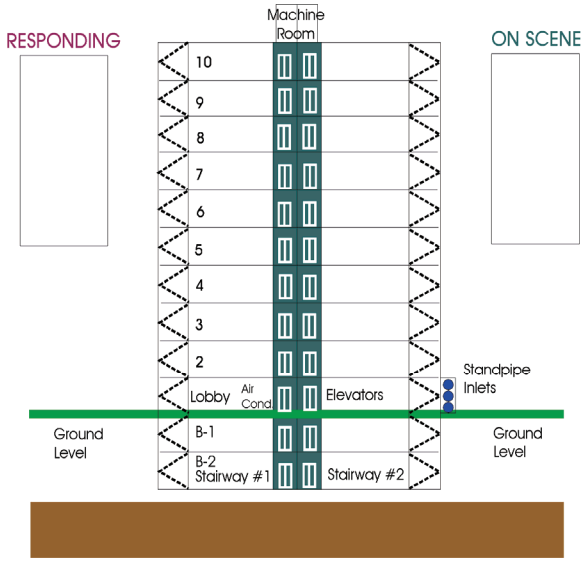
Other ICS functions also are responsible for tracking the arrival, departure, destination, and location of resources. The Base Manager maintains a list of all companies that have arrived in Base and the time that these people left for Lobby Control. The Lobby Control Unit Leader would have a list of all companies that came through Lobby and where they were sent (e.g., Staging or some other part of the organization). 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/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 PAR's 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**. PAR's conducted too frequently use extensive radio time, while those conducted too infrequently leave Command (and others) without the knowledge of where companies are traveling.

HIGHRISE INCIDENT--EXAMPLE

Highrise Fire



Building Characteristics

The subject building is a 10-story office building. The building is center-core design and is of a typical lightweight, noncombustible construction.

This building does not have a sprinkler system. However, it is equipped with a pressurized standpipe system with 2-1/2-inch outlets in each stairshaft at each floor.

The elevator system contains two cars in one shaft and a single car in another shaft (on the opposite side of the core). Elevators serve all floors, including the two levels of sub-basement parking. All elevators are equipped with Firefighter Service mode controls.

The first floor of the building is the main entrance to the ground-level lobby area. Also on the first floor are the security console for the building, and several shops.

Floors two through nine contain individual offices of varying dimensions. These offices have partitions that stop at the dropped-ceiling level. The 10th floor is an open banquet and meeting room area.

The structure is a "sealed" building with a recirculating HVAC system. The open plenum area above the dropped ceiling on all floors is used for air return to the HVAC system as well as electrical and plumbing chases. The HVAC system does not have smoke removal capability, but can be shut down at ground level in the security console.

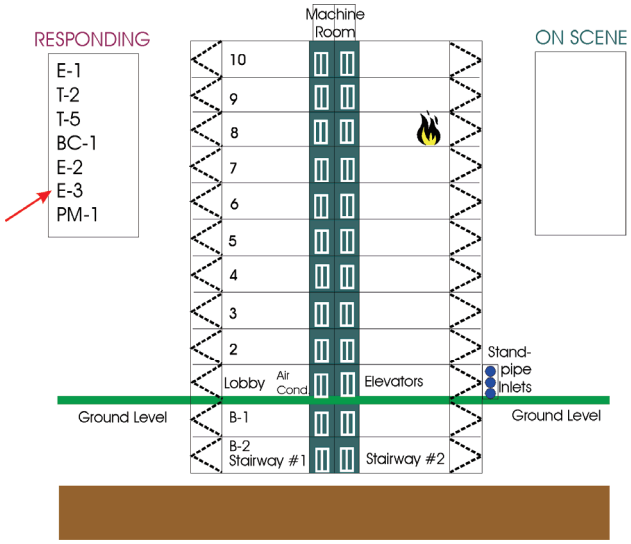
The Fire

The fire depicted in this case study occurred on the eighth floor on a Saturday at 1600 hours. Offices in the building were not occupied at this time, but a wedding reception (approximately 40 people) was in progress on the 10th floor.

Events

The First Alarm

The first-alarm dispatch was three engine companies, two truck companies, one battalion chief (BC), and one paramedic unit.



Arrival of Engine 1

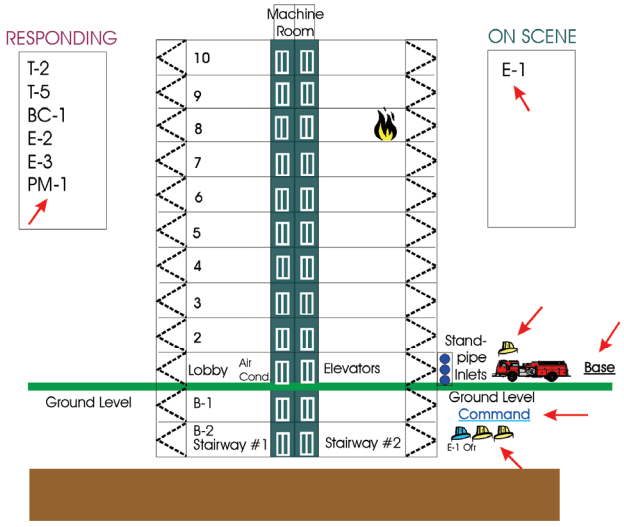
Engine 1 arrives on scene.

The CO reports heavy smoke showing from the eighth floor, Side A, of a 10-story highrise.

Engine 1 officer advises Dispatch and Truck 2 that Engine 1 is passing Command to Truck 2. Also requests that a second and third alarm be dispatched.

Also advises that Base will be located in the parking lot on the east side of the building.

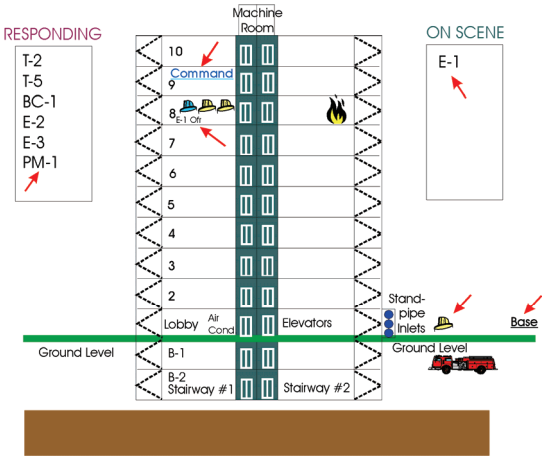
The apparatus operator from Engine 1 is directed to establish a standpipe supply.



Engine 1 to Fire Floor

Dispatch and Truck 2 are advised by Engine 1 that Engine 1 officer and crew are proceeding to the eighth floor (via the #1 stairshaft).

At this time, the ICS organization is officer of Engine 1 is Command (until Truck 2 arrives and assumes Command).

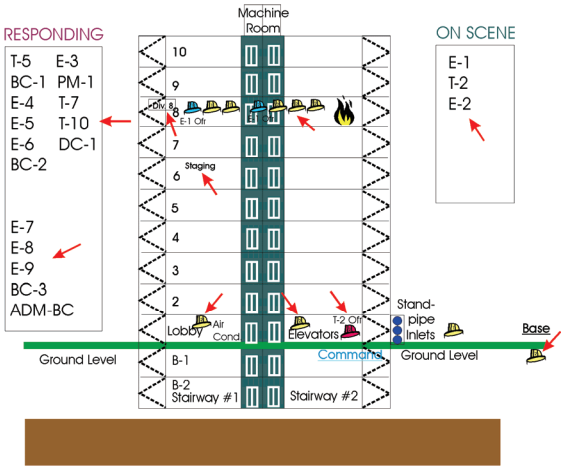


Arrival of Truck 2 and Engine 2

On arrival, Truck 2 officer contacts Command (E-1) via radio and confirms that Truck 2 is assuming Command.

Truck 2 officer also confirms that Engine 1 will be Division 8.

The Engine 1 officer:



- acknowledges the message;
- informs Command that the sixth floor is okay for Staging;
- provides a sizeup on fire conditions; and
- advises that the best approach to the fire area is from stairshaft #1.

Engine 1 officer also reports that a civilian in the stairshaft has told him/her that there are about 40 people on the 10th floor.

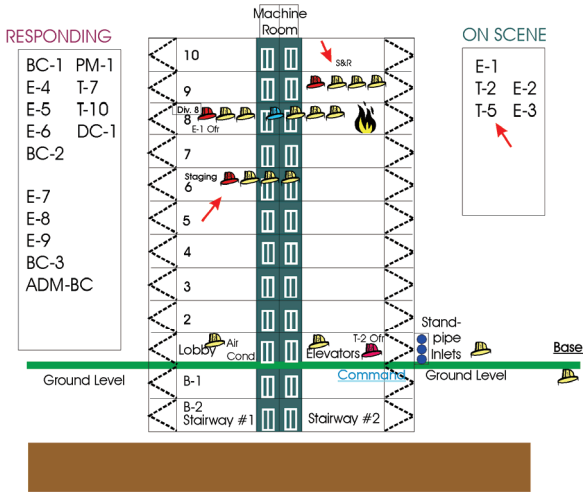
Personnel from Truck 2 are directed by Command to establish Lobby and Base.

Engine 2 arrives on scene and is instructed by Command (T-2) to report to Division 8.

At this time, the ICS organization is

- Officer of Truck 2 is Command.
- Officer of Engine 1 is Division 8.
- Personnel from Truck 2 have established Lobby Control and Base.

