NFPA 1620
Recommended Practice for Pre-Incident Planning

1998 Edition

National Fire Protection Association, 1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101
An International Codes and Standards Organization

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Pre-Incident Planning

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This edition of NFPA 1620, *Recommended Practice for Pre-Incident Planning*, was prepared by the Technical Committee on Pre-Incident Planning and acted on by the National Fire Protection Association, Inc., at its Annual Meeting held May 18–21, 1998, in Cincinnati, OH. It was issued by the Standards Council on July 16, 1998, with an effective date of August 5, 1998, and supersedes all previous editions.

This edition of NFPA 1620 was approved as an American National Standard on August 6, 1998.

Origin and Development of NFPA 1620

In 1987, following a report of a large loss fire to a sprinklered warehouse in Ohio, fire service and insurance company officials met at NFPA headquarters to discuss such fires and to determine whether there were steps that could be taken to cooperatively address this problem. After a series of meetings, the group developed a report entitled ''Before the Fire'' *(see Appendix B)*. This report made several recommendations relating to large loss fires in sprinklered properties.

One of the recommendations was that NFPA develop a document that addressed the need for adequate pre-incident planning for such occupancies. The NFPA Standards Council assigned the project to the Fire Service Training Committee. The Committee established a subcommittee with additional expertise from the insurance industry to develop a document relating to pre-incident planning for warehouse occupancies. That document, NFPA 1420, *Recommended Practice for Pre-Incident Planning for Warehouse Occupancies*, was adopted by the NFPA membership in 1993.

Following adoption of NFPA 1420, the Subcommittee of the Training Committee that had been involved with developing NFPA 1420 felt that the scope of the document could be expanded to include all occupancies. At the urging of the subcommittee, the Standards Council established a separate technical committee to assume responsibility for the document and to expand it. This edition is the result of that work. The document has been renumbered as NFPA 1620 and retitled *Recommended Practice for Pre-Incident Planning*.

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This list represents the membership at the time the Committee was balloted on the text of this edition. Since that time, changes in the membership may have occurred. A key to classifications is found at the back of this document.

NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on the site-specific pre-incident planning for response to fires and other types of emergencies.

Contents

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NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Appendix A.

A reference in parentheses ( ) following a section or paragraph indicates material that has been extracted from another NFPA document. The complete title and current edition of an extracted and referenced document is found in Chapter 19.

Information on referenced publications can be found in Chapter 19 and Appendix F.

Chapter 1 Administration

1-1 Scope.

1-1.1* This document is a recommended practice for evaluating the protection, construction, and operational features of specific occupancies to develop a pre-incident plan for responding to fires and other emergencies. The pre-incident plan should be used by responding personnel to manage fires and other emergencies in these facilities using the available resources.

The primary purpose of a pre-incident plan is to help responding personnel effectively manage emergencies with available resources. A pre-incident plan should not be confused with fire inspections, which monitor code compliance. Pre-incident planning involves evaluating the protection systems, building construction, contents, and operating procedures that can impact emergency operations.

1-1.2 Unlike fire prevention or fire safety inspections, pre-incident planning assumes that an incident will occur.

1-1.3 Chapters 1 through 8 of this document provide general information, philosophies, and principles that might or might not be applicable to all occupancies. The authority having jurisdiction should determine the level of planning appropriate for the jurisdiction and the property being pre-planned. Chapters 9 through 18 provide information addressing special or unique characteristics of specific occupancy classifications.

1-2 General.

1-2.1 A pre-incident plan is one of the most valuable tools available for aiding responding personnel in effectively controlling an emergency. Although there are many types of incidents that require emergency response, fires generally represent the most frequent challenge to emergency responders. Many of the recommendations in this document that relate to fires and fire protection features can be equally applicable to other types of incidents.

1-2.2 Pre-incident planning is a total concept based upon the following: awareness of the problem, management commitment, education, prevention, protection, and emergency organization. A thorough pre-incident plan involves information gathering, analysis, and dissemination; applying the "what-if-approach"; and planning reviewing, training, and evaluating. Pre-plans within a jurisdiction should be similar in style, procedures, and content to maximize effectiveness and to reduce the time required to familiarize responding forces with the plan.

1-2.3* The development of a pre-incident plan for new facilities should begin before construction and actual occupancy.

1-2.4 Before the pre-incident planning process begins, all parties involved should be familiar with the components of the basic information to be gathered and included in the final plan. Factors affecting a facility's situation during emergency conditions include the following:

(a) Construction
(b) Occupant characteristics
(c) Protection systems
(d) Capabilities of public or industrial responding personnel
(e) Availability of mutual aid
(f) Water supply
(g) Exposure factors

1-2.5 The pre-incident plan should be a cooperative effort between the plan developer, facility, and responding personnel. Others may be able to provide valuable input during the development of the pre-incident plan, including technical experts who might not actually respond to an incident.

1-2.6* The pre-incident plan should be coordinated with an incident management system.

1-2.7 The responding personnel's ability to respond to and control an incident in a specific occupancy should be evaluated. Factors to evaluate include the department's equipment, personnel, and personnel training, to determine whether a sufficient level of response might be achieved. It might be necessary to involve other emergency response agencies after evaluating their capabilities.

1-2.8 Once the basic information has been gathered, the development of the actual pre-incident plan can begin.

1-2.9 The plan should be developed and maintained so that all participants are aware of their respective responsibilities.

1-3 Definitions.

1-3.1 The following terms, for the purposes of this recommended practice, have the meanings given in this section, unless modified in another chapter of the recommended practice.

1-3.2 Words used in the present tense include the future. Words used in the masculine gender include the feminine and neuter. The singular number includes plural and the plural, singular.

Approved.* Acceptable to the authority having jurisdiction.

Area of Refuge. An area of refuge is either

(a) A story in a building where such building is protected throughout by an approved, supervised automatic sprinkler system installed in accordance with Section 7-7 of NFPA *101®*, *Life Safety Code®*, and has at least two accessible rooms or spaces separated from each other by smoke-resisting partitions, or

Exception to (a): Two accessible rooms or spaces shall not be required as permitted in Chapters 8 through 31 of NFPA 101.

(b) A space in a path of travel leading to a public way that is protected from the effects of fire, either by means of separation from other spaces in the same

building or by virtue of location, thereby permitting a delay in egress travel from any level. (***101***: 5-1.2)

Area of Rescue Assistance. See Area of Refuge.

Authority Having Jurisdiction.* The organization, office, or individual responsible for approving equipment, an installation, or a procedure.

Confined Space. A space that meets the following criteria:

(a) Is large enough and so configured that an individual can enter and perform physical work

(b) Has limited or restricted means for entry or exit (e.g., tanks, vessels, silos, storage bins, hoppers, vaults, crawl spaces, and pits are spaces that may have limited means of entry)

(c) Is not designed for continuous occupancy

Emergency Action Plan. Designated actions that employers, employees, and other building occupants should take to ensure they are safe from fire and other emergencies.

Emergency Operations Center. A meeting place and communications center that can be left unattended, except during emergency situations when it is occupied by emergency response personnel.

Fire Barrier. A continuous membrane, either vertical or horizontal, such as a wall or floor assembly that is designed and constructed with a specified fire resistance rating to limit the spread of fire and that will also restrict the movement of smoke. Such barriers might have protected openings. (***101***: 3-2)

Fire Command Center. A staffed or unstaffed area that typically contains monitoring and control equipment for detection, alarm, communications, utilities, and other control systems.

Fire Compartment. A space, within a building, that is enclosed by fire barriers on all sides, including the top and bottom. (***101***: 3-2)

Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of fire and having a fire resistance rating and structural stability. (**221:** 1-3)

HVAC. Heating, ventilation, and air conditioning systems and their related components.

Key Box. See Lock Box.

Lifts. Mechanically or electrically operated platforms used to work at various heights within a building.

Lock Box. A locked container often used to store building entry keys, plans, and related data. Keys to open these containers are assigned only to selected individuals, such as representatives of the local fire department or police department.

Material Safety Data Sheet (MSDS). A form that documents a variety of physical properties, precautions, and emergency actions for a specific chemical or substance.

Plan Developer. The individual, group, or agency responsible for developing and maintaining the pre-incident plan.

Pre-Incident Plan. A written document resulting from the gathering of general and detailed data to be used by responding personnel for determining the resources and actions necessary to mitigate anticipated emergencies at a specific facility.

Recommended Practice. A document that is similar in content and structure to a code or standard but that contains only nonmandatory provisions using the word "should" to indicate recommendations in the body of the text.

Responding Personnel. Private and/or public personnel available to respond to emergencies. Personnel may include, but are not limited to

(a) Facility owners, operators, or occupants
(b) Contractors hired by the owner or operator
(c) Privately organized plant emergency organizations
(d) Emergency response teams
(e) Fire brigades
(f) Hazardous material teams
(g) Rescue or medical response teams
(h) Health and safety personnel
(i) Risk management or insurance personnel
(j) Technical experts
(k) Security personnel
(l) Public fire services
(m) Law enforcement
(n) Emergency medical services
(o) Emergency management
(p) Environmental and utility departments or agencies

Should. Indicates a recommendation or that which is advised but not required.

Smoke Barrier. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed to restrict the movement of smoke. A smoke barrier might or might not have a fire resistance rating. Such barriers might have protected openings. (***101***: 3-2)

Smoke Compartment. A space within a building enclosed by smoke barriers on all sides, including the top and bottom. (***101***: 3-2)

Chapter 2 Pre-Incident Planning Process

2-1 Preparing to Plan.

2-1.1 Selection and Prioritization Process. In developing a schedule for pre-incident plans, strong consideration should be given to items such as potential life safety hazard, structure size and complexity, value, importance to the community, location, presence of chemicals, and susceptibility to natural disasters.

2-1.2* Once a site has been selected for pre-incident planning, the plan developer should explain the nature of the information required. The needs and benefits of pre-incident planning should be explained in detail to all involved participants.

2-1.3 To develop a pre-incident plan, plan developers should regularly visit the property to become thoroughly familiar with its layout, contents, construction, and protection features. *(See Figure 2-1.3.)*

2-2 Before the Incident. Emergency response programs are planned; emergencies are not. The best time to learn about an occupancy is before the incident. Therefore, deciding what to include in a pre-incident plan, how to execute it, and what to do with the information should occur before the incident.

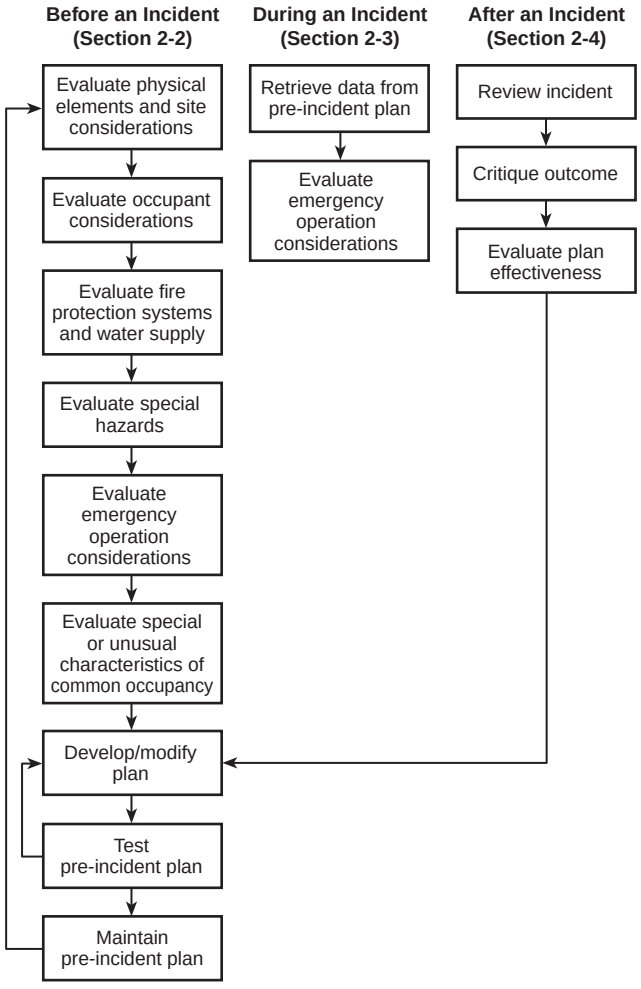

Figure 2-1.3 Development, use, and maintenance of a pre-incident plan.

2-2.1 Collect Data. Pre-incident plan data includes quantitative and qualitative information about the facility (such as physical site, operation features, personnel, and protection features).

This data should be collected by consulting with other professionals involved in the site or facility development, such as fire protection engineers, sprinkler contractors, building architects or engineers, water authorities, and insurance professionals, as well as site surveys.

Data might also be obtained from existing emergency plans required by governmental regulatory agencies.

Historical data on similar occupancies involved in emergencies should be reviewed for items that could cause problems in the structure being surveyed.

Regardless of the data source, some of the information gathered may be of a sensitive or proprietary nature. Appropriate arrangements should be taken to protect the confidentiality of this information.

2-2.2 Organize Data. Deciding what information is needed and how it is to be used influences how it should be recorded. Most organizations will find a printed form useful for data collection and retrieval. The proliferation of lightweight, high-speed personal computers, cellular telephones, facsimile machines, and other advanced information technology can support other techniques or applications.

2-2.3* Prepare Plan. Once data is collected, decisions are made about what data is to be presented, and how it should be stored, retrieved, and utilized.

2-2.4 Plan Distribution. Copies of the plan should be distributed to appropriate responding personnel. A list of all plan recipients should be maintained for distribution of updated copies of the plan.

2-2.5 Review and Evaluate Plan. Testing and practicing the pre-incident plan will provide an opportunity to review the data and refine the plan. Chapter 8 provides specific detail on how training and maintenance should be completed.

2-2.6 Training.

2-2.6.1 Unique Operations. The pre-incident planning process should include a provision for training in those portions of the plan that involve unique or unusual evolutions or operations.

2-2.6.2 Diverse Participants. Pre-incident plans can identify participating individuals or agencies that do not normally work together. Training should be utilized to communicate the plan expectations to these groups.

2-3 During the Incident.

2-3.1 The pre-incident plan should be the foundation for decision making during an emergency situation and provide important data that will assist the incident commander in developing appropriate strategies and tactics for managing the incident.

2-3.2 The pre-incident plan should help responding personnel identify critical factors that will affect the ultimate outcome of the incident, including personnel safety.

2-3.3 The pre-incident plan should provide for available facility personnel to advise responding personnel of current conditions upon arrival.

2-3.4 The information contained in a pre-incident plan should enable the incident commander to anticipate likely scenarios. A pre-incident plan should assist the incident commander in developing tactical options. Consulting the pre-incident plan throughout the incident should keep the incident commander aware of factors that might affect the success of the operation and the need for strategic or tactical adjustment.

2-4 After the Incident. The effectiveness of the pre-incident plan should be re-evaluated after an actual emergency. This review should include an analysis of the incident and the performance of responding personnel, facility owners, and occupants. The review may indicate the need for plan revision.

Chapter 3 Physical Elements and Site Considerations

3-1 General. Physical elements and site considerations are classified into three groups:

(a) Construction
(b) Building services, including utilities
(c) External conditions

These elements are relatively static and generally unaffected by outside influences and are therefore unchanging during the pre-incident planning process.

3-2 Construction.

3-2.1 Area and Height. The size of the building, both vertical and horizontal, can have a profound effect on the decision-making process during an emergency. It is therefore of utmost importance that building size, including overall height, number of stories, and square footage be determined and included in the plan.

3-2.1.1 The number of stories might not represent the height of the building. There are cases where the number of stories do not include "half stories" used for utilities that are found at varying levels throughout a facility. Additionally, there are cases where the first few stories of a building are higher than a standard floor-to-ceiling distance, and thus the number of stories could be skewed by estimating height based on the number of stories.