Arrival of Truck 5 and Engine 3



Truck 5 and Engine 3 arrive on scene.

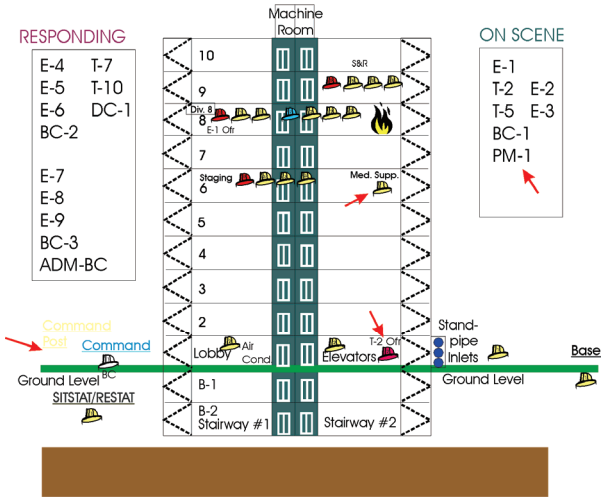
Truck 5 is informed by Command that it will be in charge of the Search and Rescue Group and that 40 people are on the 10th floor.

Engine 3 is directed to establish Staging on the sixth floor.

At this time, the ICS organization is

- Officer of Truck 2 remains in Command.
- Truck 2 personnel have established Lobby and Base.
- Engine is Division 8 with E-1 and E-2 crews.
- Officer of Truck 5 is Search and Rescue Group.
- Engine 3 is Staging.

Arrival of Battalion Chief 1 and Paramedic 1



Battalion 1 and Paramedic 1 arrive on scene.

After conferring with the officer of Truck 2, Battalion 1 assumes Command.

The Truck 2 officer remains responsible for managing both Lobby and Base.

The Battalion 1 administrative assistant is assigned to RESTAT and situation status (SITSTAT).

Paramedic 1 is directed to report to the Staging Area to provide medical support.

At this time, the ICS organization is

- Battalion 1 is Command.
- Officer of Truck 2 is supervising Lobby and Base.
- Engine 1 is Division 8. Engine 1 and Engine 2 are assigned.
- Truck 5 is Search and Rescue Group.
- Engine 3 is Staging.

Arrival of Second Alarm

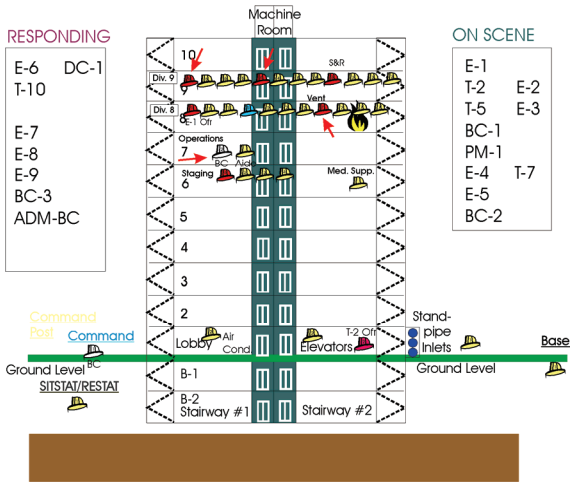
Second-alarm units are beginning to arrive at the incident.

Engine 4, Engine 5, and Truck 7 have reported to Base.

Battalion 2 is on scene.

Engine 4, Engine 5, and Truck 7 are directed to Staging by Lobby Control.

Battalion 2 is assigned by Command to Operations.



Operations assigns Engine 4 from Staging to assist with search and rescue, and Engine 5 as Division 9 to prevent possible extension. Truck 7 is assigned as the Vent Group.

At this time, the ICS organization has expanded.

- Battalion 2 is Operations.
- Engine 5 is Division 9.
- Truck 7 is the Vent Group.

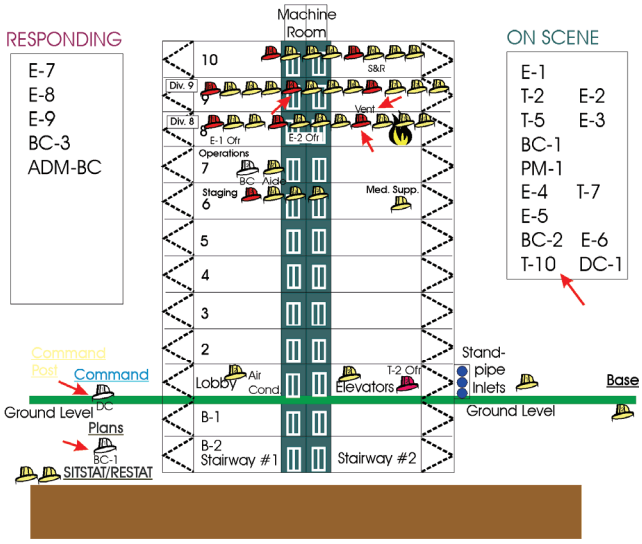
Arrival of Additional Second-Alarm Units

Engine 6, Truck 10, and the Deputy Chief arrive at the incident.

Engine 6 and Truck 10 report to Staging.

Engine 6 is assigned by Operations to Division 9, and Truck 10 is assigned to the Ventilation Group.

The Deputy Chief reports to the CP and, after receiving a briefing from Battalion 1, assumes Command. Battalion 1 is reassigned to Planning.



At this time, the ICS organization has expanded to include

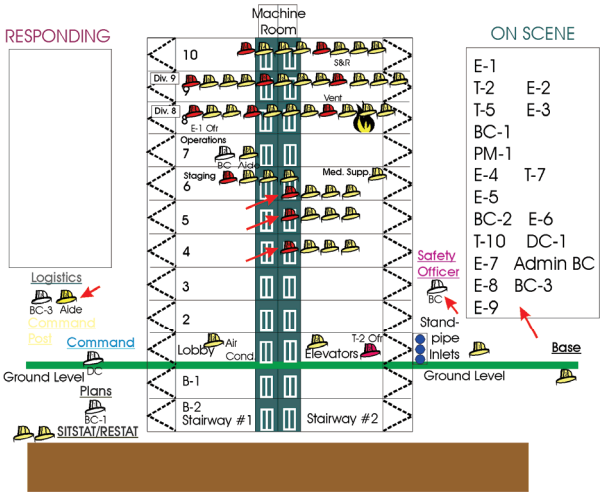
- Deputy Chief as Command.
- Battalion 1 as Planning.
- Additional resources are assigned to Search and Rescue Group and the Vent Group.

Arrival of Third Alarm

Third-alarm resources (consisting of Engine 7, Engine 8, Engine 9, Battalion 3, and the Administrative Battalion Chief (BC)) have arrived at the incident.

Engines 7, 8, and 9 have checked in at Base and have been directed to proceed to Staging to provide support or relief, as needed.

Battalion 3 has been assigned by Command to Logistics.



The Administrative BC is assigned to Safety.

At this point in time, with the arrival of the third-alarm resources and with assignments made thus far, the ICS organization is now:

- Deputy Chief is Command.
- Administrative BC is Safety.
- Battalion 2 is Operations and is supervising Staging, Division 8, Division 9, the Search and Rescue Group, and the Ventilation Group.
- Battalion 1 is Planning.
- Battalion 3 is Logistics.
- Relief for units involved in tactical operations can be provided by the three companies available in Staging and by calling additional alarms.

Activity 6.1

Highrise Incident Command System Organization

Purpose

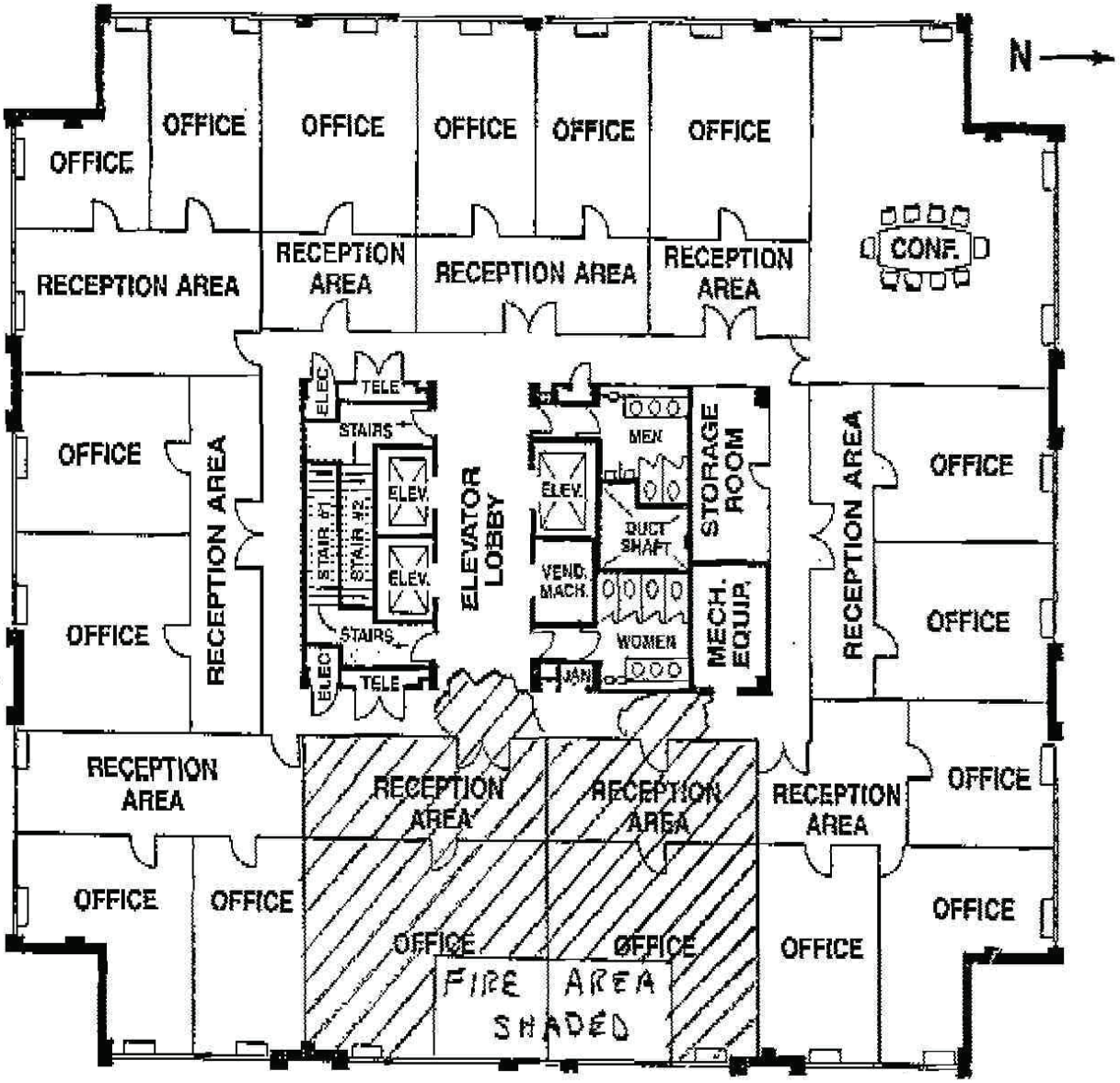
To discuss and apply the ICS to complex incidents using most of the ICS functions.