3-2.1.2 Grade level access can be to different floors on various sides of an occupancy. It is critical that the pre-incident plan address access and floor designations from all potential avenues of approach.

3-2.2 Building Features.

3-2.2.1 The pre-incident plan should address the structural integrity of walls, roofs, and floors. Potential areas of concern include added live and dead loads, indications of deterioration and structural weakening, and any other conditions that impact the following:

(a) The spread of fire, products of combustion or contaminants, and toxic gases and vapors that move from floor to floor via the building's exterior or voids in curtain walls
(b) The ability to safely perform interior operations
(c) The ability to access the building's interior, either through openings or by breaching a wall
(d) The potential for falling glass, curtain walls, exterior ornamentation, parapets, and overhanging components
(e) Exposures

3-2.2.2 Data regarding building construction details that should be recorded include wall construction and insulation information such as the location(s) of the following:

(a) Unsupported exterior walls
(b) Metal panel walls
(c) Masonry walls
(d) Glass walls
(e) Wood frame walls
(f) Plastic wall components
(g) Combustible insulation

3-2.2.3 Data regarding roof construction that should be recorded include the following:

(a) Roof support components (e.g., wood joist, wood truss, steel joist, steel truss, and beam and girder), including the length of the support spans
(b) Roof deck material (e.g., wood, metal, concrete)
(c) Roof cover, including insulation materials, vapor barrier, and waterproofing, since combustibility and buildup thickness can affect fire-fighting tactics
(d) Roof shape or configuration (e.g., peaked, flat, dome, sawtooth)
(e) Availability of means for runoff drainage (e.g., trenches, drains, scuppers, slopes)

3-2.2.4 Data regarding floor construction that should be recorded include the following:

(a) Floor support components (e.g., wood joist, wood truss, steel joist, steel truss, beam and girder), including long lengths of span and the level of protection afforded to the floor support
(b) Floor members (e.g., wood deck, metal deck, concrete)
(c) Availability of means for runoff drainage (e.g., trenches, drains, scuppers, slopes)

3-2.2.5 Data regarding other building features that should be recorded include the following:

(a) Construction of interior walls
(b) Interior finish materials
(c) Suspended-ceiling assemblies
(d) Raised floors
(e) Concealed spaces, including multiple ceiling and roof levels
(f) Windows for rescue and/or ventilation
(g) Confined space
(h) Fire resistance and protection of structural members

3-2.2.6 Data regarding the location, types, and construction of access features that should be recorded include the following:

(a) Doorways
(b) Locking devices
(c) Accessible windows
(d) Fire escapes
(e) Tunnels
(f) Breachable walls

3-2.2.7 The pre-incident plan should note areas where products of combustion or other contaminants could spread due to a lack of structural barriers. The construction of any barriers should be identified as well as the presence of any protection items such as fire doors, fire shutters, or automatic closing devices or dampers designed to contain fire, products of combustion, or contaminants. Data regarding spread of combustion products or other contaminants that should be recorded include the following:

(a) Large undivided areas
(b) Unprotected openings between floors
    1. Stairwells
    2. Elevator shafts
    3. Utility shafts
    4. Escalators
    5. Light wells
(c) High-hazard areas
(d) Wall openings

3-2.2.8 Data regarding atriums that should be recorded include the following:

(a) Their location in the building
(b) Number of stories connected by the atrium

(c) Number of stories open to the atrium
(d) Fire suppression system(s) present in the atrium area
(e) Automatic fire detection and alarm system(s) present in the atrium
(f) Smoke management systems, including location of controls and operation

3-3 Building Services. Experience has shown that various building services and their associated equipment can cause or contribute to an emergency incident. Distributing information about these services and equipment can help reduce their potential to have an adverse impact on an incident. Conversely, this information may outline methods for using building services to support effective control of an incident. Emergency contact information should be obtained for building services.

3-3.1 HVAC. HVAC systems can contribute to the spread of products of combustion and contaminants throughout a facility. The ability to control this equipment could be needed, and the plan should note the location and operation of the controls. Some facilities might be provided with central HVAC, self-contained units, or a combination of both. Some HVAC systems are designed for smoke management. *(See Chapter 5 for smoke management systems.)*

3-3.2 Utilities.

3-3.2.1 Electric Power. The location(s) and method of entrance (aboveground or underground) for electric power, the location of disconnects both inside and outside the facility, and overhead primary and secondary conductors resulting in reduced vertical clearance should be noted.

3-3.2.2 Transformers. The location of transformers, both inside and outside the building, and the combustibility and environmental concerns of transformer fluids should be noted.

3-3.2.3 Emergency Power. The location and duration of emergency power components (e.g., generators, fuel supply, batteries, uninterruptible power supply systems) as well as what equipment remains powered when normal power is lost should be noted. If the emergency power system requires manual action, it should also be noted.

3-3.2.4 Domestic Water. Water shutoffs should be noted with special consideration given to any critical equipment or processes that require an uninterrupted supply of water.

3-3.2.5 Compressed and Liquefied Gases. The location of compressors, storage containers, and the nearest disconnecting means should be noted. Special consideration should be given to any critical equipment or processes that might pose a hazard if the compressed or liquefied gas supply is interrupted.

3-3.2.6 Steam. The location of steam lines and boilers should be noted as well as the equipment that depends on them. The location of the nearest shutoff means for the steam supply should be noted.

3-3.2.7 Fuels. Some facilities have the capability of changing over from one fuel to another. Information regarding these systems should be noted.

3-3.2.7.1 Gas. The location of all metering and pressure-regulating equipment as well as all shutoff valves should be noted. For LP-Gas systems, the location and size of storage tanks, and shutoff valves should be noted.

3-3.2.7.2 Liquid Fuels. The location of all pumps, tanks, regulating equipment, and shutoff valves should be noted.

3-3.3 Elevators. The pre-incident plan should note the number, floors served, type (e.g., electric or hydraulic, passenger or freight, manual or automatic), restrictions, and location of all elevators.

3-3.3.1 Elevator Recall. The pre-incident plan should note data for automatic elevator recall, including primary and secondary recall floor levels.

3-3.3.2 Service Override. The pre-incident plan should note whether fire service override is provided on all elevators and the location of any keys necessary for this operation.

3-3.3.3* Elevator Lobbies. The pre-incident plan should note the presence of any fire- or smoke-resistant elevator lobbies.

3-3.3.4 Emergency Power. The pre-incident plan should note whether emergency power is provided for the elevators.

3-4 Site Conditions.

3-4.1 Access. Conditions that would hamper the access of responding personnel should be noted, including the following:

(a) Bridges with width or weight restrictions
(b) Narrow rights of way
(c) Roads subject to flooding, motor vehicles, drifting snow, washout, primary approach from downwind, or other blockage
(d) Low overhead clearances, railroad grade crossings, and drawbridges

3-4.2 Security. Many occupancies have some form of security measure that can restrict access to the facility, including various types of locking devices. Data regarding security measures utilized should be noted.

3-4.2.1 The height and construction of fences should be noted. Location and security (e.g., lock boxes, alarms, unusual locking devices) of access points need to be identified. Electrically charged fences or those that contain restrictive measures such as use of barbed wire or razor wire should be noted.

3-4.2.2 The use and number of guard dogs should be noted. Contact information should also be obtained for the person(s) responsible for the dogs.

3-4.2.3 Data regarding an on-site security service that should be recorded include the following:

(a) Procedure for contacting them
(b) Their location
(c) The number of personnel on duty
(d) Their level of access within the facility
(e) The scope of their emergency response training

3-4.3 Exposures. The grounds surrounding the site, structure, or building should be surveyed to identify buildings, structures, equipment, storage, and people that could be exposed by an incident and this information noted on the plan.

3-4.4 Environmental Impact. Information should be gathered on potential environmental contaminants. Sprinkler operation or manual fire-fighting operations can produce large quantities of contaminated water that can be harmful to wastewater treatment plants or the environment.

3-4.5 Communications Impact. A functional test of the communications system as it would be used at an emergency should be conducted. Data regarding communications impact that should be recorded include the following:

(a) Interference or poor coverage as a result of construction or radio system design. Areas to be checked should include belowgrade and shielded areas, interiors of large structures, and upper floors of high-rise buildings.
(b) Assignment of radio channels
(c) Other supplemental communications

Chapter 4 Occupant Considerations

4-1 General. The number and type of occupants in a facility can have a substantial impact on a pre-incident plan. Information should be gathered on the number of occupants and their ages, their physical or mental conditions, and whether they are ambulatory or nonambulatory.

4-2 Life Safety Considerations.

4-2.1 General. Depending on the type of occupancy, varying numbers of people will be present in a facility. Populations can range from a few individuals to several hundred or more. Regardless of the population, in the event of an emergency, life safety considerations are a priority that should be addressed to allow responding emergency service personnel to assist in immediate and safe evacuation of a facility or to support protection in place.

4-2.2 Hours of Operation. While most activities take place during daylight hours, major activities can occur in most occupancies at other times. The hours of operation should be noted.

4-2.3 Occupant Load. The number of occupants can vary depending upon the time of day, day of the week, and year. Information should be gathered regarding the normal occupant load and any expected variations.

4-2.4 Location of Occupants. Various uses of sections of the facilities should be identified and the number or occupants anticipated to be in those areas noted.

4-2.5 Means of Egress. The number of exits, their location, and any special locking conditions, such as delayed release, limited security access, and stairwell locking, should be noted on the pre-incident plan. The potential for exits to be compromised should be noted.

4-2.6 Emergency Action Plan. If a facility has an emergency action plan (whether known as a site emergency plan, emergency response plan, or some other name), it should be reviewed. The strategy and tactics to be used by emergency responders should be coordinated with the facility's emergency action plan.

4-2.7 Assistance for the Disabled. Special considerations might be required to evacuate or protect occupants who need assistance. The locations of occupants who need assistance to safely evacuate should be noted. Areas of refuge, if provided, should be noted. Location of equipment such as stair chairs, stretchers, or lifts that may assist evacuation should be identified.

4-2.8 Defend in Place Concept. Defend in place methods are utilized where complete evacuation is either impossible or impractical such as in high-rise, health care, or detention facilities. The planned methods, safe areas, and all areas utilizing this method should be noted.

4-3 On-Site Emergency Organization. The on-site emergency response capabilities and how their functioning coordinates with responding personnel should be noted.

4-3.1 The facility emergency action plan might specify total evacuation without any efforts to control the emergency or might specify an active occupant response. The authority having jurisdiction or the facility owner or occupant might require an emergency response organization of building occupants to specifically control fires, chemical spills, and related emergencies, or to facilitate evacuation or deliver emergency medical services.

4-3.2 Emergency Action Plan.

4-3.2.1 Organizational Structure. An organizational structure and emergency contact list should be obtained from facility management. The emergency contact list should be updated annually or when changes occur. At a minimum, the list should include whom to contact, in order of priority, in the event of an emergency.

4-3.2.2 Assignment of Non-Fire-Fighting Duties. A current list that specifies each individual's assigned emergency response duties should be available. For example, this list might identify a technical liaison who is familiar with the building's electrical and HVAC systems and other persons with similar assignments.

4-3.2.3 Special Equipment Operation. Some occupancies contain very specialized operations, processes, and hazards that can pose unique challenges in an emergency. Emergency operating procedures and personnel for these conditions should be documented and readily available.

4-3.2.4 Hazardous Materials Coordinator. Many occupancies have an individual(s) who is responsible for maintaining material safety data sheets (MSDS) and inventories of hazardous materials. Contacting this person(s) for on-scene assistance should be given priority at any emergency. The location of MSDS and related data should be indicated in the pre-incident plan.

Chapter 5 Protection Systems and Water Supplies

5-1 General. Fire protection systems and water supply should be determined in the development of, and specifically noted in, the pre-incident plan.

5-2 Water Supplies.

5-2.1* The adequacy of available water for fire-fighting purposes is probably the single most significant factor to consider when evaluating a site for its fire loss potential. This includes ensuring adequate water supplies for sprinkler systems, inside and outside hose streams, and any other special requirements or needs.

5-2.2 The required fire flow should be determined by evaluating the site in terms of size of the building (e.g., height, number of floors, and area), construction type, occupancy, exposures, fire protection systems, and any other features that could affect the amount of water needed to control or extinguish the fire.

5-2.2.1* A water supply test should be conducted in accordance with NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants*. The results should be reported in the plan, including the available flow at a specified residual pressure [typically 20 psi (138 kPa)].

5-2.2.2 The results of the water supply test should be compared to the sprinkler system demand. Where the demand exceeds the available supply, the plan should address an appropriate response to mitigate the deficiency.

5-2.3 Fire Department Connections (FDC). Data concerning the FDC that should be recorded include the following:

(a) Physical location
(b) Area covered
(c) Type of system(s) supplied
(d) Size and type of threads

5-2.4 Fire Pumps.

5-2.4.1 Data regarding the fire pump that should be recorded include the following:

(a) Location
(b) Type of driver (e.g., electric, diesel, or other)
(c) Capacity (e.g., rated flow, pressure)
(d) Source of water supply (e.g., reservoir, tank, public supply)
(e) Operation (e.g., automatic, manual)
(f) Areas or systems served
(g) Contact information for person(s) responsible for maintaining the pump

5-2.4.2 For electric fire pumps, the location and means of electrical disconnect should be identified (such that the power to the pump is not compromised during the incident). If the fire pump power supply is not electrically separated from the facility disconnect, it should be noted in the plan.

5-2.5 Fire Hydrants. Data regarding the fire hydrants that should be recorded include the following:

(a) Location and type of each fire hydrant
(b) Number and diameter of each outlet
(c) Threads and diameter
(d) Alternate hydrant locations from other sources of water (i.e., public, private, or high pressure)
(e) Size of the water main connection

5-3* Automatic Sprinkler Systems. Data concerning automatic sprinkler protection that should be recorded include the following:

(a) Type of system (e.g., wet, dry, pre-action)
(b)* Hazard classification of the system and occupancy
(c)* Known sprinkler system deficiencies
(d)* Location and identification of all exterior control valves, including street boxes
(e)* Location and identification of all interior control and sectional valves
(f) Location and identification of all risers
(g) Location and identification of local water flow alarms and procedures for silencing the local alarms
(h) Contact information for person(s) responsible for maintaining the system
(i) Extent of sprinkler coverage

5-4* Standpipe System.

5-4.1 Data concerning standpipe systems that should be recorded include the following:

(a) Type of system (e.g., wet, dry, pre-action)
(b) Location, threads, and size of hose outlets
(c)* Pressure available at hose valve outlet(s)
(d) Water supply (demand)
(e) Location and identification of all exterior control valves, including street boxes
(f) Location and identification of all interior control and sectional valves
(g) Location and identification of all risers
(h) Contact information for person(s) responsible for maintaining the system

5-4.2* Pressure Restricting Devices and Pressure Reducing Valves. In order to regulate the residual and/or static pressure at standpipe outlets, some systems are equipped with standpipe valves that are pressure restricting devices (regulate residual pressure only) or pressure reducing valves (regulate both static and residual pressures). The presence of these devices should be noted in the pre-incident plan.

5-5 Protective Signaling Systems.

5-5.1* Protective signaling systems can provide notification to building occupants and responding personnel as well as provide supervision of the operational status of protection systems.

5-5.2 Data regarding the protective signaling system that should be recorded include the following:

(a) Method of system activation (e.g., manual, automatic)
(b) Area of coverage
(c) Location of fire alarm control panel (FACP) and remote annunciator panels
(d) Type of automatic detectors provided (e.g., smoke, heat)
(e) Method of off-site alarm transmission, if any
(f) Name of, and contact number for, any off-site monitoring agency
(g) Capability for public address system or voice alarm
(h) Capability for emergency fire service telephone and the location of telephone connections and handsets
(i) Name of, and contact information for, person(s) responsible for maintaining the system
(j) Method and extent of occupant notification

5-6 Special Protection Systems.