Directions

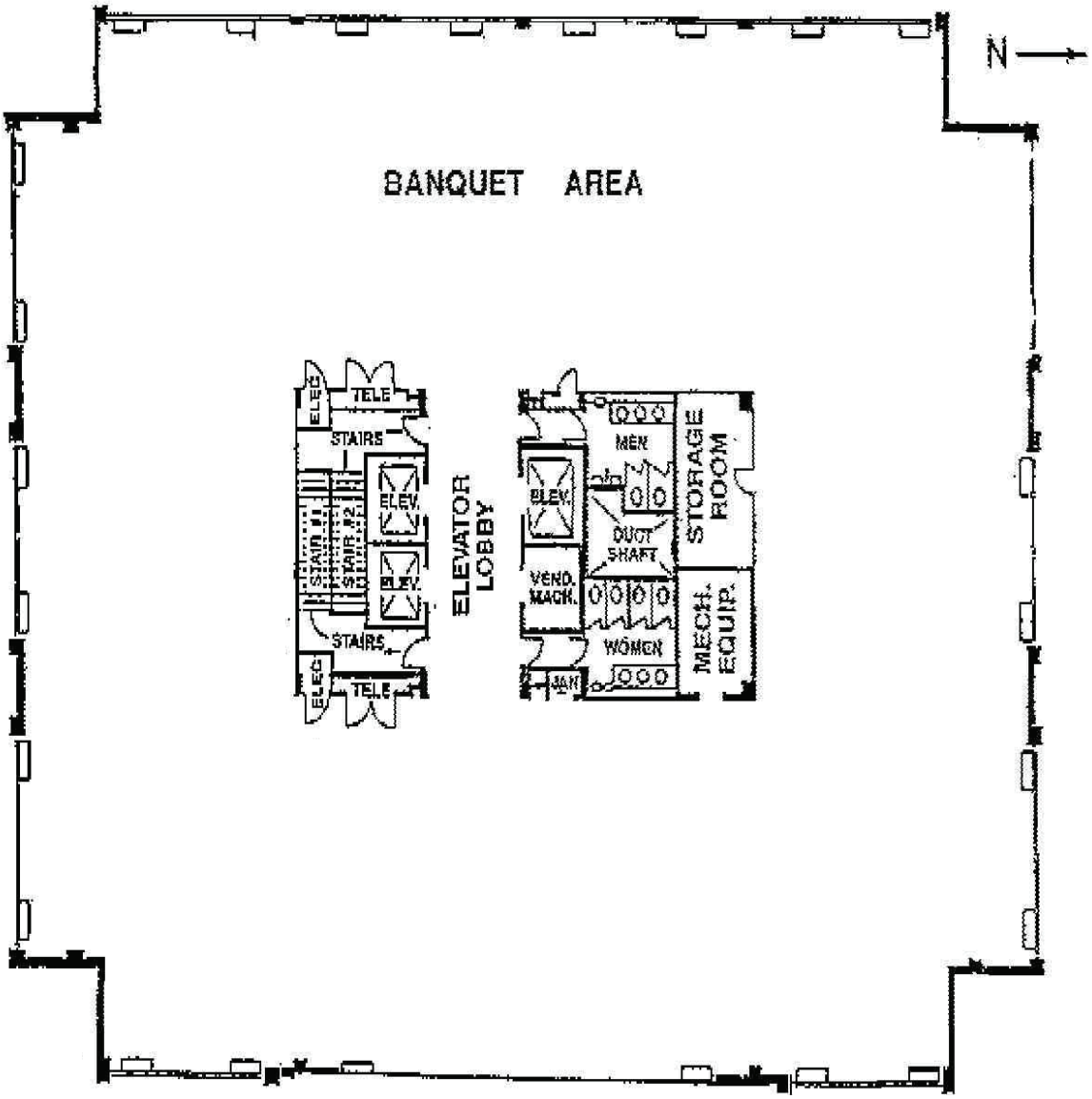
1. Your instructor will divide the class into four work groups.
2. Each group will be assigned one of the following major sections of the ICS:
   a. Work Group #1: Incident Command and Command Staff.
   b. Work Group #2: Operations Section (including Staging).
   c. Work Group #3: Planning Section.
   d. Work Group #4: Logistics Section.
3. The incident/scenario for this activity involves a 10-story office highrise with a small compartmentalized fire on the eighth floor. (A floor plan of the building, which shows the fire area, has been provided.)
4. Your group is to
   a. Elect a group spokesperson and recorder.
   b. Complete the Student Activity Worksheet associated with your assigned ICS function. Base your answers on the scenario and video presented.
5. You will have 50 minutes to complete this assignment.
6. Have your recorder place your answers on an easel pad.
7. Your instructor will reconvene the class at the conclusion of the allotted time.
8. Each group spokesperson will have approximately 5 minutes to report group findings.

Activity 6.1 (cont'd)

Floor Plan--Eighth Floor



Floor Plan--Office Highrise--Ninth Floor



Activity 6.1 (cont'd)

Work Group #1: Incident Command and Command Staff

Respond to the following questions/tasks:

1. What ICS functions are required to be staffed in this area of responsibility?

2. What specific jobs must each function perform?

3. What is your overall strategy for the incident given?

4. What is the number of alarms that will be needed for operational success?

   (Note: first alarm = three engines, two trucks, one medic, one Battalion Chief; second alarm = three engines, two trucks, one Battalion Chief, one Deputy Chief; third alarm = four engines, one Battalion Chief; fourth alarm = four engines.)

Work Group #2: Operations Section

Respond to the following questions/tasks:

1. What is the location for Staging?

2. What tactical operations are required for control of the fire and for occupant safety?

3. What specific divisions and groups are required to accomplish these operations and what is the number of resources that would need to be assigned to each?

4. Draw an ICS organization chart that shows the Operations Section.

Work Group #3: Planning Section

Respond to the following questions/tasks:

1. What functions need to be staffed in the Planning Section?

2. Develop a "Plan B" for the operation based on scenario possibilities (technically, this plan is to be activated only after conferring with the IC and the Operations Section Chief). Note that this should be a "worst case" plan.

3. What resources would be needed if "Plan B" were to be activated?

4. Describe the type of accountability system you would use to obtain a PAR.

Work Group #4: Logistics Section

Respond to the following questions/tasks:

1. What functions (for highrise operations) need to be implemented at this incident?

2. List the responsibilities for each function staffed.

Activity 6.2

Using the Incident Command System at Highrise Fires

Purpose

To demonstrate knowledge of how the ICS process works, and to apply appropriate strategy and tactics at a highrise incident.

Directions

1. Your instructor will assign you a role.

2. Simulation details:

   a. During this simulation, you will assume/perform the ICS roles and responsibilities associated with your assigned position.

   b. You will review the slides and building scenario.

   c. You will be expected to report out at the conclusion of the simulation.

3. The following items (found on the following pages of this SM) will be reviewed by your instructor:

   a. Quick Access Prefire Plan (QAP).

   b. Building floor plans (floors 8 and 10).

4. Ask any questions that you may have at this point.

5. Your instructor will perform a Postincident Analysis (PIA) at the conclusion of this activity. During this PIA, the instructor will

   a. Ask each group/person to describe its/his/her actions.

   b. Correct tactics and suggest other options as appropriate.

Building Description

- Ten-story, Type I Fire Resistive.
- Center-core design.
- Restaurant/Banquet facility on 10th floor.
- Two elevators--one on emergency power supply.
- During off-hours elevators block out floors 2 to 9.
- Two stair shafts--scissors design--sublevel 2 to roof.
- Standpipe in both stair shafts.
- Electric fire pump in first sub-basement.
- Three HVAC systems--1 to 4, 5 to 9, and 10.
- Smoke and heat detection system throughout open areas, stairwells, elevator shafts.
- Building is 100' x 100', compartmented floor design, except 10th floor, which is open space.