5-6.1 Special protection systems provide protection for special hazards in many types of occupancies. These can include CO_2, halon, gaseous extinguishing agents, foam-water, dry chemical, and wet chemical systems.

5-6.2 Data regarding any special protection systems that should be recorded include the following:

(a) Type of system
(b) Hazard or area protected by the system
(c) Location of control panels
(d) Location of all protective agent supply and reserve containers

(e) Activation method
(f) Activation threshold
(g) Personnel hazards of protective agent
(h) Name of, and contact information for, person(s) responsible for maintaining the system
(i) Method and extent of occupant notification

5-7 Portable Fire Extinguishers.

5-7.1 Portable fire extinguishers can be found in many types of occupancies. The plan should note the location and type of fire extinguishers when they are useful for responding personnel.

5-7.2 In some facilities, large wheeled equipment and/or specialized extinguishers (e.g., Class D fire extinguishers, chemical neutralization units) might be provided. In these instances, consideration should be given to the value that these extinguishers might have to responding personnel.

5-8* Smoke Management. The term *smoke management* as used in this section includes all methods that can be used alone or in combination to modify smoke movement for the benefit of occupants or responding personnel, or to reduce property damage. Data regarding smoke management systems that should be recorded include the following:

(a) Type of system
(b) Location of areas served by system
(c) Location of control systems
(d) System operation information (e.g., automatic or manual)
(e) Location of backup operating instructions
(f) Location of manual override controls
(g) Location and type of detection devices
(h) Location of supply (e.g., makeup air) and discharge arrangement
(i) Contact information for person(s) responsible for maintaining the system

Chapter 6 Special Hazard Considerations

6-1* General. Special hazards are those hazards that an occupancy can contain that are not usual or typical for emergency response or fire department personnel, and can pose significant additional risk if not evaluated properly during an emergency. The pre-incident plan needs to document these special conditions to ensure that emergency response personnel are aware of the situation, and that appropriate response considerations and/or resource activation occur during an emergency.

6-2 Transient Conditions.

6-2.1 Many special hazards might exist only during specific times throughout the year and can include the following:

(a) Annual maintenance
(b) Special events or productions
(c) Construction
(d) Special manufacturing production runs

6-3 Inventory.

6-3.1 Inventory of special hazard materials can fluctuate throughout the year. It is essential to request maximum inventory values during site surveys. The plan should include a method to obtain current inventories of special hazard materials at the time of an emergency.

6-3.2 Some materials presenting special hazards are shipped in bulk and nonbulk containers that can be temporarily stored at or near the occupancy being surveyed. The operational conditions, locations, and characteristics of these containers can be documented as part of the pre-incident survey. Data regarding special hazards that should be recorded include the following:

(a) Rail cars
(b) Tank trucks
(c) Van trailers
(d) Intermediate bulk containers
(e) Hazardous materials storage lockers
(f) Construction trailers

6-4 Special Hazards. Experience has shown that various hazardous materials and conditions can cause great difficulties and risks during an emergency incident.

6-4.1 Flammable and Combustible Liquids. Flammable and combustible liquids create fires that grow faster and produce much more heat than ordinary combustibles. The high-heat release can cause premature structural collapse, in addition to making entry into the fire area extremely difficult. Data regarding flammable and combustible liquids that should be recorded include the following:

(a) Where material will drain if spilled
(b) Amount of fire-fighting water that can be contained with the spilled materials if secondary containment is provided
(c) Necessary extinguishing agent resources (e.g., fire-fighting foams)

6-4.2 Explosives. The use or storage of explosive materials in an occupancy will normally be highlighted as part of the initial site survey. The presence and location of such materials should be noted on the pre-incident plan, since these materials can pose extreme risk to the emergency responder.

Typical commercial materials that could explode upon exposure to fire and/or heat, such as ammonium nitrate, should also be documented on the pre-incident plan.

6-4.3 Toxicological/Biological Agents. The use of toxic or biological agents within an occupancy can pose a risk to emergency responders. The location and quantity of these materials should be documented in the pre-incident plan, with special notation as to what special protective equipment might be needed.

The impact of these materials on neighboring or downwind occupancies should also be evaluated.

6-4.4 Radioactive Materials. The location and type of radioactive materials and radiation-producing devices should be identified.

Small amounts of radioactive material used in laboratory, manufacturing, health care, or other occupancies could pose significant risks.

6-4.5 Reactive Chemicals and Materials. Many chemicals can produce an adverse reaction if contaminated or mixed with other materials. Additionally, many chemicals undergo chemical reaction when exposed to elevated temperatures, as in a fire. The buildup of pressure in containers, generation of toxic by-products, and heat generated by chemical reaction

should be evaluated during the pre-incident plan development.

Reactive chemicals that require cooling (e.g., in a refrigerated warehouse) should also be noted, since it is likely that power could be interrupted during an emergency.

Materials that react upon exposure to air or water need to be documented on the pre-incident plan.

6-4.6 Electrical and/or Mechanical Hazards. Some occupancies have large electrical and or mechanical systems that could present the emergency responder with hazards of electrocution, mechanical entrapment, or other perils.

Systems that present hazards to the emergency responder can usually be de-energized or the mechanical energy can be isolated and secured. The pre-incident plan should identify where the instructions for such procedures exist.

6-4.7 Special Atmospheres. Some occupancies maintain special rooms or equipment with special gases or vapors that can present hazards to the emergency responders. Such areas could include the following:

(a) Confined spaces
(b) Inert atmospheres
(c) Ripening facilities
(d) Special equipment treating atmospheres

Chapter 7 Emergency Operations

7-1 General. A system to utilize the pre-incident plan should be designed to allow access to the plan, or a summary with key elements of the plan, while in route and during the incident. An important component of the responding personnel's emergency response plan is the inclusion of a system that provides for the preparation, distribution, and updating of pre-incident plans of various occupancies. The pre-incident information should be presented so as to be easily deciphered and understood under the emergency response conditions that could be encountered within a responding emergency vehicle's passenger compartment.

7-2* Incident Notification. The pre-incident plan can provide critical information that could be advantageous for responding personnel at the time of dispatch. Communicating this information should be incorporated as part of the normal dispatching procedures.

7-3* Incident Operations.

7-3.1 The plan should address a standard response to an incident at the facility or site, as well as additional resources required for significant incidents. Where local resources are limited, the plan should address acquiring additional resources.

7-3.2 The plan can include initial actions based on the priorities of life safety, scene stabilization, and incident mitigation.

7-3.3 The plan must address the importance of the facility and responding personnel having a working knowledge of each other's capabilities and emergency operational procedures. This will facilitate the smooth transference of information at the incident command post.

7-3.4 The plan should address the implementation of an appropriate incident management system upon the arrival of the first emergency units. The plan should address how timely information will flow in both directions between the facility and the fire department. When a facility representative is not available, the facility should provide the fire department information allowing for rapid access to, and consultation with, a site representative until an on-site liaison can be established. While the scope and intensity level of required information flow between the facility staff and the fire department incident commander will vary during various phases of the incident, information flow, including any actions taken by the occupants, between both parties must continue throughout the incident.

7-3.5 The location of the incident command post and emergency operations center, if provided, should be noted, as should whether it is staffed or not staffed and how to gain access to the area. Some supplemental detailed information such as building plans and fire alarm drawings can be kept in a lock box or other secured area.

7-3.6 The plan should provide that emergency operations commenced by the facility should be communicated to the emergency responders.

7-3.7 The plan should contain provisions for sheltering evacuated occupants.

7-3.8 The plan should address situations that are likely to require the use of long hose stretches that could include supply and attack hose lines.

7-4 Accountability System. The location and number of occupants should be determined since these will vary with the facilities' operations and time of day. Many facilities have implemented an accountability system. An understanding of such a system will assist emergency responders in carrying out their life safety priority actions.

Chapter 8 Plan Testing and Maintenance

8-1 General. During the planning process, it can be difficult to recognize various problems or requirements that might be encountered during an emergency. An effective plan requires initial and periodic testing and maintenance.

8-2 Plan Evaluation.

8-2.1 Testing can be conducted by various methods including computer modeling, blackboard or tabletop exercises, or a full-scale test. During testing, using the pre-incident plan can provide an opportunity to train facility and responding personnel.

8-2.2 In preparation for a test of the pre-incident plan, three questions should be addressed:

(a) What is the test designed to accomplish?
(b) How will the test be conducted?
(c) What resources will be needed for the test?

8-2.3 It is important to consider all of the variables that might be encountered during an actual emergency. Plans for a test should rely on research, development, and experience, rather than perceptions or assumptions. In any test, unusual conditions should also be considered, such as how to identify and handle an actual emergency that might occur during a test.

8-2.4 To the extent possible, plan testing should involve all who might be expected to assist during an actual emergency. Such persons might include mutual aid units, emergency medical service personnel, law enforcement officials, facility management, and technical experts.

8-2.5 Pre-incident plan testing should be coordinated with both emergency responders and facility personnel. For tests involving the facility itself, it is necessary to involve the facility management in the planning of the test and it might even be necessary to convince management of the need for a drill or on-site test. In such cases, presentation of a videotape of an earlier major fire or emergency in a similar occupancy could be of assistance.

8-2.6 The test should be planned with as much detail as used in the development of the pre-incident plan itself. Distribute copies of the plan to all assisting parties, including facility representatives, so that all participants know what to expect and what their responsibilities are.

8-2.6.1 Internal coordination is necessary to ensure that the owner and occupant are aware of their individual roles in the test and that all available resources are most efficiently utilized. Each level of management within the facility should ensure that the staff and employees are aware of their individual roles and responsibilities during the test, stressing the flexibility of such roles and responsibilities.

8-2.6.2 Since no facility or fire department is completely self-sufficient, external coordination is also essential if the pre-incident plan is to be effective. Such external coordination should involve public relations personnel, the news media, police, medical services, dispatch center, and other units as appropriate.

8-2.7 The respective duties and responsibilities of the various participants in the test need to be clearly identified. The use of color-coded arm bands, head gear, vests, or some other form of visible identification is recommended.

8-2.8 Appropriate security measures should be established. It should be recognized that occupancies can contain valuable objects and that the facility operator also maintains information about operations and employees that should remain secure.

8-2.9 The communication system for a test should include an ''emergency signal'' to identify an actual emergency during the test or exercise. This signal would be used if an emergency situation occurs, such as an injury to a test participant.

8-2.10 A visitor or observer identification system should be established. This system should distinguish between actual test participants and spectators. In addition, procedures need to be established to control the movement and location of spectators.

8-2.11 An on-site test will involve a large number of personnel, apparatus, and other forms of vehicular traffic. Plans to handle additional traffic that is not normally present at the facility or during an actual incident should be included.

8-2.12 The most valuable portion of a test is the post-test analysis. This can result in subsequent modifications of the plan to correct any deficiency or increase efficiency. Personnel who are not participants in the test should be assigned to observe and provide critical evaluation to the post-test analysis.

8-2.13 The analysis should fully discuss test procedures to assist in future testing of the pre-incident plan.

8-3 Plan Maintenance.

8-3.1 Most occupancies present an ever-changing environment making ongoing maintenance of the pre-incident plan as critical as the original development of the plan.

8-3.2 New construction or expansion, changes in water supply, changes in available hydrants, changes in occupancy, changes in response routes or traffic patterns, testing that identifies problems, or problems in an actual incident can indicate the need for updating or review of the plan.

8-3.3 Responsibility for plan maintenance must be determined at the time of planning initiation. The ideal procedure will provide for a review of each plan on at least an annual basis.

8-3.4 New information or circumstances that could indicate the need for plan revision include the following:

(a) Property or deed transfers
(b) Issuance of occupancy permits
(c) Information from utilities (e.g., water, electric, gas, or sewer authorities)
(d) Information from police and security officials
(e) Changes in telephone numbers
(f) Issuance of building permits
(g) Inquiries from architects, engineers, or other consultants
(h) Observations of economic or social change
(i) Observations by response personnel during training exercises
(j) Notices from highway department of street closings
(k) Protection equipment impairment notices
(l) Submission of data to regulatory authorities
(m) Actual incidents
(n) Loss experience in similar occupancies
(o) Fire department inspections

8-3.5 Where conditions indicate that a change in a pre-incident plan is warranted, the plan should be updated and distributed in accordance with 2-2.4 to appropriate persons and agencies. Prior editions of the pre-incident plan should be archived or destroyed in accordance with local policy.

Chapter 9 Assembly Occupancies

9-1 Administration.

9-1.1 Pre-incident planning in an assembly occupancy involves not only the emergency responders, but also administrators, event supervisors, and other staff members.

9-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

9-1.3 Special Definition.

Assembly. Assembly occupancies include, but are not limited to, all buildings or portions of buildings used for gathering together 50 or more persons for such purposes as deliberation, worship, entertainment, eating, drinking, amusement, or awaiting transportation. Assembly occupancies also include special amusement buildings regardless of occupant load.

Assembly occupancies include the following:

Armories

Assembly halls

Auditoriums

Bowling lanes

Club rooms

College and university classrooms, 50 persons and over

Conference rooms

Courtrooms

Dance halls

Drinking establishments

Exhibition halls

Gymnasiums

Libraries

Mortuary chapels

Motion picture theaters

Museums

Passenger stations and terminals of air, surface, underground, and marine public transportation facilities

Places of religious worship

Pool rooms

Recreation piers

Restaurants

Skating rinks

Theaters

Occupancy of any room or space for assembly purposes by fewer than 50 persons in a building or other occupancy and incidental to such other occupancy shall be classified as part of the other occupancy and shall be subject to the provisions applicable thereto. (***101***: 4-1.2)

9-2 Pre-Incident Planning Process. No special considerations.

9-3 Physical Elements and Site Considerations.

9-3.1 Places of assembly may occur within other occupancies. The pre-incident planning concepts of this chapter should be utilized for these areas.

9-3.2 Situations where access is difficult due to location and other conditions that include the following should be noted in the plan:

(a) Low levels of lighting
(b) High-rise top stories
(c) Waterfront locations
(d) Fixed water crafts
(e) Subgrade locations

9-4 Occupant Considerations.

9-4.1 Due to the possible large numbers of occupants, consideration should be given to the expected characteristics of the persons, including the following:

(a) Age
(b) Mobility
(c) Awareness
(d) Knowledge
(e) Density

9-4.2 A means of egress can become obstructed or impaired by items such as the following:

(a) Variable seating arrangements (e.g., festival and temporary)
(b) Decorations and displays
(c) Temporary storage
(d) Waiting spaces
(e) Furniture and fixtures

9-4.3 Expected effectiveness of crowd managers, security, or on-site emergency services, if provided, should be included in the pre-incident plan.

9-5 Protection Systems and Water Supply.

9-5.1 The automatic sprinkler systems in locations where exhibits, live stage productions, and similar shows are conducted should be closely evaluated to determine whether adequate protection is present for the intended use. The findings should be noted in the plan.

9-5.2 The nature of an event could result in the intentional temporary impairment of a protection system to allow for pyrotechnic displays or theatrical smoke generation. The plan should note alternate protection means or procedures for these situations.

9-6 Special Hazards. No special considerations.

9-7 Emergency Operations.

9-7.1 Consideration of life safety at places of assembly should be the major point addressed by the plan.

9-7.2 Sufficient space and resources should be provided to relocate occupants away from operating emergency units.

9-7.3 The potential for an emergency responder's access to become obstructed or impaired should be noted in the plan.

9-8 Plan Testing and Maintenance. Testing of the pre-incident plan under actual occupancy conditions will not be practical in most instances. Every effort and consideration should be exercised during testing to account for the expected occupant load.

Chapter 10 Educational Occupancies

10-1 Administration.

10-1.1 Pre-incident planning in an educational occupancy involves not only the emergency responders, but school administrators, teachers, other staff members, and students.

10-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

10-1.3 Special Definition.

Educational. Educational occupancies include all buildings or portions of buildings used for educational purposes through the twelfth grade by six or more persons for four or more hours per day or more than 12 hours per week.

Educational occupancies include the following:

Academies

Kindergartens

Nursery schools

Schools

Other occupancies associated with educational institutions shall be in accordance with the appropriate parts of NFPA *101*.

In cases where instruction is incidental to some other occupancy, the section of NFPA *101, Life Safety Code,* governing such other occupancy shall apply. (***101***: 4-1.3)

10-2 Pre-Incident Planning Process. No special considerations.

10-3 Physical Elements and Site Considerations. The pre-incident plan should note any changes in access patterns that might occur during occupancy.

10-4 Occupant Considerations. The pre-incident plan should contain the following:

(a) Number of students and their age range
(b) Location of various age groups within the facility
(c) Location and occupant load of any assembly areas

10-5 Protection Systems and Water Supply. No special considerations.

10-6 Special Hazards.

10-6.1 The location of any hazard areas such as shops, laboratories, and kitchens should be noted on the pre-incident plan.

10-6.2 The quantity, type, and location of any hazardous materials should be noted on the pre-incident plan.

10-7 Emergency Operations.

10-7.1 The pre-incident plan should note the system or method used for accounting for all of the occupants.

10-7.2 The pre-incident plan should include provisions for handling the interaction between emergency responders, facility staff, and students and their parents or guardians.

10-8 Plan Testing and Maintenance. No special considerations.

Chapter 11 Health Care Occupancies

11-1 Administration.

11-1.1* Pre-incident planning in a health care occupancy involves not only the emergency responders, but also health care administrators, section or department supervisors, the maintenance director or building engineer(s), and other staff members.

11-1.2 Within health care facilities, an established management team will have the overall responsibility of operating the health care facility. This team should be consulted for the development of the pre-incident plan.

11-1.3 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

11-1.4 Special Definitions.

Facility Emergency Action Plan. A plan developed by the health care facility to describe the actions to be taken during various internal and external emergencies and that is generally available on site. The depth of each facility plan will vary depending on the size of the facility and the type and extent of medical services provided. This plan should detail evacuation protocol, emergency contacts, and the responsibilities and required action of various health care facility staff. Other sections of the facility plan could note the use of communication systems, security and traffic control, and procedures to follow in the event of natural disasters and civil disturbances.

Health Care. Health care occupancies are those used for purposes such as medical or other treatment or care of persons suffering from physical or mental illness, disease, or infirmity; and for the care of infants, convalescents, or infirm aged persons. Health care occupancies provide sleeping facilities for four or more occupants and are occupied by persons who are mostly incapable of self-preservation because of age, physical or mental disability, or because of security measures not under the occupants' control.

Health care occupancies include the following:

Hospitals

Limited care facilities

Nursing homes

Health care occupancies also include ambulatory health care centers. (***101***: 4-1.4)

11-2 Pre-Incident Planning Process.

11-2.1 Obtain the health care facility fire or disaster plan and incorporate the information into the pre-incident plan. Note the acronyms that the facility uses to implement the fire or disaster plan.

11-2.2 During the planning process, a knowledge of existing safety-related documentation will enhance and expedite the development of the pre-incident plan itself. Example documentation includes the following:

(a) Emergency procedures established for controlling chemical spills
(b) Procedures for operating room or surgical suite emergencies, including evacuation and equipment shutdown procedures, and provisions for control of emergencies by facility staff until arrival of the emergency responders

11-3 Physical Elements and Site Considerations.

11-3.1 General. Large health care facilities or complexes may occupy a large tract of land with numerous site specific hazards. Separate, stand-alone buildings may provide physical plant support functions or specialized medical care or treatment. Pre-incident plans should address each of these operations individually and note the criticality of them, and what impact, both from a fire and continued facility services point of view, their loss would have on the entire facility. Smaller health care facilities, such as nursing homes, will generally occupy one building.

11-3.2 Construction. In general, health care facilities are designed with construction features to compartmentalize a fire within the enclosure or area of origin. The location of fire walls, fire barriers, smoke barriers, and areas of refuge should be noted in the pre-incident plan.

11-3.3 Access. A health care facility can have multiple entrances including a main entrance, an emergency room entrance, and specialized treatment entrances. These entrances can be located on different sides of the facility and, due to grade changes, are commonly located on different floor levels.

11-3.4* Building Services. Since evacuation of a health care facility is not always feasible or necessary, shutting off building

utilities can be detrimental to the occupants' safety and health. The plan should address the decision-making process to shut off a health care facility utility.

11-3.5* Special Utility Considerations. The types and extent of special utilities will be based on the size and types of treatment being provided. The plan should address the decision-making process to shut off a special utility.

11-4 Occupant Considerations. The pre-incident plan should note the maximum number of patients within each smoke zone. This will help allocate resources should an incident occur.

(a) *Facility Emergency Action Plan.* The pre-incident plan should incorporate appropriate data from the facility plan.

(b) *Special Needs.* A health care facility will consist mostly of patients who are incapable of self-preservation. Movement of patients and their care after movement are issues that require consideration, and planning should include a close working relationship with the facility staff.

11-4.1* Health Care Facility Evacuation Procedures. If horizontal evacuation is necessary, reference to the individual smoke zones could be necessary. An analysis of the required resources necessary for the horizontal evacuation of patients should be considered as part of the pre-incident plan. Building plans of the health care facility will assist in evaluating the features of such smoke zones.

The pre-incident plan should include relevant procedures and guidelines that could be needed if exterior evacuation of patients becomes necessary. Evacuation of health care facilities will require additional resources to ensure each patient is attended to and cared for after the evacuation. Additional issues to consider when evacuating patients from health care facilities include the following:

(a) Weather
(b) Relocation facilities for patient evacuation
(c) Movement of bedridden patients and patients on life support systems
(d) Special needs of the patients
(e) Medical records and required medications

11-4.2 Special Considerations for Health Care Facilities. Due to the unique functions performed by health care facilities, special occupant considerations are needed. These areas include the following:

(a) Operating rooms and surgical suites
(b) Recovery rooms
(c) Intensive care and cardiac care units
(d) Areas that house patients on a locked floor, wing, or room due to their clinical needs; such areas might house patients with dementia, with psychiatric illnesses, or under the control of the courts.

11-5 Protection Systems and Water Supply. No special considerations.

11-6 Special Hazards. The pre-incident plan should note the following:

(a) Laboratories
(b) Areas containing, using, or storing biological hazards
(c) Areas containing, using, or storing radioactive hazards
(d) Areas with strong magnetic radiation, such as magnetic resonance imaging (MRI) equipment

11-7 Emergency Operations. No special considerations.

11-8 Plan Test and Maintenance. No special considerations.

Chapter 12 Detention and Correctional Occupancies

12-1 Administration.

12-1.1 Pre-incident planning in a detention and correctional occupancy involves not only emergency responders, but detention and correctional facility administrators, section or department supervisors, the maintenance director or building engineer(s), and other staff members.

12-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

12-1.3* Special Definitions.

Facility Emergency Action Plan. A facility plan developed by the detention and correctional facility to describe the actions to be taken during various internal and external emergencies and that is generally available on site. The depth of each facility plan will vary depending on the size of the facility and the type and number of residents housed. The plan should detail evacuation protocol, emergency contacts, and the responsibilities and required action of various detention and correctional facility staff. Other sections of the facility plan could note the use of communication systems, security and traffic control, and procedures to follow in the event of natural disasters and civil disturbances.

> **Sally Port.** A compartment provided with two or more doors where the intended purpose is to prevent continuous and unobstructed passage by allowing the release of only one door at a time. (***101***: 14-1.3)

> **Use Conditions.** Detention and correctional occupancies are used to house individuals under varied degrees of restraint or security and are occupied by persons who are mostly incapable of self-preservation because of security measures not under the occupants' control. (***101***: 4-1.5)

Community residential facilities, training schools, work camps, and substance abuse centers can also be considered detention and correctional facilities if they fall within the definition with respect to occupancy restraint and security measures.

12-2 Pre-Incident Planning Process.

12-2.1 Obtain a copy of the detention and correctional facility's fire or disaster plan and incorporate it into the pre-incident plan.

12-2.2 The pre-incident plan should address the level of security provided in a facility and the restrictions that the emergency responders will be operating under. The following issues should be understood and considered in the development of the pre-incident plan:

(a) The site and/or facility's buildings will be secured, therefore, access will be delayed. In addition, exiting a facility or site will also be delayed.
(b) Access to the site or a building could be limited to

responding personnel by the facility staff to ensure the safety of the responding personnel.

12-3 Physical Elements and Site Considerations.

12-3.1 General. Facilities can be small, stand-alone buildings, or can be located as part of another occupancy, in high-rise buildings or on campus-style sites. Large facilities on large sites can contain numerous occupancies in addition to the resident housing and administration buildings. These can include assembly occupancies such as gymnasiums, industrial occupancies used in the production of furniture or other commodities, warehouse occupancies, and health care occupancies. Each occupancy can have different levels of security (use conditions).

12-3.2 Access. The pre-incident plan should reference the security measures necessary to enter a site or facility. Large facilities can require access through sally ports.

12-3.3 Construction. Detention and correctional facilities are designed with construction features to compartmentalize a fire within the enclosure or area of origination. The location of fire and smoke barriers should be noted on the pre-incident plan.

12-3.4 Building Services. Evacuation of a detention and/or correctional facility is not always practical or necessary. Shutting off building utilities can be detrimental to the resident's safety and health. Detention and correctional facilities can be located in buildings of different occupancies. The plan should address the decision-making process to shut off any utilities.

12-4 Occupant Considerations. The pre-incident plan should address a process for identifying the maximum number of residents, staff members, or visitors within smoke zones.

12-4.1 The level of restraint of the residents will vary between facilities as well as different areas within a facility. Inmates in most cases will not automatically be released outside the secured boundaries (the boundaries being within a building or site).

(a) *Facility Emergency Action Plan.* The pre-incident plan should incorporate appropriate data from the facility plan.

(b) *Special Needs.* Movement of inmates is an issue that requires a close working relationship and planning with the facility staff.

12-4.2* Detention and Correctional Facility Evacuation Procedures. Detention and correctional facility staff are trained to evacuate residents when necessary to an adjacent smoke zone through horizontal exits as the first level of evacuation. The location of the smoke zones and areas of refuge should be emphasized in the pre-incident plan.

The pre-incident plan should include relevant procedures and guidelines that could be needed if exterior evacuation of residents, outside of secured enclosures, becomes necessary. In all cases, regardless of how far residents are moved in a fire incident, any movement of residents must be done under the direction of on-site staff.

12-5 Protection Systems and Water Supply. Fire department connections serving sprinkler and/or standpipe systems can be remotely located away from the building served, or outside of the secured site perimeter. The pre-incident plan should note the location of all connections and the protection systems served.

12-6 Special Hazards. Armory or munitions storage areas should be noted.

12-7 Emergency Operations. During an emergency operation, the following special considerations should be kept in mind:

(a) Avoid any direct contact with inmates.

(b) All equipment brought into a facility must be accounted for, as any piece of equipment brought to the site by responding personnel can be used as a weapon.

(c) In most cases, responding personnel will not be given keys to secured doors and will probably require escorting by facility staff.

12-8 Plan Testing and Maintenance. No special considerations.

Chapter 13 Residential Occupancies

13-1 Administration.

13-1.1 Pre-incident planning in residential occupancies such as hotels, motels, dormitories, apartment buildings, and lodging or rooming houses involves not only the emergency responders, but administrators, owners, managers, the maintenance director or building engineer(s), and other staff members.

13-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

13-1.3 Special Definitions.

Apartment Buildings. Buildings containing three or more dwelling units with independent cooking and bathroom facilities, whether designated as apartment houses, tenements, garden apartments, or by any other name. (***101***: 18-1.3)

Dormitories. Buildings or spaces in buildings where group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room or a series of closely associated rooms under joint occupancy and single management, with or without meals, but without individual cooking facilities. Examples are college dormitories, fraternity houses, and military barracks. Rooms within dormitories intended for the use of individuals for combined living and sleeping purposes shall be deemed ''guest rooms'' or ''guest suites'' as indicated (in Chapter 16 of NFPA *101)* unless specifically excepted. (***101***: 16-1.3)

Hotels. Buildings or groups of buildings under the same management in which there are sleeping accommodations for more than 16 persons primarily used by transients (those who occupy accommodations for less than 30 days) for lodging with or without meals, whether designated as a hotel, inn, club, motel, or by any other name. So-called apartment hotels shall be classified as hotels because they are potentially subject to the same transient occupancy as hotels. (***101***: 16-1.3)

Lodging or Rooming Houses. Applies to buildings that provide sleeping accommodations for a total of 16 or fewer persons on either a transient or permanent basis, with or without meals, but without separate cooking facilities for individual occupants. . . . (***101***: 20-1.1)

Residential. Residential occupancies are those occupancies in which sleeping accommodations are provided for normal residential purposes and include all buildings designed to provide sleeping accommodations.

Exception: Those classified under health care or detention and correctional occupancies.

Residential occupancies are treated separately in NFPA *101* in the following groups:

(a) Hotels, motels, and dormitories
(b) Apartment buildings
(c) Lodging or rooming houses
(d) One- and two-family dwellings
(e) Board and care facilities (***101***: 4-1.6)

13-2 Pre-Incident Planning Process. No special considerations.

13-3 Physical Elements and Site Considerations.

13-3.1 Construction.

13-3.1.1 The fire-resistive separation (or lack of) between guest rooms in transient occupancies and corridors should include details on transoms, transfer grills, and door closures.

13-3.1.2 Common attics, cocklofts, truss spaces, and other areas of potential concealed fire spread should be noted in the plan.

13-3.2 Building Services. Supplemental heating equipment such as coal or wood stoves should be noted in the pre-incident plan.

13-3.3 External Conditions.

13-3.3.1 The availability of master key(s) and a list of doors that cannot be opened by the master key(s) should be noted in the pre-incident plan.

13-3.3.2 During operating and especially late night hours, exterior doors might be locked, preventing access to the building(s). Interior doors and stairwells might be locked to prevent movement within or between buildings. Where the locking of any door impacts the accessibility of emergency responders, it should be noted in the pre-incident plan.

13-4 Occupant Considerations.

13-4.1 Where means of egress or escape are considered inadequate, operational considerations necessary to effect evacuation should be included in the plan. Special attention should be paid to public assembly areas, including auditoriums, banquet halls, meeting rooms, theatrical stages, and so forth.

13-4.2 Hours of Operation. The pre-incident plan should include a process to identify occupant load by area of the building(s) and operating hours.

13-4.3 Occupant Load. Hotel management maintains a continual list of guests by room number at the front or registration desk. The availability of this list should be noted in the pre-incident plan.

13-4.4 Staffing. The number of hotel management, supervisory staff, and other personnel who are responsible for building operations varies greatly by the time of day. Personnel who are knowledgeable in building operations or who can assist in emergency operations should be noted in the plan.

13-4.5 Location of Occupants. The pre-incident plan should include a process to identify occupants needing assistance. In hotel occupancies, the guest list might or might not include this information.

13-5 Protection Systems and Water Supply.

13-5.1 The type and design of automatic sprinkler systems should be noted in the pre-incident plan. In residential occupancies, systems designed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems,* or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height*, often utilize fast-response residential-type sprinklers. In particular, the design area of the application and nonsprinklered areas should be noted.

13-5.2 Special Extinguishing Systems. In hotel occupancies special extinguishing systems might be installed in kitchens and might also be found in computer rooms. The areas or hazards protected and the operating procedures for those areas should be noted in the pre-incident plan.

13-6 Special Hazards. Special hazards such as hotel or tenant storage areas, automobile parking, maintenance shops, kitchens, restaurants, retail outlets, exhibition halls, and mechanical rooms should be noted in the pre-incident plan.

13-7 Emergency Operations. No special considerations.