Scenario

- Saturday, 10:00 p.m.
- 10th floor.
- Restaurant--staff and customers, about 50 persons.
- Wedding reception--50 persons.
- Fire situation:

  - Fire reported on Side A (south side) of eighth floor, fire in four windows on arrival.

  - Tenth floor evacuating by both stair shafts.

  - One elevator stalled on seventh floor.

  - Other elevator at the Lobby.

  - Annuciator panel showing heat and smoke on eighth floor with smoke activation on 7, 8, 9, and 10.

Incident Commander

1. Will this incident require Branches due to the number of Divisions and Groups that may be assigned?

2. What functions will be immediately subordinate to the IC?

3. Whom do you need to communicate with?

4. What problems do you anticipate in performing your Command responsibilities?

5. What safety issues do you have for the operating personnel?

Operations Section Chief

1. Will this incident require Branches due to the number of Divisions and Groups that you may assign?

2. What functions will be immediately subordinate to the Operations Section Chief?

3. Whom will you need to communicate with?

4. What problems do you anticipate in performing your Operations responsibilities?

5. What safety issues do you foresee?

Planning Section Chief

1. What subordinates will you establish in the Planning Section?

2. Whom will you need to communicate with?

3. What problems do you anticipate in performing your Planning responsibilities?

4. How will you prioritize your need for the Unit Leaders in the Planning Section?

5. Do you foresee any safety issues?

6. Develop a Plan "B" for possible extension to Division 9.

Logistics Section Chief

1. What Unit Leaders and managers will you establish in the Logistics Section?

2 How will you prioritize your need for the Unit Leaders in the Logistics Section?

3. Whom will you have to communicate with?

4. What problems do you anticipate in performing your Logistics responsibilities?

5. Do you foresee any safety issues?

Safety Officer

1. Will you require additional Assistant Safety Officers, and how many?

2. What Divisions/Groups will you need to coordinate with?

3. How will you prioritize the placement of additional Safety Officers as they become available at the scene?

4. What problems do you anticipate in performing your safety responsibilities?

5. What types of safety issues do you anticipate?

Staging Area Manager (two floors below the fire floor)

1. What type of equipment will you start stockpiling at Staging?

2. What jobs will you and your crew be doing in the Staging Area?

3. What safety concerns would you anticipate?

4. How much staff will you require to move equipment to the fire area and staff the Staging function?

Rehab Manager

1. Where will you establish the Rehab function?

2. What type of functions will you have performed at Rehab?

3. How much staff will it take to perform these functions?

4. What safety concerns do you anticipate?

5. Whom will you need to communicate with?

Systems Unit Leader

1. How many personnel will you need to monitor and control the building system?

2. What systems do you need to be familiar with?

3. Whom will you need to coordinate with?

4. What safety concerns would you have?

Lobby Control Unit Leader

1. What critical functions are you responsible for?

2. How will you accomplish these functions?

3. When will it be safe to use the elevators?

4. How will you account for emergency responders who come through the Lobby?

5. Whom will you communicate with?

Base Manager

1. What critical functions do you have?

2. How will you accomplish these functions?

3. Whom will you communicate with?

Suppression Branch Director

1. What critical functions do you have to accomplish?

2. What Divisions and Groups are your subordinates?

3. Whom will you communicate with?

4. What safety concerns do you have?

5. How many hoselines will you use to control the fire on the eighth floor?

6. How many firefighters will you need to accomplish all your tasks?

Rescue Branch Director

1. What critical functions do you have to accomplish?

2. What Divisions and Groups are your subordinates?

3. Whom will you communicate with?

4. What safety concerns do you have?

5. How many firefighters will you need to accomplish all your tasks?

6. What critical functions do you have to accomplish?

Medical Branch Director

1. What critical functions do you have to accomplish?

2. What Divisions and Groups are your subordinates?

3. Whom will you communicate with?

4. What safety concerns do you have?

5. How many firefighters will you need to accomplish all your tasks?

6. What critical functions do you have to accomplish?

Division 8 Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. How many hoselines will you use to control the fire on the eighth floor?

6. How many firefighters will you need in total to accomplish your tasks?

Division 9 Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. How many hoselines will you use to control the extension of the fire to the ninth floor?

6. How many firefighters will you need in total to accomplish your tasks?

Division 10 Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. How many hoselines will you use to control the extension of fire to the 10th floor?

6. How many firefighters will you need in total to accomplish your tasks?

Division 7 Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. How many hoselines will you use to control downward extension of the fire to the seventh floor?

6. How many firefighters will you need in total to accomplish your tasks?

Ventilation Group Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. What problems do you anticipate in performing your tasks?

6. How many firefighters will you need in total to accomplish your tasks?

Rescue Group Supervisor

1. What critical tasks do you have?

2. How will you accomplish these tasks?

3. Whom do you need to communicate with?

4. What safety concerns do you have?

5. What problems do you anticipate in performing your tasks?

6. How many firefighters will you need in total to accomplish your tasks?

Activity 6.2 (cont'd)

Role Assignment Sheet

Student Name		Assignment
1		**Engine 1 Officer**
2		**Truck 2 Officer**
3		**Truck 2 Firefighter**
4		**Truck 2 Firefighter**
5		**Engine 2 Officer**
6		**Battalion 1**
7		**Battalion 1 Aide**
8		**Deputy Chief 1**
9		**Deputy Chief 1 Aide**
10		Battalion 2
11		Battalion 2 Aide
12		Battalion 3
13		Dispatcher
14		Facilitator
15		Medic 1
16		Engine 3 Officer
17		Truck 5 Officer
18		Admin. BC - Safety
19		Engine 4 Officer
20		Engine 5 Officer
21		Engine 6 Officer
22		Truck 7 Officer
23		Truck 10 Officer
24		Engine 7 Officer
25		Engine 8 Officer
26		Engine 9 Officer
27		Engine 10 Officer
28		Engine 41
29		Engine 51
30		Engine 61
31		Engine 71
32		Engine 81

Activity 6.2 (cont'd)

Simulation Structure/Chain-of-Events

1. **The first alarm consists of:**

Engine 1	Truck 2
Engine 2	Truck 5
Engine	Battalion 1
	Medic 1

The first-in company has one officer and three personnel. All other companies have one officer and three personnel. All Chief officers have an aide (depending upon the number of students in the class).

There is a Dispatcher and a Facilitator assignment.

a. The Dispatcher is provided with a Run Card for the assignment and an Arrival Sequence Sheet.

b. The Facilitator will draw the firefighting assignments and ICS on a Tactical Worksheet.

2. **First-arriving unit will be Engine 1. A second alarm is struck.**

The pump operator is directed to stand by at the base of the building to assist with any difficulty in communications. When the second unit arrives, Engine 1 will connect to and supply the standpipe connection.

The E-1 officer will assume Command and proceed to the fire floor assessing the floor two floors below the fire floor for Staging and then give a report on conditions on the fire floor and floor above. Initial attack on the fire will be started. This officer will assign additional companies to the other tactical operations until Operations is staffed.

3. **The second-arriving unit will be Truck 2.**

The officer will assume Command from Engine 1 and make Engine 1 Division 8. Truck 2's firefighters will be assigned to Base and Lobby Control.

4. **The next company to arrive will be Engine 2.**

This unit will report to Division 8 for assignment.

5. **The next unit to arrive will be Engine 3.**

   This unit will go to the Staging Area and assume Staging Area Manager. This crew can switch roles with Engine 1 (should Engine 1 run out of air before additional units are available in Staging).

6. **Battalion 1 arrives and assumes Command from Truck 2.**

   Truck 2 officer is reassigned to Logistics Section Chief. Logistics needs to staff the following functions:

   a. Stairwell Support.
   b. Systems.
   c. Lobby Control (being played by a firefighter from Truck 1).
   d. Base (being played by a firefighter from Truck 1).

7. **Truck 5 arrives and is sent to Staging to be assigned by Division 8.**

8. **The second alarm consists of:**

Engine	Truck 7
Engine 5	Truck 10
Engine 6	Battalion 2
	Deputy Chief 1

9. **All engines and trucks on second alarm are sent to Staging (unless Command assigns some of them to assist with support functions).**

10. **Battalion 2 arrives, is made Operations, and assumes a position in the stairwell on the 9th floor.**

    Operations continues to build on the plan of Division 8 by assigning additional units to tactical operations.

11. **Deputy Chief 1 arrives and assumes Command from Battalion 1.**

    Command directs Battalion 1 to become Planning Section Chief.

12. **Command must direct some companies to support functions at the request of the Plans and Logistics Chiefs.**

    Students so assigned will carry out the responsibilities of those functions and record their actions on a piece of note paper.

13. **The third alarm, if requested, consists of:**

Engine 7	Battalion 3
Engine 8	Administration BC
Engine 9	

14. **The third-alarm companies are sent to Staging (unless Command assigns some to support functions).**

15. **Battalion 3 is assigned as the Logistics Section Chief.**

16. **Fourth alarm consists of 3 engines (should it be requested):**

Engine 10	Engine 51
Engine 41	

17. **The simulation continues until the fire is "under control."**

Activity 6.2 (cont'd)

Job Descriptions: Dispatcher and Facilitator

The **Dispatcher** has the following duties:

1. Dispatches all requested resources.
2. Records (and dispatches) all requested Special Call Resources.
3. Places units on scene (per the Arrival Sequence Sheet provided by instructor).
4. Answers and responds to all calls from Command.

(The instructor provides Dispatch with a Run Card and Arrival Sequence Sheet.)

The **Facilitator** has the following duties:

1. Using a Tactical Worksheet, tracks all companies operating at the incident.
2. Places the Tactical Worksheet on an easel pad.
3. Draws all hoselines from the standpipe system that are being used to attack the fire.
4. Physically locates/sets up between the Command Group and the Operations Group.

Activity 6.2 (cont'd)

Quick Access Prefire Plan

Building Address: *1300 Crain Highway*

Building Description:
100' x 100', 10-story, highrise, noncombustible construction.

Roof Construction:
Poured concrete on steel bar joist.

Floor Construction:
Poured concrete on steel bar joist.

Occupancy Type:
First floor: lobby and shops.
Second through ninth floors: offices.
10th floor: banquet hall.

Initial Resources Required:
3 engines, 2 trucks, 1 Medic Unit, 1 Battalion Chief

Hazards to Personnel:
Elevators

Location of Water Supply:
Hydrants on each corner around building.

Available Flow:
3,000 gpm each

	Estimated Fire Flow*			
Level of Involvement	*5%*	*10%*	*25%*	*100%*
Estimated Fire Flow	450	900	2,250	9,000

**Estimated fire flow based on one floor with five exposure floors.*

Fire Behavior Prediction:
Rapid horizontal, slow vertical extension.

Predicted Strategies:
Rescue, exposures, confinement, ventilation.

Problems Anticipated:
Water flow for fire control, ventilation, people on banquet floor.

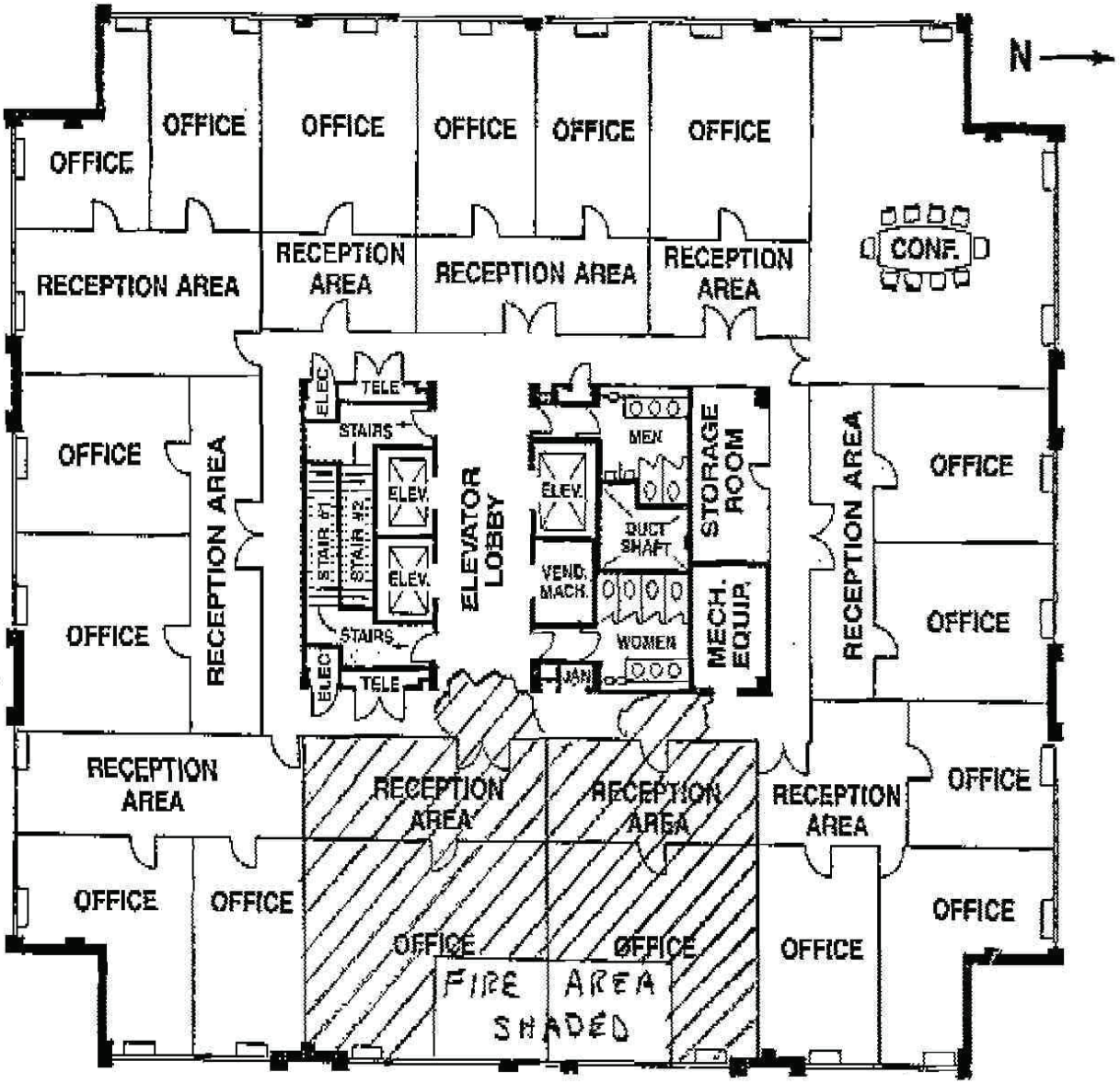
☒ **Standpipe:** *Yes*

☐ **Sprinklers:** *No*

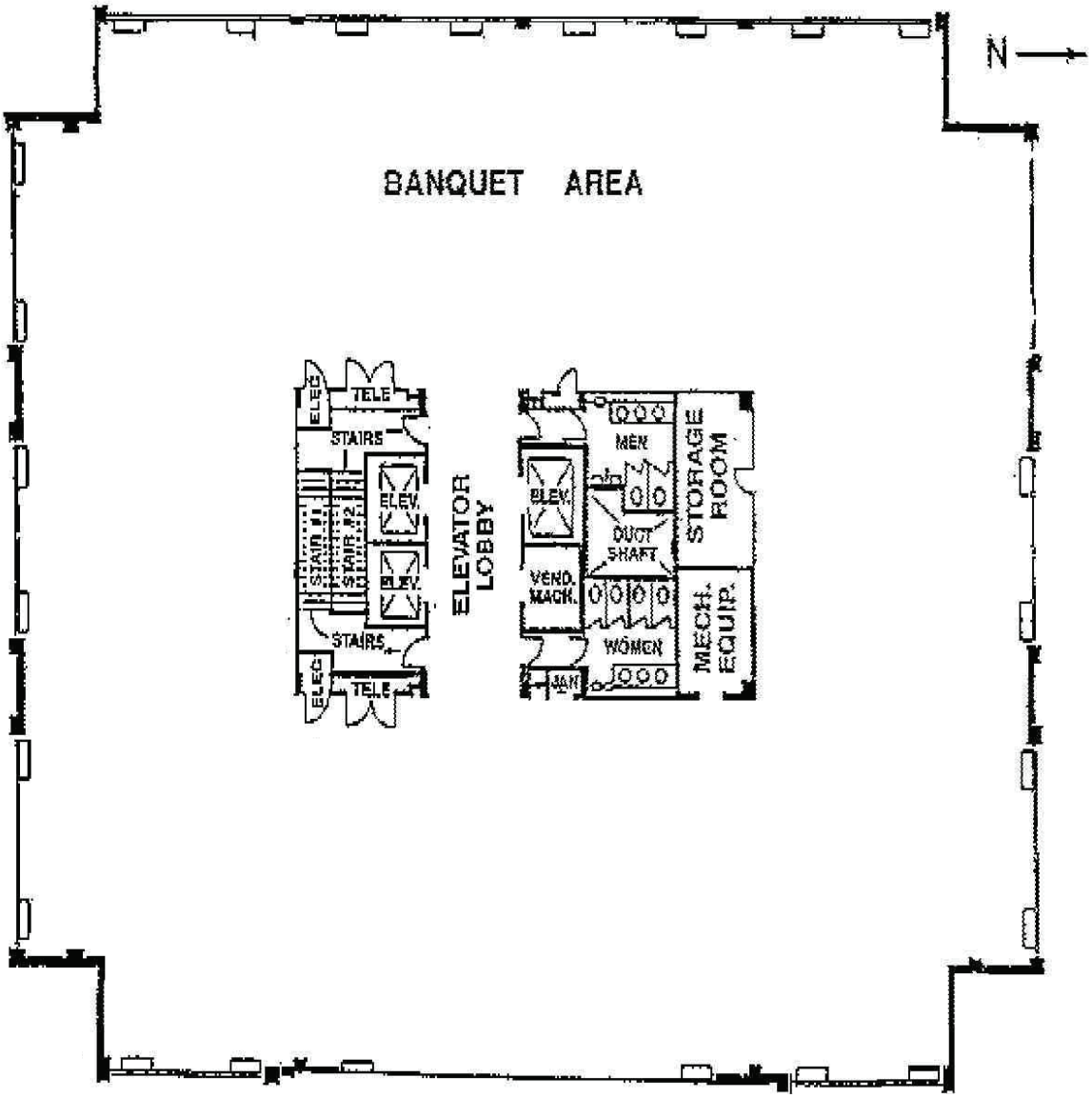
☒ **Fire Detection:** *Yes*

Activity 6.2 (cont'd)

Floor Plan--Eighth Floor



Floor Plan--10th Floor



APPENDIX

THE INCIDENT COMMAND SYSTEM

COMMAND PROCEDURES--PURPOSE

Fire departments respond to a wide range of emergency incidents. This unit identifies Standard Operating Guidelines (SOG's) 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 highrise 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 decisionmaking).
- 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.
- Provision of safety, accountability, and welfare of personnel. (This priority is 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 SOG's;
- 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, haz mat release, multivehicle accident, etc.).