13-8 Plan Testing and Maintenance. No special considerations.

Chapter 14 Residential Board and Care Occupancies

14-1 Administration.

14-1.1 Pre-incident planning in a board and care occupancy involves not only the emergency responders, but managers, owners, the maintenance director or building engineer(s), and other staff members.

14-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

14-1.3 Special Definitions.

Evacuation Capability.* The ability of the occupants, residents, and staff as a group either to evacuate a building or to relocate from the point of occupancy to a point of safety. If the occupants of the residential board and care facility include family members of the owners or operators, it is intended that the needs of the family members be considered in determining evacuation capability.

Following are the levels of evacuation capability:

(a) *Prompt.* The ability of a group to move reliably to a point of safety in a timely manner that is equivalent to the capacity of a household in the general population.

(b) *Slow.* The ability of a group to move reliably to a point of safety in a timely manner, but not as rapidly as members of a household in the general population.

(c) *Impractical.* The inability of a group to reliably move to a point of safety in a timely manner. (***101***: 22-1.3)

Residential Board and Care Occupancy. A building or part thereof that is used for lodging and boarding

of four or more residents, not related by blood or marriage to the owners or operators, for the purpose of providing personal care services. (***101***: 22-1.3)

14-2 Pre-Incident Planning Process. No special considerations.

14-3 Physical Elements and Site Considerations. No special considerations.

14-4 Occupant Considerations.

14-4.1 The pre-incident plan should note the evacuation capabilities of the residents. Where evacuation capabilities are determined to be slow or impractical, the pre-incident plan should note any additional required resources. Where facilities are deemed to have all residents capable of prompt evacuation, the pre-incident plan should also consider the recommendations of Chapter 13, "Residential Occupancies."

14-4.2 Staffing. The number of staff who are responsible for residents will vary depending on time of day, size of facility, and personal care needs of the residents. In many residential board and care facilities, staff could be asleep at night. The number of staff and their locations within the facility should be noted in the pre-incident plan.

14-4.3 Location of Occupants. Occupants needing assistance to evacuate should be noted in the pre-incident plan.

14-4.4 The adequacy and arrangement of means of egress should be noted in the pre-incident plan. In addition to normal means of egress provisions, residential board and care facilities can include emergency escape routes consisting of exterior windows or doors.

14-5 Protection Systems and Water Supply. The type and design of automatic sprinkler systems should be noted in the pre-incident plan. In residential board and care occupancies systems designed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems;* NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes;* or NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* often utilize fast-response residential-type sprinklers. In particular, the design area of the application and nonsprinklered areas should be noted.

14-6 Special Hazards. No special considerations.

14-7 Emergency Operations. The plan should contain provisions for sheltering evacuated occupants with special needs.

14-8 Plan Testing and Maintenance. No special considerations.

Chapter 15 Mercantile Occupancies

15-1 Administration.

15-1.1 Pre-incident planning in a mercantile occupancy involves not only the emergency responders, but administrators, section or department supervisors, the maintenance director or building engineer(s), and other staff members.

15-1.2 This chapter contains recommendations specific to this type occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8. *(See also Chapter 18 for bulk merchandising retail buildings.)*

15-1.3 Special Definitions.

Anchor Store. A department store or major merchandising center having direct access to the covered mall but having all required means of egress independent of the covered mall. (***101***: 25-1.3)

Bulk Merchandising Retail Building. A building where the sales area includes the storage of combustible materials on pallets, in solid piles, or in racks in excess of 12 ft (3.7 m) in storage height. (***101***: 25-1.3)

Covered Mall Building. A building, including the covered mall, enclosing a number of tenants and occupancies, such as retail stores, drinking and dining establishments, entertainment and amusement facilities, offices, and other similar uses, wherein two or more tenants have a main entrance into the covered mall. (***101***: 25-1.3)

Mercantile. Mercantile occupancies include stores, markets, and other rooms, buildings, or structures for the display and sale of merchandise.

Mercantile occupancies include the following:

Auction rooms

Department stores

Drugstores

Shopping centers

Supermarkets (***101***: 4-1.7)

15-2 Pre-Incident Planning Process. No special considerations.

15-3 Physical Elements and Site Considerations.

15-3.1 Construction. The presence, location, and component ratings of fire walls, fire barriers, and smoke compartments should be noted on the plan, as well as the protection provided for any openings. Specific concerns that should be noted include the following:

(a) Strip shopping centers or rows of attached mercantile occupancies have common walls. Cocklofts, attics, or basements can be common areas or provided with fire barriers. Breached fire barriers should be noted on the plan.

(b) Covered mall buildings have large, undivided areas and unprotected openings between floors. The tenants are open to the covered mall, adding to the size of the open areas. Entrances to anchor stores from the covered mall might be protected by water curtains, fire barriers, or smoke barriers. The size and characteristics of the protection for the openings should be detailed along with reliability of the closing mechanism.

15-3.2 Building Services. No special considerations.

15-4 Occupant Consideration.

15-4.1 Life Safety Considerations. In a covered mall building with anchor stores, the hours of operation of the tenants can vary. There could be separate entrance and egress controls for tenants in a covered mall building and for the anchor stores. Seasonal events, temporary kiosks, and special promotions in common areas could affect occupant evacuation or the operations of emergency responders. Information on these characteristics should be noted.

15-4.2 Emergency Organization. Expected effectiveness of mall or store managers, security, or on-site emergency services, if provided, should be included in the plan. Evacuations of covered mall occupancies can be difficult to accomplish and should be jointly completed with the emergency organization. The plan should note the resources needed to complete this task.

15-5 Protection Systems and Water Supply.

15-5.1 Hydrants. Water supply for on-site hydrants, public or private, should be noted in the plan due to the potential complexity of multiple sources. For private systems, an emergency contact familiar with the supply should be noted.

15-5.2 Automatic Sprinkler Systems. It is not uncommon for there to be numerous risers and control valves due to the potential complexity of multiple systems located throughout a covered mall building and anchor stores. Details on the types of systems and their location, layout, and protected areas should be noted.

15-5.3 Standpipes. Interior hose line stretches within the mall or stores can be extensive and should be noted.

15-5.4 Protective Signaling Systems. The areas of coverage and method of occupant notification included in protective signaling systems can vary within a covered mall building and anchor stores. There can be separate systems for tenants in covered mall buildings. As a result, there could be multiple fire alarm control panels. The presence of multiple fire alarm control panels should be noted.

15-5.5 Smoke Management. No special considerations.

15-6 Special Hazards. Hazards that should be noted include the following:

(a) Stock areas
(b) High-challenge commodities or hazardous materials such as aerosols, oxidizers, pesticides, and flammable or combustible liquids. Incompatibility of materials like oxidizers and petroleum products should be identified
(c) Warehouse store concerns typically found in large home improvement stores, large furniture stores, carpet outlets, and automobile tire distributors
(d) Food courts or restaurants with commercial cooking equipment
(e) Trash collection and compactor rooms
(f) Seasonal events, temporary kiosks, and special promotions in common areas

15-7 Emergency Operation. No special considerations.

15-8 Plan Testing and Maintenance. No special considerations.

Chapter 16 Business Occupancies

16-1 Administration.

16-1.1 Pre-incident planning in general business offices; physician's offices; outpatient clinics; college, instructional, and university classrooms under 50 persons; and government offices involves not only responding personnel, but administrators, owners, managers, the maintenance director/building engineer(s), and other staff members.

16-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

16-1.3 Definition.

Business. Business occupancies are those used for the transaction of business, for the keeping of accounts and records, and for similar purposes.

Business occupancies include the following:

Air traffic control towers (ATCTs)

City halls

College and university instructional buildings, classrooms under 50 persons, and instructional laboratories

Courthouses

Dentists' offices

Doctors' offices

General offices

Outpatient clinics, ambulatory

Town halls (***101***: 4-1.8)

16-2 Pre-Incident Planning Process. No special considerations.

16-3 Physical Elements and Site Considerations. No special considerations.

16-4 Occupant Considerations.

16-4.1 Special attention should be paid to public assembly areas, including auditoriums, banquet halls, cafeterias, and conference or meeting rooms, that are common to business occupancies.

16-4.2 Location of Occupants. The pre-incident plan should include a process to identify occupants needing assistance.

16-5 Protection Systems and Water Supply. No special considerations.

16-6 Special Hazards. High-hazard contents might be stored in multiple areas throughout the building(s), including in print shops, storage areas, file storage areas, automobile parking, maintenance shops, kitchens, and retail outlets. Physician's offices, outpatient clinics, or instructional laboratories might store flammable or combustible liquids or flammable gases. Significant high-hazard contents should be noted in the pre-incident plan.

16-7 Emergency Operations. Open floor plans could be a maze of cubicles and present a hazard to emergency responders during operations.

16-8 Plan Testing and Maintenance. No special considerations.

Chapter 17 Industrial Occupancies

17-1 Administration

17-1.1 Pre-incident planning in a industrial occupancy involves not only responding personnel, but administrators, section or department supervisors, the maintenance director or building engineer(s), and other staff members.

Within industrial occupancies, an established management team will often have the overall responsibility of operating a

specific facility, including its environmental and safety functions. Personnel with knowledge of or direct control over industrial hygiene operations, emergency response teams, and plant engineering will be assigned to this team. Much of the preliminary data gathering process and assignment of safety duties might already be established. In any event, requests for information and other related pre-incident planning material should be referred to the local facility management team, where appropriate.

17-1.2 This chapter contains recommendations specific to this type of occupancy. All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

17-1.3 Special Definitions.

Industrial. Industrial occupancies include factories making products of all kinds and properties devoted to operations such as processing, assembling, mixing, packaging, finishing or decorating, and repairing.

Industrial occupancies include the following:

Dry cleaning plants
Factories of all kinds
Food processing plants
Gas plants
Hangars (for servicing maintenance)
Laundries
Power plants
Pumping stations
Refineries
Sawmills
Telephone exchanges (***101:*** 4-1.9)

Process Hazard Analysis. An analysis of a process or system used to identify potential cause and effect relationships and resultant hazards or system failures. The methods used to perform the analysis vary from simple to complex and depend upon the detail required and the risk being evaluated. For example, a simple checklist or a detailed fault tree analysis can be utilized.

Spill Prevention Control and Countermeasure (SPCC) Plans. A plan prepared for facilities with chemical(s) that exceed certain capacities in accordance with governmental regulations.

17-2 Pre-Incident Planning Process. During the planning process, a knowledge of preexisting safety-related documentation will enhance and expedite the development of the pre-incident plan itself. Example documentation includes the following:

(a) Process hazard analysis
(b) Confined space rescue plans
(c) Spill prevention control and countermeasure (SPCC) plans

17-3 Physical Elements and Site Considerations.

17-3.1 General. Industrial occupancies can occupy a large tract of land with numerous site specific hazards. Separate, stand-alone buildings can provide physical plant support functions, or supply materials in various stages of development to other buildings on site as part of the overall process. Examples include steam generation plants, chemical reactors, raw material conveyor processes, and general assembly operations. Pre-incident plans should address each of these operations individually and note the criticality of them and what impact their loss would have on the entire facility.

17-3.2 Construction. Buildings might be provided with walls or panels designed to relieve pressure in the event that an explosion occurs. Reactors and other process vessels might incorporate relief mechanisms into their design. The plan should note these features.

17-3.3 Utilities. The plan should address the decision-making process for shutting off utilities, because their interruption can have catastrophic consequences.

17-3.4 Access. Certain operating features can hinder access to a facility. These include rack storage, rolling stock, railroad sidings, trucking, container storage, automatic rack storage retrieval systems, fences or caged-in areas (e.g., aerosols), furnaces (e.g., molten metal), and plating operations (e.g., caustic or acidic solutions).

17-4 Occupant Considerations. The total number of people present at an industrial facility will vary widely depending on time of day, time of year, level of automation, and to what extent nonemployees (e.g., contractors, delivery personnel) are used.

(a) *Accountability or Location of Personnel.* Occupant load will vary with the operations conducted. Personnel may work in remote locations, for example, in outside buildings, overhead cranes, and boiler rooms. Many facilities have implemented an accountability system. Understanding such a system will assist emergency responders in carrying out their life safety priority actions.

Depending on the magnitude of the incident and the hazard potential, many large industrial facilities will not have a need for total evacuation. Areas of refuge that utilize fire walls and other rated separations may be provided. Building plans will assist in evaluating the location and appropriateness of such features.

(b) *Emergency Action Plan (EAP).* Smaller facilities might list their plan of action to include total evacuation of the building. A local emergency contact can be listed along with a designated meeting area to account for personnel after an evacuation. Larger facilities might list an emergency response team in their action plan with responsibility for controlling an emergency incident until responding personnel arrive. Other sections of the plan could note the availability of subject matter experts, authorized personnel, procedures for shutting down processes, and procedures to follow in the event of civil disturbances.

Note that some processes can require an extended period of time for proper shutdown. Shutdown procedures can be performed manually. Depending on the location of the emergency incident, this could expose the process operators to potentially hazardous conditions in the surrounding area. A decision must be made by the emergency responders at what point such operators should be removed.

(c) *Special Needs.* Special arrangements could be necessary for personnel evacuation due to their being physically challenged or because of their location. For example, personnel could be located in overhead cranes, on upper floors of a multiple story building, or in critical control centers where standard means of evacuation might not be applicable. Consideration should be given for alternative means of evacuation or rescue.

17-5* Protection Systems and Water Supply. In addition to standard sprinkler systems, many industrial facilities utilize a

wide variety of fire and special protection systems that can be very complex. The plan should note the location, coverage, and type of system.

17-6 Special Hazards. Hazards that should be noted include the following.

(a) *Controlled Environments.* Cleanrooms, freezers, and other environmentally controlled areas should be noted. Procedures for entering these areas during an incident should be reviewed with facility personnel and noted on the pre-incident plan.

(b) *Commodity Combustibility and Hazard.* The hazardous properties of the commodity as well as its stability under fire conditions are of importance. Facilities could have some quantity of flammable liquids, most in the form of solvents and cleaning chemicals. Dedicated storage of flammable liquids might be inside or outside. Outside storage of flammable or toxic gases might be in separate buildings or bunkers. Some materials can be reactive with air or water. Should a release occur, whether or not water is used, consideration for air or water contamination should be taken into account.

(c) *Fueling Facilities.* Industrial facilities might utilize powered industrial vehicles with a variety of fuels.

(d) *Treatment Plants.* On-site treatment plants will present their own hazards including storage of chemicals such as chlorine, other oxidizers, and corrosives.

(e) *Process Hazards.* The plan should identify any process hazards that could involve hazardous materials and operations.

(f) *Radiological Hazards.* The plan should identify all radiological hazards, both ionizing and contamination.

17-7* Emergency Operation. An industrial facility will often maintain their own emergency response team with varying degrees of training and areas of expertise. Discussions with the on-site emergency response team coordinator to determine the level of response and resources available from the site team should be included.

17-8 Plan Testing and Maintenance. No special considerations.

Chapter 18 Warehouses and Storage Occupancies

18-1 Administration.

18-1.1 Pre-incident planning in a warehouse occupancy involves not only emergency responders, but also administrators, owners, the maintenance director or building engineer(s), and tenants.

Warehouses pose one of the greatest challenges to fire control for both automatic fire suppression systems and manual fire fighting. Manual fire suppression cannot take the place of a properly designed, installed, and functioning sprinkler system in a warehouse. If the warehouse is not protected by automatic sprinklers designed for the commodities stored and the configuration in which they are arranged, there is little chance of controlling a fire. Likewise it must be recognized that even the best designed sprinkler system might not extinguish a warehouse fire and manual fire suppression can be required to effect final extinguishment. For warehouse firefighting operations to be successful, the pre-incident plan should be developed with a full knowledge of the design and capabilities of the sprinkler systems within the warehouse.

18-1.2 This chapter contains recommendations specific to this type of occupancy. *(See also Chapter 18 for bulk merchandising retail buildings.)* All pre-incident plans should follow the general provisions set forth in Chapters 1 through 8.

18-1.3 Special Definitions.

Bonded Warehouse. A facility for storing controlled materials, such as alcohol and tobacco products, that generally has high levels of security and very limited access. An entire building or portions of a building can be designed with these restrictions.

Controlled Atmosphere (CA) Warehouse. A facility for storing specialty products, such as fruits, that generally includes sealed storage rooms, with controlled temperature and air content, the most common being an atmosphere containing a high percentage of a gas such as nitrogen.

Storage Occupancy. Storage occupancies include all buildings or structures utilized primarily for the storage or sheltering of goods, merchandise, products, vehicles, or animals whether designated as a warehouse, storehouse, distribution center, or any other name. Such buildings can be used for general-purpose storage, flammable/combustible liquids, cold storage, or other specialized goods, merchandise, or products, and includes bonded warehouses and controlled atmosphere warehouses.

18-2 Pre-Incident Planning Process. No special considerations.

18-3 Physical Elements and Site Considerations.

18-3.1 Construction Features. The construction of the building, information on whether internal walls are fire rated and constructed as fire walls or fire barriers, and the rating of the wall assembly should be noted on the plan. The protection of openings in fire walls and fire barriers should also be noted. The adequacy of maintenance for fire doors should be evaluated to determine their probable performance in a fire.

18-3.2* Building Access. Warehouses are generally built with limited access and increased security measures for inventory control. In addition to building construction barriers, operating features can hinder access. These should be noted.

18-3.3 Controlled Environments. The presence of large freezers and a controlled atmosphere should be noted. Special care might be required before entering these areas. It might also be necessary to identify persons or procedures for shutting down.

18-4 Occupant Considerations. Storage configuration, seasonal variations in stock, and material-handling devices all impact on life safety considerations, on-site emergency action plans, and the safety of emergency responders.

18-5 Protection Systems and Water Supply.

18-5.1 Automatic Sprinklers.

18-5.1.1 The presence of automatic sprinkler systems and the systems' designs should be noted along with any special design features such as in-rack systems, large-drop sprinklers, early suppression fast response (ESFR) sprinklers, sprinkler control valves, and hydraulic placard information.

18-5.1.2 Design Deficiency. Sprinkler system design deficiencies can occur when the water supply is not adequate to support the system design, or the system design is not appropriate for the commodity stored, or its arrangement. Identified deficiencies should be noted on the plan.

18-5.2 Water Supply. A sprinkler system's water supply should be capable of meeting not only the sprinkler demand, but also the demand for hose streams. There is a vital need to evaluate the water supply and to determine if it is adequate for the sprinkler system design, storage, configuration, and the warehouse occupancy class.

18-5.3 Products of Combustion or Contaminants and Heat Venting.

18-5.3.1 Control of products of combustion or contaminants is important in warehouse occupancies due to the large volume of combustible commodities stored within them. Proper venting of products of combustion or contaminants and hot gases minimizes property damage and increases responding personnel effectiveness and safety. The plan should note how venting can be accomplished and the location of any manual or automatic controls.

18-5.3.2 Automatic venting details should be noted in the pre-incident plan, as this could affect fire behavior. The power supply to fans and ventilation equipment should be investigated to determine if it is reliable enough to remain in service during a fire. Likewise, the actual fan components themselves must be able to withstand the heat of a fire if they are to be of value during a fire.

18-6 Special Hazards.

18-6.1 Storage. Storage of high-hazard items, such as plastics, toxic materials, aerosols, or flammable or combustible liquids, can test the limits of protection even in a fully sprinklered warehouse. New commodities can be introduced or moved within the warehouse. If the commodity changes, existing protection might be inadequate. Recording the commodity class on the plan will indicate changed classifications.

18-6.2 Storage Configuration. Some commodities require extensive manual fire-fighting operations. All interior operations should be conducted with full knowledge that the stored commodity might not be stable and that fire fighters are at risk from collapsing commodity storage. Stock can be stored in bulk or palletized piles, in racks, or on shelves. Fire behavior of a given material can vary with such factors as storage height, shelving, presence or absence of vertical flue and aisle spaces, and pile stability. Storage configuration and the use of any floor-marking system should be recorded.

18-6.3 Storage Configuration Variations. The plan should note the possibility of storage configuration variations due to daily, weekly, monthly, or seasonal changes that in turn could lead to arriving or departing shipments being double stacked on the rack level, or stored ''temporarily'' in access aisles despite efforts to prevent excessive storage heights or storage in aisles.

18-6.4* Material-Handling Operations. Personnel using lift trucks powered by batteries or internal combustion engines remain the most common means of moving stock in warehouses. Some high-capacity warehouses use specialized equipment such as computerized stackers. The number, availability, and operation of the material-handling equipment should be investigated.

In high-rack warehouses, storage height can reach over 100 ft (30.5 m). In such situations the custom stackers provide the only practical means of gaining quick access to the racks for suppression, rescue, or overhaul. Personnel with special training will be required to operate the equipment.

18-6.5 Fueling Facilities. Fueling stations and fuel storage areas should be identified in the plan. Electrical battery-charging stations provide a personnel hazard due to corrosive materials as well as to the off-gassing of hydrogen during charging operations. LP-Gas cylinders for forklifts introduce a boiling liquid evaporating vapor explosion (BLEVE) hazard.

18-6.6 Environmental Considerations. Certain commodities contribute to air or water pollution during an emergency. The pre-incident plan should make note of these commodities.

18-6.7 Outside Storage. Outside storage is often an integral part of warehouse operations, and sometimes includes hazardous commodities such as idle pallets and cylinders of flammable gases. Toxic and flammable liquids are often segregated from a main building and located in the open or in separate small structures that are usually unprotected. Outside storage can reduce accessibility or create a fire exposure hazard to the facility.

18-7 Emergency Operations. No special considerations.

18-8 Plan Testing and Maintenance. No special considerations.

Chapter 19 Referenced Publications

19-1 The following documents or portions thereof are referenced within this recommended practice and should be considered as part of its recommendations. The edition indicated for each referenced document is the current edition as of the date of the NFPA issuance of this recommended practice. Some of these documents might also be referenced in this recommended practice for specific informational purposes and, therefore, are also listed in Appendix F.

19-1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269-9101.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 1996 edition.

NFPA 13D, *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes,* 1996 edition.

NFPA 13R, *Standard for the Installation of Sprinkler Systems in Residential Occupancies up to and Including Four Stories in Height,* 1996 edition.

NFPA *101®*, *Life Safety Code®*, 1997 edition.

NFPA 221, *Standard for Fire Walls and Fire Barrier Walls,* 1997 edition.

NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants,* 1995 edition.

Appendix A Explanatory Material

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

A-1-1.1 Fire and/or life safety hazards observed during the pre-incident planning process should be reported to the appropriate authority having jurisdiction.

A-1-2.3 The planning process should begin during the construction design process of the proposed facility to identify emergency responders' concerns. The planning process should allow for revisions to the plan during different phases of construction.

A-1-2.6 The pre-incident plan will be most effective when coordinated with an incident management system such as the one presented in NFPA 1561, *Standard on Fire Department Incident Management System.*

A-1-3.2 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A-1-3.2 Authority Having Jurisdiction. The phrase "authority having jurisdiction" is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A-2-1.2 This document assumes that the public fire department will take a lead role in the preparation of a pre-incident plan; however, this does not preclude any other interested party from assuming the lead role if the public fire department does not.

A-2-2.3 It is recommended that each plan be kept simple enough to remain useful. As individual pre-incident plans become too cumbersome, it is strongly recommended that each be split into multiple plans.

Various levels of pre-incident planning may be utilized depending on factors such as the complexity of the facility, expected first responders, special hazards, and special needs. Three planning levels are established here and generally described. The three levels of plans are overview plans, building level plans, and process level plans.

(a) *Overview Plans.* This is the highest level plan and the simplest. It is expected to identify the location of a simple facility, with a standard response by emergency responders. It will show details such as public water supplies, access, and occupancy. An overview plan could be used as a starting point for large campus-style facilities to act as a directory to more detailed plans.

(b) *Building Level Plans.* This level of detail is intended for circumstances where a strategy to respond to a fire within a unique building is needed. This level pre-incident plan will include building access and hazards, fire protection and water supply details, structural construction considerations, and specific occupancy details. If necessary, it is expected that this level plan will be supported by an overview plan and/or a "process" plan.

(c) *Process Level Plans.* This is the most detailed level of planning and is intended to include process hazards and protection schemes, detailed occupancy considerations, room or area layouts, and operational features (e.g., ventilation, power). The defining criterion does not have to be a process; it can be a floor, a building wing, or even a unique building. This level plan is recommended where it is expected that emergency responders will require detailed information for limited scope scenarios.

The pre-incident plans presented in Appendix E demonstrate planning levels applied to a hospital-type facility, although the concept is equally applicable to other facilities.

A-3-3.3.3 Some elevator lobbies are formed by the activation of a power-operated sliding door by the fire alarm system. These doors have either a swinging door or a special release device to open the door to a predefined width [typically 32 in. (81 cm)]. Other types of operable elevator lobby separations are available.

A-5-2.1 The adequacy of a water supply is based on two primary factors.

(a) *Capacity.* Being able to deliver the quantity of water needed for as long as it is needed

(b) *Pressure.* Having the pressure necessary to deliver the required quantity of water to the point of use plus meet any additional pressure requirements of the systems being supplied

Most authorities having jurisdiction do not accept fire pumps drawing water directly from a natural well (belowground) as a source of water, as its capacity is unknown and could change at anytime because of naturally occurring phenomena like changes in the water table and new fissure in rock strata that could channel water away. This reduces the reliability of a natural well since the quantity of water required for fire protection might not be continually available.

Evaluating Water Supplies. Evaluating the adequacy of a water supply requires determining the amount of water required for both fire protection and building services, including domestic, process, and cooling use. The water requirement for fire protection may be less than the water demand during times of normal operation. However, one cannot conclude that all domestic, process, and cooling use will cease when a fire starts, particularly when the water source is a public system. The evaluation then requires determining the amount of water available. Only after both the need and the availability have been determined can one draw a conclusion as to the acceptability of the water supply.

The following factors should be considered when evaluating the water required.

(a) The quantity of water required for fire protection including the following:
   1. Automatic sprinkler system demand *(see NFPA 13, Standard for the Installation of Automatic Sprinkler Systems)*
   2. Standpipe system requirements *(see NFPA 14, Standard for the Installation of Standpipe and Hose Systems)*
   3. Outside hose line requirements *(see NFPA 13, Standard for the Installation of Automatic Sprinkler Systems; NFPA 231, Standard for General Storage; NFPA 231C, Standard for Rack Storage of Materials)* and local fire department requirements

4. Other aqueous-based extinguishing system demands *(see NFPA 16, Standard for the Installation of Deluge Foam-Water Sprinkler and Foam-Water Spray Systems, and others)*

(b) The quantity of water required for building services including:
1. Air conditioning, heating, refrigeration
2. Restroom, potable (drinking), cooking and other uses

(c) The quantity of water needed for processes that cannot be interrupted *(see equipment manufacturer's literature, users' actual water use experience, or the International Plumbing Code)* including the following:
1. Cooling purposes (e.g., cooling machines)
2. Water used in actual processes (e.g., additive, catalyst)

(d) Additional factors that could affect the quantity of water required or the duration of time that the water must be available include the following:
1. Type of construction (e.g., fire resistive, noncombustible, wood frame) and the presence of fire-limiting construction features (e.g., fire walls, rated fire doors, draft curtains), or the lack of such construction features (e.g., atriums, large open areas)
2. Combustibility of contents of high-fire loading
3. Presence of quantities of flammable or combustible liquids, gases, or aerosols
4. Presence of quantities of hazardous materials (e.g., pyrophoric material, oxidizers, or water reactive material)
5. Local fire department response time
6. Human resource and equipment capabilities

Additional resources that could provide information on the quantity or duration of water that should be available include the following:

(a) Local fire department requirements

(b) Requirements in applicable fire protection standards including the following:
1. NFPA 22, *Standard for Water Tanks for Private Fire Protection*
2. NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*
3. NFPA 30, *Flammable and Combustible Liquids Code*
4. NFPA 30B, *Code for the Manufacture and Storage of Aerosol Products*
5. NFPA 1231, *Standard on Water Supplies for Suburban and Rural Fire Fighting*

Once the water demand has been determined, the next step is to determine the water available. The following procedures should be followed:

(a) Test the existing water supply. This should ideally be done during the peak periods of use.

(b) Verify the test results and the supply's reliability with the local water department and fire department.

(c) Conduct follow-up testing to identify any changes in or deterioration of the water supply.

The following references could assist with measuring the water supply, including tank capacity, system pressure, and pump output:

(a) NFPA 20, *Standard for the Installation of Centrifugal Fire Pumps*

(b) NFPA 22, *Standard for Water Tanks for Private Fire Protection*

(c) NFPA 24, *Standard for the Installation of Private Fire Service Mains and Their Appurtenances*

(d) NFPA 291, *Recommended Practice for Fire Flow Testing and Marking of Hydrants*

(e) NFPA 1231, *Standard on Water Supplies for Suburban and Rural Fire Fighting*

When the evaluation of the available water supply is completed, the user can compare the water available to the water required. If the quantity and necessary pressure of the water required is less than the amount available, there should be an adequate water supply for fire protection purposes. If either the quantity or necessary pressure requirements are greater than the water supply, the user should take the necessary steps to address the deficiency. This should include investigating ways to decrease the necessary water demands in addition to upgrading, supplementing, or replacing the deficient supply.

Once the water supply is adequate to meet the needs of a site, it is essential that this level of protection be maintained. This means that users should maintain the components of the water supply system under their control and perform regularly scheduled tests to verify the system's continued reliability.

A-5-2.2.1 Care should be exercised in interpreting the test results, as only the available water supply in the water mains are determined. The actual flow from the hydrant will be less than the test results depending on the size and length of the hydrant lateral, the type of hydrant, and which outlet is used.

A-5-3 Information on the design and installation of automatic sprinkler systems can be found in NFPA 13, *Standard for the Installation of Sprinkler Systems.* Information on the inspection, testing, and maintenance of sprinkler systems can be found in NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.*

These systems play a vital role in providing adequate overall fire protection for many occupancies. If these systems fail to control or extinguish the fire, it is quite possible that it will be impossible to prevent deaths, injuries, and substantial property losses, even with a large commitment of manual fire-fighting forces.

A-5-3(b) Most systems installed today are hydraulically designed systems based on occupancy or commodity classifications. Sprinkler contractors use a computer to custom-design the exact protection configuration to meet the facility's needs. Hydraulically designed systems should have a placard posted on the riser indicating the specific design characteristics of the system. A piping system where branch lines form a loop is always hydraulically designed, even though a hydraulic placard is not provided at the riser.

A-5-3(c) An important part of pre-incident planning is to anticipate potential sources of sprinkler system failure and to take action to correct any known or suspected problem areas. A fire protection engineer or other qualified individual might need to be consulted to identify any deficiencies.

Design deficiencies can occur when the water supply is not adequate to control or extinguish a fire, or when the sprinkler system is improperly designed for the occupancy hazard. Each sprinkler system is designed for a specific occupancy and any change in occupancy classification, building layout, contents, or storage array might render protection inadequate. Even seemingly minor changes can compromise existing sprinkler protection.

A-5-3(d) The leading cause of sprinkler system failure is closed or partially closed valves in the water supply system.

Impairments to the sprinkler system can occur before a fire. This generally occurs where a sprinkler system is actually shut off for legitimate reasons during construction, renovations, or maintenance, but the control valves are either inadvertently not re-opened or not opened fully. Impairments can also be the result of obstructions, such as rocks, working their way into sprinkler piping and blocking the flow of water.