3. Obvious conditions (working fire, haz mat 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 Eleven is on the scene of a 10-story building with a working fire on the 2nd floor. Engine Eleven 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 Eleven will be 7th Street Command."

For a defensive structure fire
"Engine One is on the scene of a six-story carpet mill fully involved with exposures to the east. Engine One 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 One 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. The 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 time, 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 highrise 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 highrise 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 with 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, haz mat 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 SOG's. 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

Table 1-1 (Basic ICS Organization and its Relationship to Incidents of Varying Size) shows how ICS organization applies to incidents of differing size.

Table 1-1
Basic ICS Organization and
its Relationship to Incidents of Varying Size

Initial Response	**1 to 5 Increments/1st Alarm**
Reinforced Response	**Greater Alarm/Mutual Aid**

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.

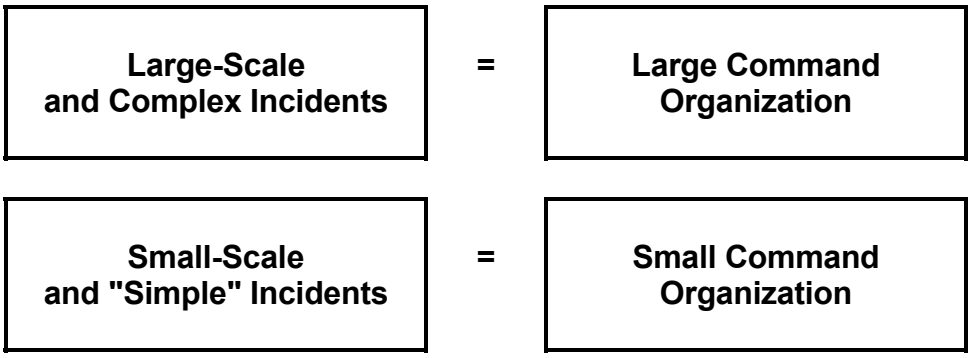


Figure 1-2
The ICS: Large Versus Small Organization and Incidents

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.

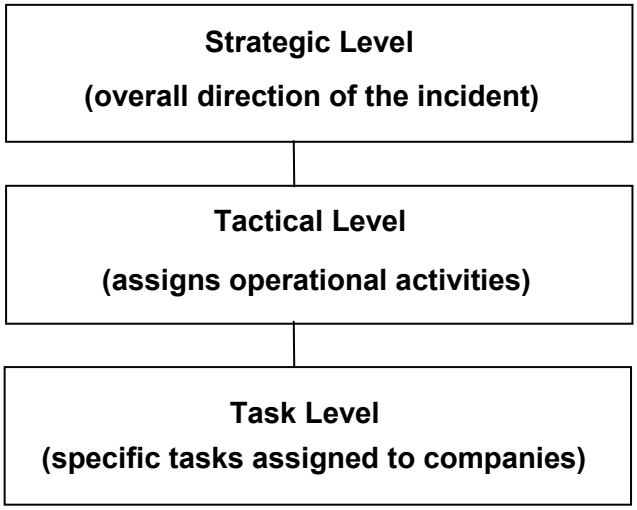


Figure 1-3
Basic Configuration of Command

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 SOG's);
- 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 Chief.

Task Level

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 CO's. 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.

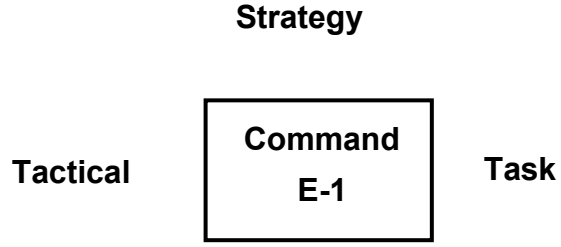


Figure 1-4
Basic Structure: Single Unit Response

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.

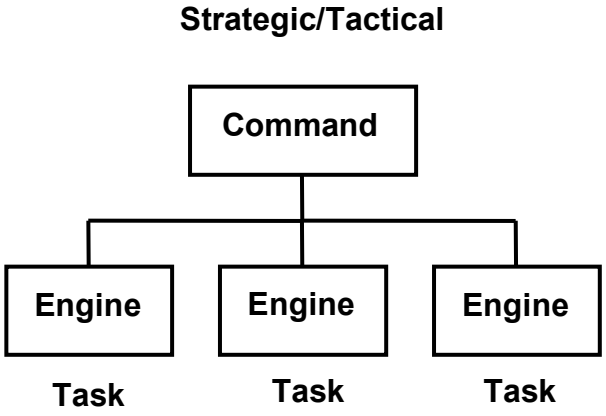


Figure 1-5
Basic Structure: Multiunit Response

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

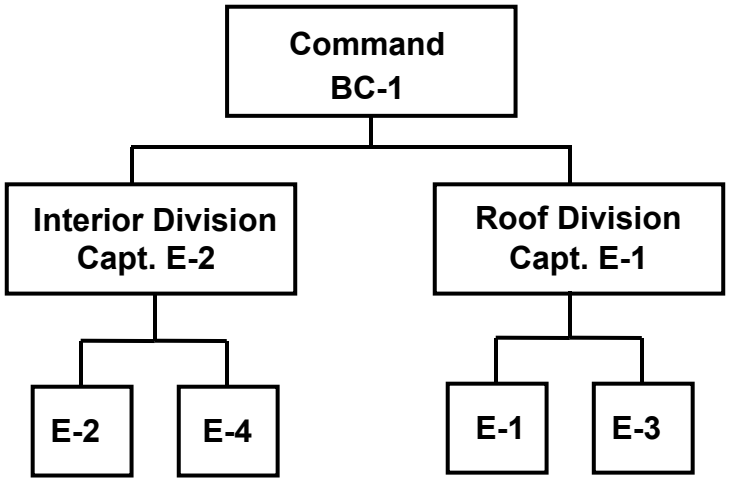


Figure 1-6
Division Designation

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.

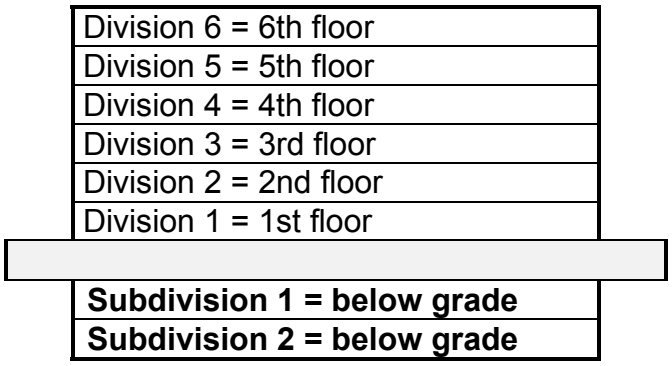


Figure 1-7
Division Designations

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.

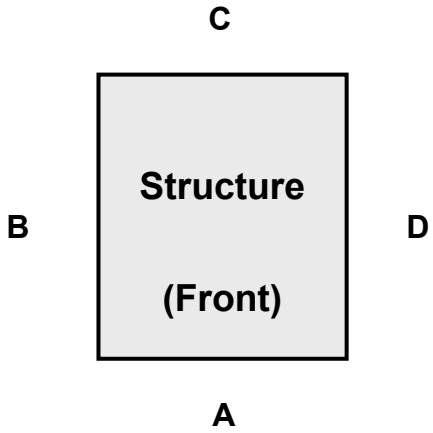


Figure 1-8
Exterior Designations

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.

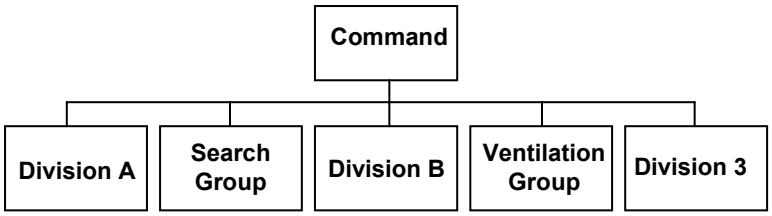


Figure 1-9
Division/Group Designation

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 company officers), 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 CO's 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, highrise 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, CO's, 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 SOG's.

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 CO's working within a division or group is to direct the operations of their individual crews in performing assigned tasks. CO's 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.
- When 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 highrise 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)).

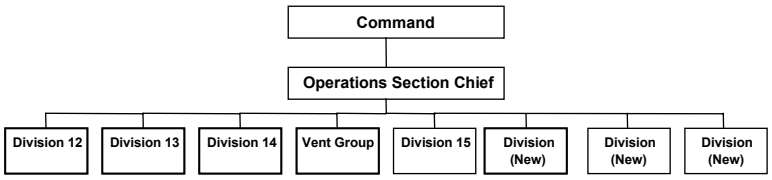


Figure 1-10
Before Multibranch Structure

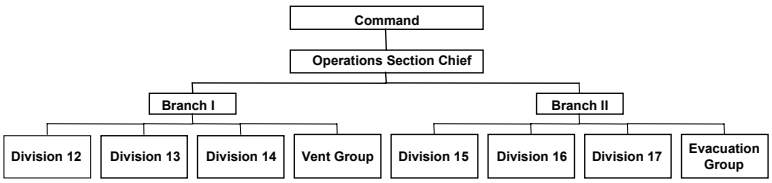


Figure 1-11
Two-Branch Organization

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 currently assigned; 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 highrise operations, branches should be located at operational locations. When a highrise 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.