Impairments to the sprinkler system can also occur during a fire. A system can become impaired when any sprinkler control valve is shut off prematurely during a fire. This obviously turns off the water to the sprinklers. Well-meaning occupants or responding personnel might shut off the valve to improve visibility by reducing products of combustion or contaminants, or to control water damage. However, this action only prevents the sprinklers from gaining control of a fire in its critical development stage. Even if the valve is turned on again later, the fire might have grown beyond the point where sprinklers can control it.

A-5-3(e) See A-5-3(d).

A-5-4 Standpipe systems play a vital role in effective manual fire suppression evolutions. Standpipes can be found in low-, mid-, and high-rise buildings as well as large area single-story buildings. It is crucial that these systems be designed, installed, tested, and maintained in accordance with the appropriate standards. Failure of a standpipe system can hinder responding personnel operations and result in the need to lay out substantial quantities of hose lines across large areas or up stairways.

A-5-4.1(c) In any standpipe system, even those without pressure-restricting devices or pressure reducing valves, it is possible that the pressure available at the standpipe outlet valve might be limited to 65 psi or 100 psi (448 kPa or 690 kPa).

The pre-incident plan should note the pressure available at the outlet of the standpipe valves and whether or not the pressure is adequate for the anticipated hose evolutions (e.g., hose line length and size and nozzle type) used by the responding personnel. It could be necessary to provide alternative hose evolutions with certain standpipe systems to ensure adequate fire flows.

A-5-4.2 Prior to the 1993 edition of NFPA 14, *Standard for the Installation of Standpipe and Hose Systems,* a minimum residual pressure of 65 psi (448 kPa) at the topmost 2 ½-in. (65-mm) hose valve outlet was permitted. Beginning with the 1993 edition, the minimum residual pressure at the outlet was raised to 100 psi (690 kPa). Higher pressures are permitted if specified by the authority having jurisdiction.

Determining the pressure available at the outlet is vital since many of the automatic nozzles require a minimum of 100 psi (690 kPa) at the nozzle for proper operation.

Almost all pressure reducing valves and pressure restricting devices are designed so that making adjustments during emergency operations is extremely difficult, if not impossible.

A-5-5.1 Information on the design installation, testing, and maintenance of fire protection signaling systems can be found in NFPA 72, *National Fire Alarm Code®*. These systems can provide automatic detection through heat, products of combustion or contaminants, and flame detectors, or can rely on manual detection and operation of manual pull stations. Systems can also be activated by water flow in automatic sprinkler systems or other special extinguishing systems.

Many facilities, especially inside living units in residential occupancies, are provided with single- or multistation products of combustion or contaminants detectors. While these types of detectors may be interconnected with one another, they do not provide automatic emergency forces notification. These types of detectors are designed to provide occupant notification in only the areas where the detectors are located.

A-5-8 Smoke is recognized as a major killer in fires. Smoke often migrates to building locations remote from the fire space, threatening life and damaging property. Stairwells and elevator shafts frequently become smoke logged, thereby blocking evacuation and inhibiting rescue and fire fighting. The MGM Grand Hotel fire is an example of the smoke problem. The fire was limited to the first floor, but smoke spread throughout the building. Some occupants on upper floors were exposed to smoke for hours before rescue. The death toll was 85, and the majority of the deaths were on floors far above the fire.

The concept of smoke management was developed as a solution to smoke migration. Smoke movement can be managed by use of one or more of the following mechanisms:

(a) Compartmentation
(b) Dilution
(c) Airflow
(d) Pressurization
(e) Buoyancy

Compartmentation is the use of barriers with sufficient fire endurance to remain effective throughout a fire exposure. In fire compartmentation, the walls, partitions, floors, doors, and other barriers provide some level of smoke protection to spaces remote from the fire. Many codes, such as NFPA *101, Life Safety Code,* provide specific criteria for the construction of smoke barriers, including doors and smoke dampers in these barriers.

Dilution of smoke might be referred to as smoke purging, smoke removal, smoke exhaust, or smoke extraction. Dilution can be used to maintain acceptable gas and particulate concentrations in a compartment subject to smoke infiltration from an adjacent space. This can be effective if the rate of smoke leakage is small compared to either the total volume of the safeguarded space or the rate of purging air supplied to and removed from the space. Also, dilution can be beneficial to the responding personnel for removing smoke after a fire has been extinguished. Many people have unrealistic expectations about what dilution can accomplish in the fire space. There is no theoretical or experimental evidence that using a building's HVAC system for smoke dilution will result in any significant improvement in tenable conditions within the fire space.

It is well known that HVAC systems promote a considerable degree of air mixing within the spaces they serve. Because of this and the fact that very large quantities of smoke can be produced by building fires, it is generally believed that dilution of smoke by an HVAC system in the fire space will not result in any practical improvement in the tenable conditions in that space. It is recommended, therefore, that smoke-purging systems intended to improve hazardous conditions within the fire space or in spaces connected to the fire space by large openings not be used.

Airflow has been used extensively to manage smoke from fires in subway, railroad, and highway tunnels. Large flow rates are needed to control smoke flow, and these flow rates can supply additional oxygen to the fire. Because of extensive controls, airflow is not used so extensively in buildings. The control problem consists of having very small flows when a door is closed and then having those flows increase significantly when that door is opened.

Pressurization produced by mechanical fans is referred to as smoke control in NFPA 92A, *Recommended Practice for Smoke-Control Systems.* By definition, stairwell pressurization, elevator pressurization, and zoned smoke control are all types of smoke control systems. Pressurization results in airflows of high velocity in the small gaps around closed doors and in construction cracks, thereby preventing smoke backflows through these openings. The pressurization systems most commonly used are pressurized stairwells and zoned smoke control. Elevator smoke control is less common. Many pressurized stairwells are designed and built with the goal of providing a tenable environment within the escape route in the event of a building fire.

Buoyancy of hot combustion gases is employed in both fan-powered and nonpowered venting systems. Such fan-powered venting for large spaces is commonly employed for atria and covered shopping malls. Design analysis of these systems for malls is treated in NFPA 92B, *Guide for Smoke Management Systems in Malls, Atria, and Large Areas.* There is concern that the sprinkler flow will cool the smoke, thus reducing its buoyancy and the smoke management system's effectiveness. There is no question that sprinkler flow does cool smoke, but it is unknown to what extent the cooling reduces the effectiveness of fan-powered venting.

The following mechanisms are used by themselves or in combination to manage smoke conditions:

(a) Compartmentation
(b) Dilution
(c) Airflow
(d) Pressurization
(e) Buoyancy

A-6-1 Many occupancies contain quantities of chemical, physical, and biological hazards that pose significant additional risk in a release or fire incident if not adequately recognized and addressed during pre-planning and response.

These special-hazard occupancies have been the subject of substantial regulatory and consensus standards over the past few decades. Plan developers should be familiar with the following documents before initiating pre-planning for special-hazard occupancies.

(a) NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents;* NFPA 472, *Standard for Professional Competence of Responders to Hazardous Materials Incidents;* and NFPA 473, *Standard for Competencies for EMS Personnel Responding to Hazardous Materials Incidents*
(b) CCPS, *Guidelines for Chemical Process Quantitative Risk Analysis*
(c) NRT, *The National Response Team's Integrated Contingency Plan Guidance*

A-7-2 Data Gathering. See Appendix E.

A-7-3 Guidance on the development of emergency response and post-incident recovery procedures can be found in the following NFPA documents:

(a) NFPA 471, *Recommended Practice for Responding to Hazardous Materials Incidents*
(b) NFPA 600, *Standard on Industrial Fire Brigades*
(c) NFPA 1500, *Standard on Fire Department Occupational Safety and Health Program*
(d) NFPA 1600, *Recommended Practice for Disaster Management*

A-11-1.1 To better help understand the functions performed in health care facilities, the development of the pre-incident plan should include a review of NFPA 99, *Standard for Health Care Facilities,* and NFPA *101, Life Safety Code.*

A-11-3.4 The pre-incident plan should address the following.

(a) *HVAC.* The control for this equipment is important. It could be designed for products of combustion or contaminant removal or could have a separate dedicated products of combustion or contaminant removal system.

(b) *Utilities.* Most health care facilities will be provided with an emergency power source usually consisting of an emergency generator operated from an on-site fuel source. The type of fuel, storage location, quantity, and emergency shutoff are important.

(c) *Electric Power.* Small facilities such as ambulatory health care centers could be provided emergency electrical systems capable of supplying a limited amount of lighting for egress and power service for the orderly cessation of procedures. Larger health care facilities could have expanded emergency electrical systems serving such things as life support systems, intensive care units, and task lighting in critical areas. In addition, the facility might have additional emergency systems serving equipment considered necessary for patient care. Such equipment can include central suction systems, products of combustion or contaminant control systems, and facility heating equipment. The operating features and controls should be identified including what major functions each emergency system supplies.

(d) *Water Supply.* Shutoffs should be noted for domestic water supplies. Any equipment or operations that are critically dependent on water should be noted.

A-11-3.5 Special utilities might include the following.

(a) *Gas and Vacuum Systems.* Health care facilities can have piped nonflammable medical gas systems, flammable and nonflammable laboratory gas systems, and vacuum systems. The type of systems, control points, and significance to patient care should be noted. Typical patient care gases used in health care facilities include oxygen and nitrous oxide, which are both strong oxidizers. These gases can be contained in individual compressed gas cylinders located in patient care areas or in bulk storage rooms, can be individual cylinders located on carts and hand trucks, or can be compressed tanks located on the exterior of the building and serving a closed pipe network. Similarly, nonpatient care gases used in laboratories may be portable cylinders, fixed cylinders in the laboratory, bulk storage or individual cylinders, or bulk storage cylinders outside the building. Compressed gas systems used for patient care are usually zoned by treatment or use areas with an emergency shutoff valve located in the zone served. Zone control valve locations should be noted in the pre-incident plan. The pre-incident plan should note when it is necessary to shut off compressed gases used for patient care, and that shutdown should be performed at the zone control valve. A shutoff valve at remotely located supply cylinders should never be used to shut off medical gases in a health care facility, except as a "last resort."

(b) *Environmental Systems.* Large health care facilities can have dedicated exhaust systems for such areas as anesthetizing locations and laboratories. These systems could have been designed for automatic venting of smoke and products of combustion. The areas served by these systems and associated manual controls should be noted.

A-11-4.1 In order to have a successful outcome of a fire emergency in a health care facility, the emergency responders must work closely with the facility staff. The working relationship should be stressed in the pre-incident plan.

Due to the nature of the occupants in a health care facility, the construction and built-in fire protection features of the facility have been designed to minimize the probability that a fire would require the vertical movement of occupants. The building standards for health care facilities recognized that movement of patients at best is difficult, and practically impossible if life support equipment is in use. Fire and smoke barriers in health care facilities have been designed to limit occupants' exposure to any single fire. These barriers allow patients to remain in place or provide for the horizontal movement of patients to areas of refuge on a single floor. This philosophy is known as the defend in place concept. Vertical movement or exterior evacuation of patients is to be a ''last line of defense.''

If vertical evacuation of occupants is determined to be necessary in multistory facilities, vertical movement only as far as necessary to remove the patient from the area of danger should be considered. Relocation of patients to a lower floor, if practical, is far better than full vertical evacuation to the exterior. An option to use elevators should be evaluated in the development of the pre-incident plan, especially if different elevator banks are located in different areas of refuge (smoke compartments).

Historically, fires in health care facilities have resulted in numerous injuries and deaths due to the decision to unnecessarily evacuate health care patients vertically or to the exterior. It is imperative that the emergency responders understand the defend in place concept in health care facilities and that the pre-incident plan clearly represents this philosophy.

A-12-1.3 Use Conditions. The level of restraint will fall into one of the five following classifications. Different areas within a given facility may have different use conditions. The use condition of a facility or area within a facility dictates what life safety features have been provided in the facility.

Use Condition I—Free Egress. Free movement is allowed from sleeping areas and other spaces where access or occupancy is permitted to the exterior via means of egress that meet the requirements of NFPA *101, Life Safety Code*.

Use Condition II—Zoned Egress. Free movement is allowed from sleeping areas and any other occupied smoke compartment to one or more other smoke compartments.

Use Condition III—Zoned Impeded Egress. Free movement is allowed within individual smoke compartments, such as within a residential unit comprised of individual sleeping rooms and group activity space, with egress impeded by remote controlled release of means of egress from such smoke compartment to another smoke compartment.

Use Condition IV—Impeded Egress. Free movement is restricted from an occupied space. Remote controlled release is provided to permit movement from all sleeping rooms, activity spaces, and other occupied areas within the smoke compartment to another smoke compartment.

Use Condition V—Contained. Free movement is restricted from an occupied space. Staff controlled manual release at each door is provided to permit movement from all sleeping rooms, activity spaces, and other occupied areas within the smoke compartment to another smoke compartment. (***101***: 14-1.4.1)

A-12-4.2 Due to the security measures imposed on the residents in a detention and correctional facility, the construction features of the facility have been designed to minimize the probability that a fire would require the movement of occupants. The building standards for detention and correctional facilities recognize that movement of residents is difficult, not only due to security measures imposed on the residents, but also due to the potential impact imposed on others by the movement of residents. Fire and products of combustion or contaminants barriers have been designed in detention and correctional facilities that are intended to allow residents to remain in place or provide for the horizontal movement of residents to areas of refuge on a single floor, limiting residents' exposure to any single fire. This philosophy is known as the defend in place concept.

In order to have a successful outcome of a fire incident in a detention and correctional facility, the municipal fire service must work closely with the facility staff throughout the incident. The working relationship should be stressed in the pre-incident plan.

A-14-1.3 Evacuation Capability. NFPA *101, Life Safety Code,* should be referred to for further explanation and methods of determining the evacuation capabilities of a residential board and care facility.

A-17-5 Special protection systems include explosion suppression systems, local application and total-flooding gaseous systems, fixed foam systems, dry chemical systems, as well as inerting and vapor mitigating and recovery systems. A basic understanding of the system operational features, potential hazards involved, and availability of reserve agent supplies should be known.

A-17-7 Teams and/or resources for hazardous materials response, confined space rescue, high-angle rescue, and emergency medical services can be included. Note that different standards are used for fire response and hazardous materials response training. Consequently, a fire brigade is not necessarily a hazardous materials team nor is a hazardous material team a fire brigade. Where a facility has their employees respond to emergency releases of hazardous materials, government standards regulate emergency response plans and the training requirements for a hazardous materials team.

A-18-3.2 Stock stored in the aisles, internal control barriers such as wire cages in bonded warehouses or aerosol storage, or trucks parked at the loading dock can contribute to building access problems. Storage racks hundreds of feet long without cross aisles can reduce access to the interior of the building and dictate the use of exterior doors only at the rack ends for manual fire suppression operations.

A-18-6.4 Full-scale fire tests in warehouse storage arrangements have shown that overhaul and final extinguishment of fires occurring in warehouses require personnel trained and equipped for manual fire suppression operations. This could be personnel from the public fire department, the plant fire brigade, or a combination of both. The scope of final extinguishing operations are usually vastly underestimated. In a warehouse these operations are generally conducted while the sprinkler system is operating. Moving pallets of burning or smoldering materials out of the warehouse where they can be

broken open and overhauled requires the use of lift trucks and other material-handling equipment. Equipment drivers will probably have to wear protective clothing and equipment including self-contained breathing apparatus. Training personnel in these skills must be accomplished before the fire. Likewise, in high-rack storage facilities that use computerized stacking and retrieval systems, emergency response will require skilled equipment operators. Depending on the location of the control center, the operators might have to wear protective clothing and equipment including self-contained breathing apparatus. Procedures for operating the fire protection equipment under such conditions can be practiced before an incident occurs.