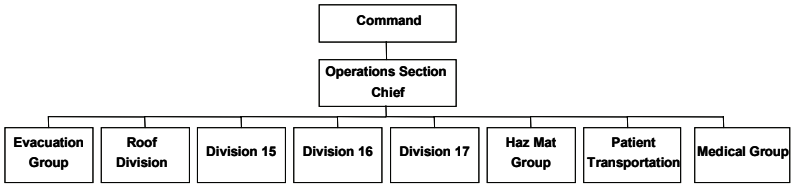


Figure 1-12
"Original" (Overloaded) Organization

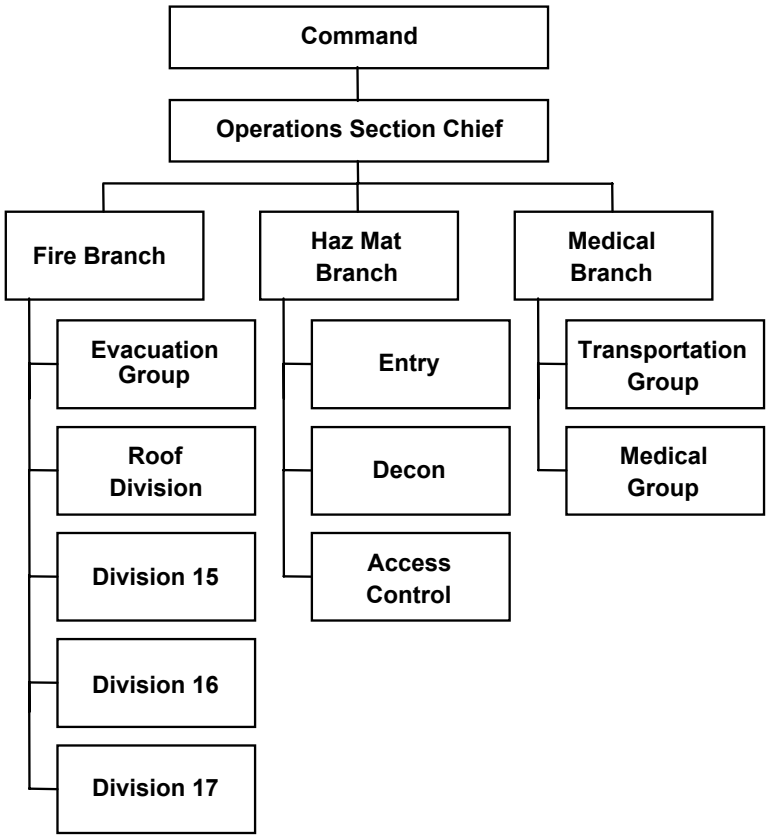


Figure 1-13
"Expanded" (Corrected) Organization

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.

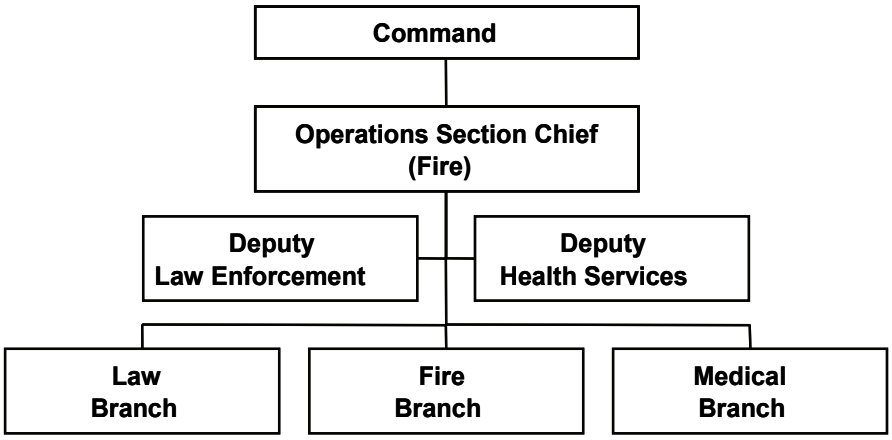


Figure 1-14
Functional Branches Illustrating Three Agencies

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.

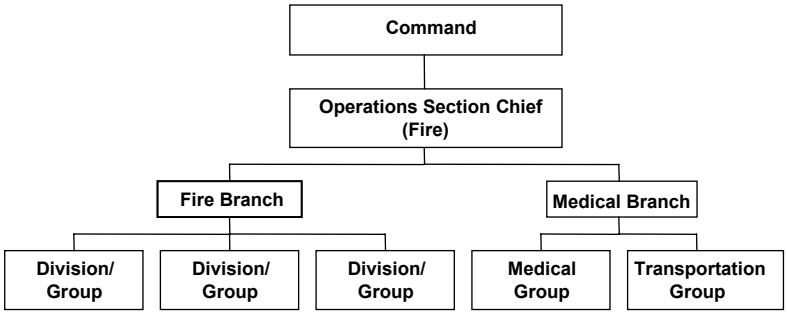


Figure 1-15
Multibranch Organization Under an Operations Chief

When the incident requires the use of aircraft (such as for the transportation of victims from a multicasualty incident, highrise 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 highrise 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 highrise 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 highrise 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.

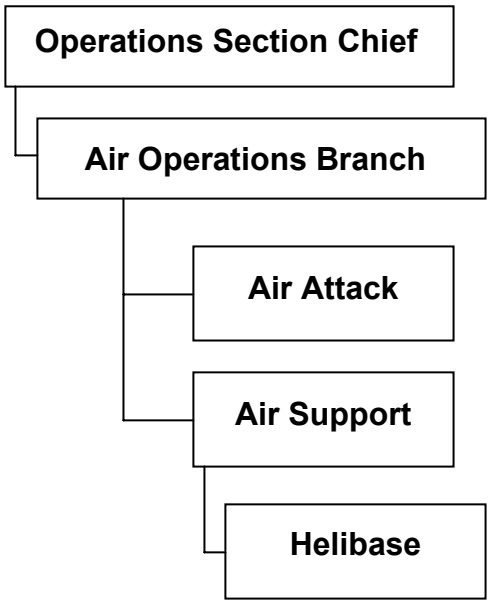


Figure 1-16
Air Operations Branch

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.

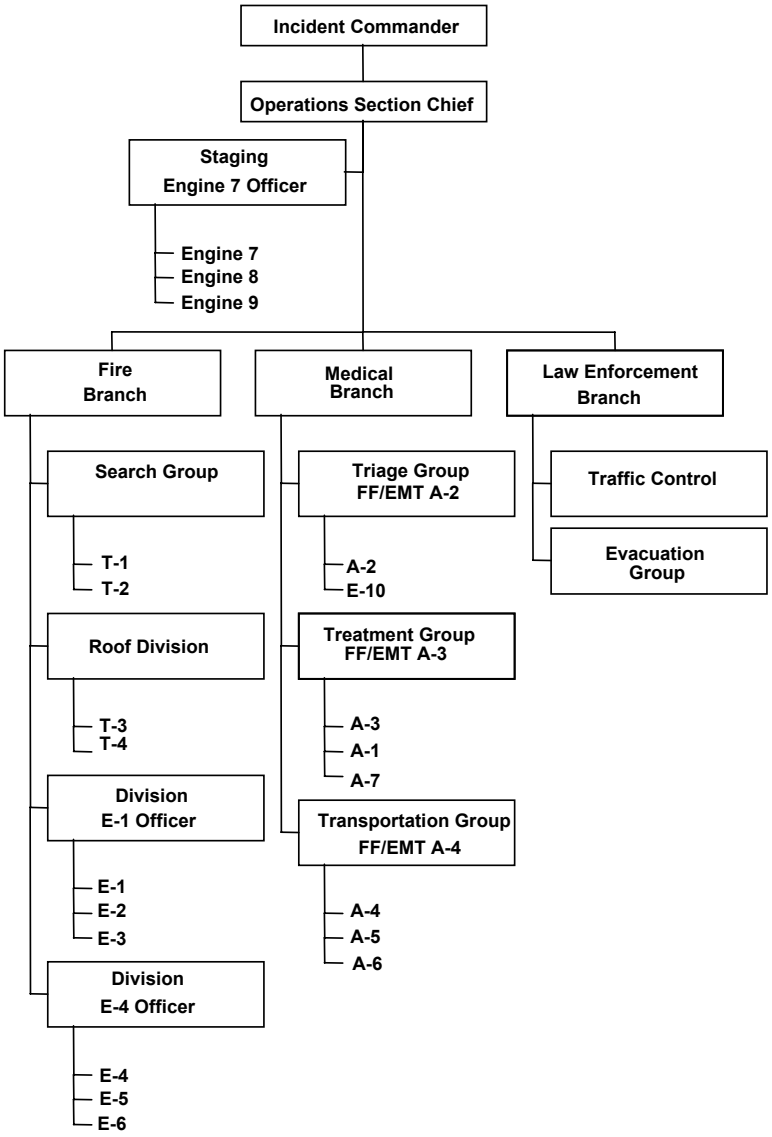


Figure 1-17
Command Procedures:
Expanding the Organization (Structure Fire)

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.

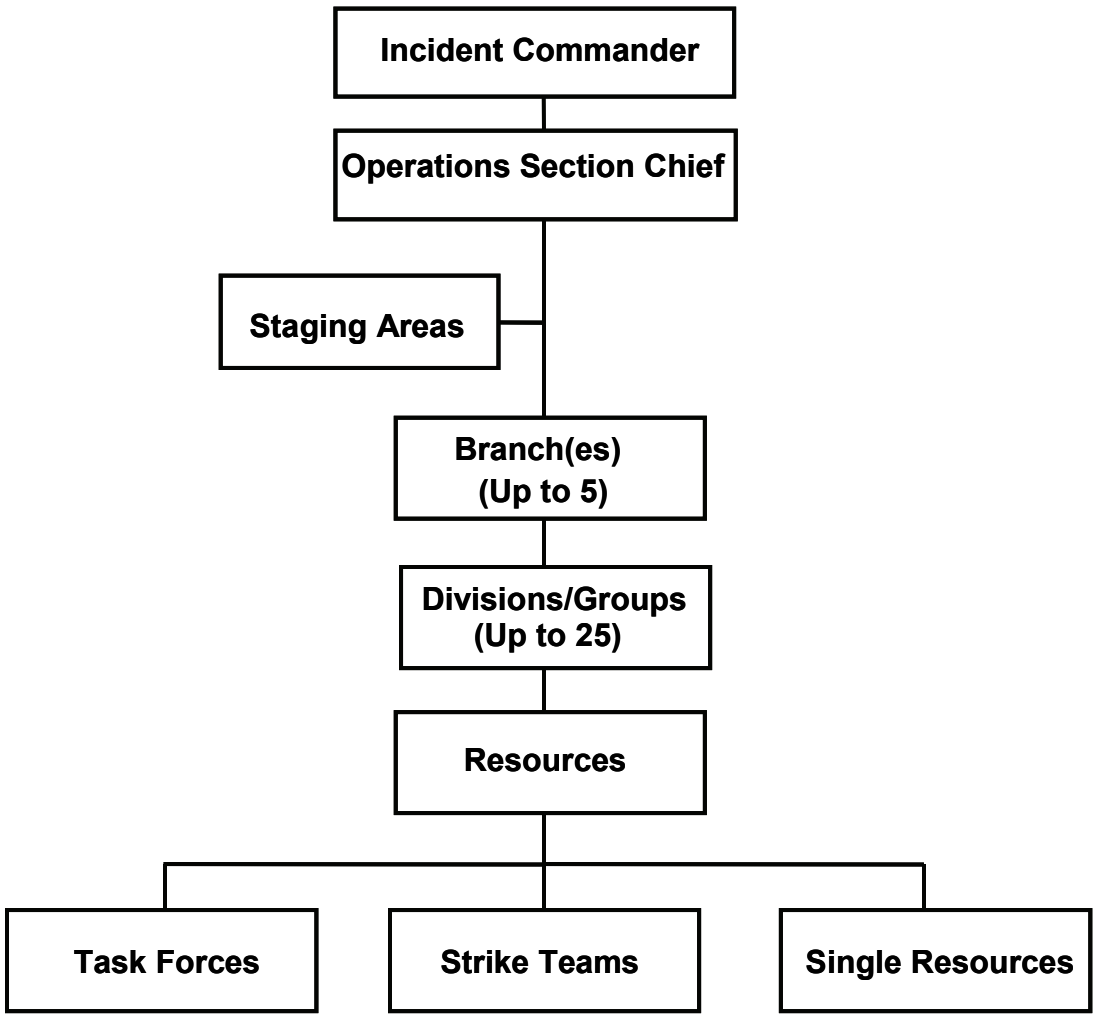


Figure 1-18
Operations Section/Functions

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.

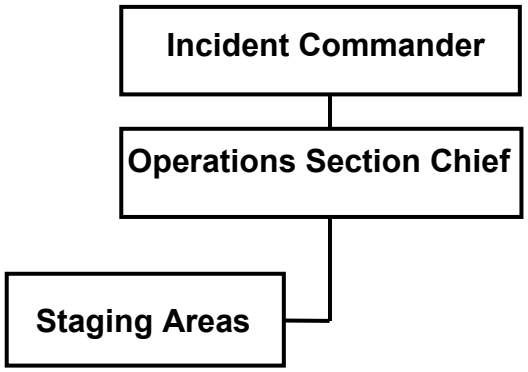


Figure 1-19
Staging Area

Planning Section

The Planning Section is responsible for gathering, assimilating, analyzing, and processing information needed for effective decisionmaking. Information management is a full-time task at large and complex incidents. The Planning Section serves as the IC's clearinghouse for information. This allows the IC's 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 whomever 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.

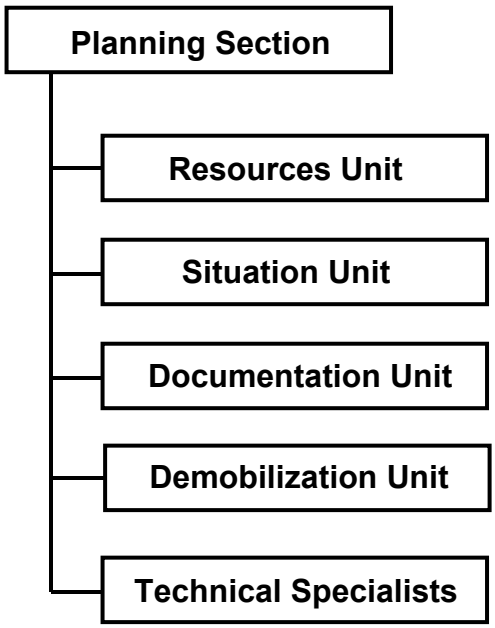


Figure 1-20
Planning Section

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.

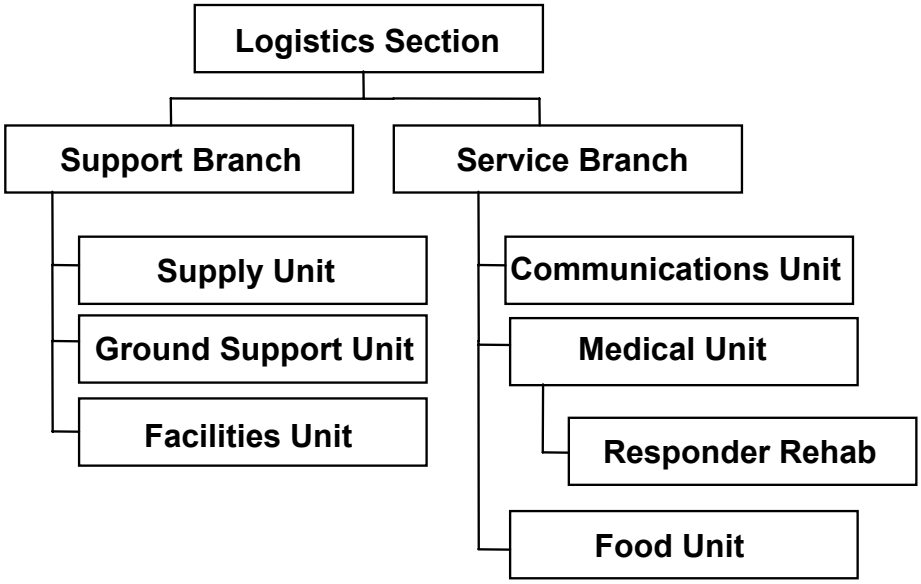


Figure 1-21
Logistics Section

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.

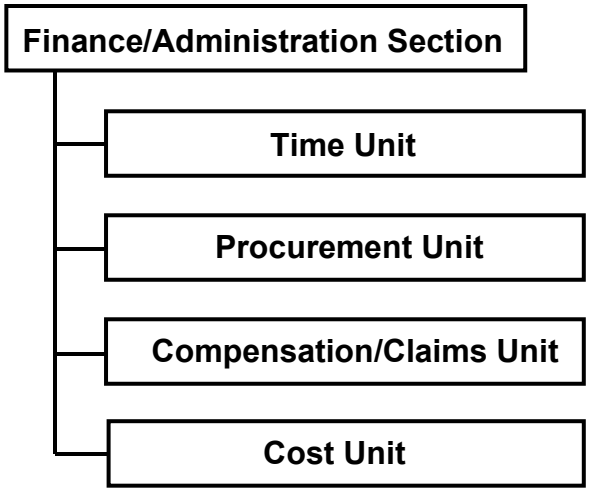


Figure 1-22
Finance/Administration Section

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.

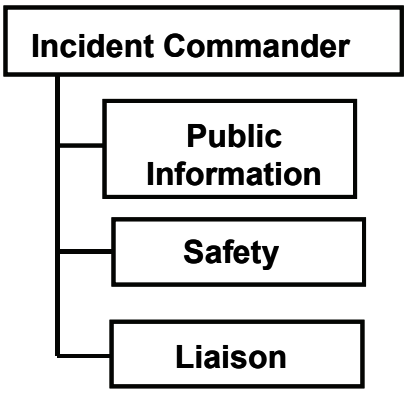


Figure 1-23
Command Staff

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 function is to develop accurate and complete information regarding incident cause, size, current situation, resources committed, and other matters of general interest. The Public Information Officer normally will be the point of contact for the media and governmental agencies desiring information. Only one Public Information Officer 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 Public Information Officer with the media **at all times**.

A highrise 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 Public Information Officer 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.