Appendix B Case Histories of Warehouse Fires

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

Fire Barriers in a Distribution Warehouse, May 1987
This warehouse was specifically designed for storage of paints and related flammable liquids. The main storage area was 180,000 ft^2 (16,700 m^2). A fire wall subdivided the warehouse into two separate areas. Protection was provided by an automatic sprinkler system and a fire pump capable of delivering 2500 gpm (9465 L/min).

A relatively small amount of paints, resins, and solvents [(8 gal to 10 gal (30 L to 38 L)] stored in the warehouse were accidentally spilled while some of the stored material was being moved by a lift truck. A spark from the lift truck ignited the liquid. Portable extinguishers and hose stations were available for employee first-aid fire attack while the fire department was enroute. Water flow detection systems were in place to sound an alert and this system worked as planned. The automatic sprinkler system began operating before the fire department arrived.

The warehouse managers had developed and enforced a program to prepare employees for emergency response but this fire spread faster than expected. The clothes of one of the employees began to burn, diverting attention from the extinguishing effort. Problems grew with the fire. Neither use of the portable extinguishers nor operation of the sprinkler system stopped the fire before it spread to other storage. Employees began to evacuate, but some of the nearly 1 million 16-oz (0.5-L) and 220,000 6-oz (0.18-L) aerosol containers had already begun to explode and fall outside amid the evacuating employees.

The fire department pumpers arrived 6 minutes after dispatchers sounded the alarm, and fire fighters began their preparations for an offensive attack. When the first pumper arrived, the fire fighters encountered huge clouds of thick, black smoke. Worse, flames had already extended through the roof several hundred feet into the air. Fire fighters heard explosionlike sounds inside the warehouse, and aerosol cans were flying from the building. The intense heat from the fire and the danger of rocketing aerosol cans prevented fire fighters from approaching the building to hook up to the sprinkler system Siamese pumper connection. In the meantime, although the building fire pump maintained adequate pressure, the sprinkler system did not appear to have any positive effect on the fire.

The fire spread throughout approximately 180,000 ft^2 (16,700 m^2) of the building within 28 minutes of ignition. This rate was roughly equivalent to fire spreading completely over the area of a football field in less than 6 minutes. Although the fire department was trained for an aggressive attack where possible, in this case it was forced into a defensive position to protect exposures. This decision was dictated by fire spread that had developed before the fire department had even arrived. The loss — $49 million — included damage to the building itself, all of the contents, and the cost of removing the useless debris. (Other factors: hazardous commodity, collapse, emergency organization)

Hazardous Commodity in a Grocery Warehouse in Edison, NJ, 1979
This sprinklered distribution center contained 290,000 ft^2 (27,000 m^2) of rack storage for supermarket stock, and health and beauty aids, including many aerosol cans. The center supplied more than 100 stores. Employees discovered a small fire that spread rapidly through cardboard boxes containing aerosol cans. Exploding aerosol cans prevented employees from attempting early extinguishment. The sprinkler system was overwhelmed, and an exterior wall collapsed soon after the fire department arrived. Estimated loss was $50 million. More than 200 workers lost their jobs as a result of the fire. (Other factors: size, collapse)

Discount Store Warehouse, Falls Township, PA, June 1982
At the time of this incident, it was called ''the most costly single building fire in U.S. history.'' The 5-year-old sprinklered warehouse with 1.2 million ft^2 (85,750 m^2) of storage supplied 375 large discount stores from Maine to Virginia. Grading had been started for an additional 923,000 ft^2 (85,750 m^2) of storage.

The fire began when some aerosol cans (among more than 1 million in the warehouse) fell, burst, and were ignited by a lift truck spark. An employee discovered the fire immediately after ignition and attempted to extinguish it with a portable extinguisher. It was not effective, nor was the sprinkler system. Within 3 minutes of the arrival of the fire department, flames were reported to be coming through the roof. Exploding aerosol cans, some trailing flames, rocketed through the roof and doorways protected by deluge curtains. Complete extinguishment took 7 days. The loss of the building and contents exceeded $100 million. (Other factors: size, hazardous commodity, fire walls, collapse, emergency operations, protection inadequacy)

Impairment During a Grocery Warehouse Fire, Boston, MA, August 1969
On August 5, 1969, fire leveled a 460,000 ft^2 (43,000 m^2) warehouse in Boston, MA. The building was the principal supply center for a system of stores in the New England area. The loss was over $15 million.

The building was built in 1959. It was 800 ft (244 m) long and 575 ft (175 m) wide. It was one story high with a 25-ft (7.6-m) high roof. The building had masonry walls and a poured gypsum roof supported on unprotected steel trusses. The building was a single fire area.

Wet pipe sprinklers systems were provided throughout the building on an ordinary hazard pipe schedule with 120 ft^2 (11.1 m^2) per head spacing. The water supply for the sprinkler system was from a 10-in. (254-mm) yard main, which was fed from an 8-in. (200-mm) public water main and a l000-gpm (3785-L/min) electric fire pump taking suction from a 250,000-gal (946,000-L) reservoir. Sprinkler water flow alarms were transmitted directly to the public fire department, and

security guards made unrecorded rounds throughout the facility. However, at the time of the fire, the fire alarm system had been inoperative for about 4 months.

Stock was stored to about 20 ft (6.1 m) in height, with minimal aisles. Such an arrangement promoted good traffic flow in the warehouse, but limited access in the event of an emergency. In addition to the normal grocery stocks, the warehouse also contained a variety of flammable and combustible liquids in aerosol cans. This storage was mixed in with the ordinary storage for ease of handling.

At about 10:00 p.m., an employee discovered smoke in the warehouse. Instead of turning in an alarm, he went to the site of the smoke to investigate. By the time he arrived, sprinklers in the area had already fused and were operating. On hearing the sprinkler alarm ringing, a supervisor pulled the fire alarm system, but realizing it was inoperative, he went to the phone to call the fire department. Unfortunately, the phone was dead.

A security guard was instructed to drive to the nearest fire station and turn in the alarm. At 10:26 p.m., the alarm was turned in at the fire station. On arrival, fire fighters were directed to the area of the building where employees were attempting to direct a hose stream into the area where the fire was located. A small fire involving some paper products had been controlled by the sprinklers, and fire fighters used a hose stream to overhaul the debris and effect final extinguishment.

At 10:50 p.m., the district chief in charge of the fire signaled that the fire was out. He then ordered that the sprinklers be shut down. Because the fire fighters were not familiar with the building, they did not know which valves to close to isolate the sprinklers that had been operating. As a result, four valves covering 25 percent of the building were closed down. Fire fighters remained on the scene while cleanup operations commenced.

At about 11:20 p.m., an employee reported another fire in the center of the building. The district chief and several fire fighters went to investigate. Encountering heavy smoke and heat, the chief ordered the building evacuated. Fire fighters dove out of the building just ahead of a massive wall of flames and smoke.

The maintenance foreman sent a man to open the sprinkler valves that had been closed, but he did not identify them. On the way to open the valves, the maintenance man checked on the fire pump, found that it was not running, and started it. Using matches to read the valves in the dark, he found all of the closed valves and opened them. By the time he was finished, there were flames coming through the roof of the building. There were also aerosol cans rocketing around the building.

The fire department tried to use the private hydrants, which were fed from the plant underground, but found the pressure too low. A check of the fire pump found it running slowly, apparently running on a single phase. Fire fighters could not locate the sprinkler system connection and thus could not supplement the water supply to the sprinkler system. Within an hour, the roof had collapsed and the building was a total loss.

The exact cause of the fire was not determined. It was found that the insulation board used on the underside of the roof deck burned readily. One theory advanced was that the insulation board, ignited by the first fire, smoldered some time before breaking into open flaming. It was also suspected that the fire may have been set. (Other factors: improvements, physical size, storage commodity, protection familiarity)

Protection Inadequacy, Cold Storage Warehouse, Madison, WI, May 3, 1991

This cold storage complex consisted of five buildings with a total area of 224,000 ft^2 (20,800 m^2). The building of origin, building No. 1, had an area of approximately 62,000 ft^2 (5760 m^2) and consisted of one 55-ft (16.8-m) high story. The storage racks consisted of double and multiple racks with up to 50-ft (15-m) high storage. Computer-controlled equipment placed and moved stocks of cheese, butter, cranberries, and other food products in the modern high-rack storage facility. Four of the five buildings were sprinklered by two wet pipe and two dry pipe systems. The system in building No. 1 was designed for a density of 0.15 gpm/ft^2 (6.14 L/min·m^3) over the most remote 2600-ft^2 (242-m^2) area using 286°F (141°C) sprinklers. There were no in-rack sprinklers, no column sprinklers, and the ceiling sprinkler system was inadequate for the occupancy.

A forklift operator heard a sound like a ''torch being lit'' and noticed a fire involving a battery-powered forklift. As employees discharged portable extinguishers, the public fire department was notified. The first-due engine company reported heavy smoke and fire conditions from the station just one block away. An interior attack was initiated as the fire department connection to the sprinkler system was supplemented. Hazardous material concerns included the building's ammonia refrigeration system, several acids, and various other chemicals.

The interior sector officer reported that sprinklers were operating, and that visible fire had been ''knocked down.'' Roof level personnel reported intensifying conditions and interior operations were moved back to the dock area of the building. The roof of the warehouse collapsed within the first hour of fire department operations. The fire extended to building No. 2, a nonsprinklered, high-piled storage warehouse, within 4½ hours of the initial dispatch. Extensive mutual aid was requested to maintain coverage of the city, as a majority of the department was committed to the fire. The fire was declared under control almost 2 days later and final extinguishment completed 2 additional days later. Damage to the building and contents totaled over $75 million. Extensive cleanup of the melted residue from fire department equipment and the surrounding area cost several million dollars. (Other factors: hazardous materials, roof collapse, size, emergency operations)

Multiple Floors at Grade, Distribution Warehouse, January 1995

At 7:02 p.m. on January 5, 1995, members of a rock band practicing on the lower level of the warehouse called the fire department to report a fire. The multi-occupancy building had no sprinkler, smoke detection, or fire alarm systems.

The original one-story building was built in 1901 and had been modified a number of times over the years using a variety of construction materials. At some point, the street on the east side was raised, and a second story was added. Additions to the building had also been made to its west and north sides, and what had once been the street level of the building was now its basement. From the east side, the warehouse looked like a one-story structure, but was really two stories. As a result, the first crew to arrive, which approached from the east side, inaccurately concluded that the building had only one story. They began fighting the fire on the assumption that it had started on the exterior and spread to the interior, despite the fact that one crew member later told an investigator that the floor was so hot he could not kneel on it.

According to statements from the interior crews, they believed that they were working on a solid concrete floor. Events would prove them tragically wrong when, 36 minutes after the initial alarm, fire burned through a wood ''cripple wall'' that had been built to support new flooring during building modifications. This short section of wall was constructed of small dimension wood, about 4 ft (1.2 m) high, and did not have the same fire-resistive characteristics as the main structural system of heavy timber construction.

The floor, as it turns out, was actually made of wood planking, floor joists, and timber covered by a layer of concrete about ½ in. (12.7 mm) thick. At the time of failure of this section, thirteen fire fighters were inside the structure and nine were on the roof.

Four fire fighters who had been operating directly over the main body of the fire fell through the hole in the floor.

Despite rescue attempts, all four fire fighters died of asphyxiation. Three due to air depletion in their SCBAs, and one due to exposure to combustion products. The structure was so badly damaged that it took several days to extricate the fallen crew members.

Confusion over the number of levels and the location of the main body of fire allowed the crews to operate longer than they should have. They thought they were making headway and were hitting spot fires, unaware that the main body of the fire was actually working below them.

Had the crews involved in fire-fighting operations made ongoing progress radio reports, the incident commander might have realized earlier that they were on two different levels. Upon arrival, he had sized up the building as two stories high, but this information was not transmitted to all fireground personnel. This lack of communication also contributed to confusion about the location of the fire and where the crews were in relation to it.

The fire was determined to have been set in the building's lower level, directly below the area in which fire crews were conducting interior fire operations. It spread to the upper story along the building's exterior and through interior penetrations.

Adequate Sprinkler Protection, AT&T Warehouse, New York, 1978

The warehouse was over 500,000 ft^2 (46,450 m^2) in area. The 27-ft (8.2-m) high storage racks contained pallets of rubber cable products. Sprinkler protection consisted of ceiling and in-rack sprinkler heads supplied by the public water system and a 2500-gpm (9500-L/min) fire pump with a 300,000-gal (1,135,500-L) suction tank.

An arson fire activated three ceiling and three in-rack sprinklers during the nonoperating hours of the facility. The sprinkler water flow alarms activated at the guard station, and the guard alerted the fire department. Fire department operations were limited to salvage and overhaul. Damage was limited to three pallet loads of product worth about $20,000.

AT&T Warehouse, February 1981

The warehouse was over 500,000 ft^2 (46,450 m^2) in area. The 27-ft (8.2-m) high storage racks contained pallets of electronic components and packaging materials. Sprinkler protection consisted of ceiling and in-rack sprinkler heads supplied by two 2000-gpm (7600-L/min) fire pumps with two separate 300,000-gal (1,135,500-L) suction tanks.

A maintenance employee was repairing a lift truck in the warehouse and heard a ''crackling'' sound. He investigated, saw fire and smoke, and saw an in-rack sprinkler in operation. A 1½-in. (38-mm) hose line from a nearby hose station was used to attack the incipient fire. As outlined in the facility's emergency action plan, a fire evacuation alarm was sounded, a sprinkler water flow alarm was actuated at the guard station, a backup phone call was placed to the guard station, the plant emergency organization (PEO) responded, and the public fire department was notified.

The PEO personnel connected a large hose line to a yard hydrant and stretched the line inside the warehouse. This 2½-in. (65-m) line supplied two 1½-in. (38-mm) backup hose lines. These operations were completed within 10 minutes of the discovery of the fire and before the fire department's arrival. The fire had been controlled and the fire department operations were limited to salvage and overhaul. Damage was limited to several pallet loads of product worth approximately $10,000.

Good Pre-Incident Planning, Paper Products Warehouse, Enfield, CT, May 26, 1991

The warehouse was 408 ft × 388 ft × 75 ft (124 m × 118 m × 23 m) high and of light noncombustible construction. The storage racks supported the roof of the warehouse and contained eleven tiers of gift and greeting card products. Ceiling sprinklers and eight levels of in-rack sprinklers were provided.

During an overnight shift, employees working on an automatic stacker crane in the warehouse heard a loud noise and saw sparks at the ceiling. Power was lost to the warehouse and the remainder of the facility. The fire department and PEO were alerted as a fire developed at the top of the rack. PEO members met and directed the fire department to the fire area.

The fire department connected to a yard hydrant and advanced two 1¾-in. (44-mm) hose lines into the warehouse. Fire fighters used a ladder on the stack crane to access the fire, which was 75 ft (23 m) above the floor. The fire was extinguished in less than 30 minutes and prior to the operation of the automatic sprinklers.

Fire and water damage was limited to three pallet loads of stock. The operation of the warehouse was partially interrupted for 3 days while repairs were made to the electrical system. Total damage from the fire was less than $10,000.

Appendix C Data Collection

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

C-1 General. The level of detail of the data collected is determined by the level of pre-incident planning that is to be developed. Effective pre-incident plans of simple sites or facilities or a plan with simple objectives can be developed with minimal amounts of data. Additional data is required for pre-incident planning of more complex sites or facilities, facilities with more numerous potential hazards, plans with more complex objectives, or for potential incidents with greater risks. Data that may be useful should be collected with the understanding that it can be filtered out later if not needed in the final plan.

If a plan developer intends to prepare a single pre-incident plan, the recommendations provided in Chapters 1 through 8 and applicable occupancy chapters can be followed to aid in determining the types of data that could be needed. Alternatively, data collection forms can be developed to aid in the

efficient and consistent collection of data for pre-incident plan development. A sample data collection form is provided in Appendix E.

It is helpful to understand the intended audience for the final pre-incident plan and to obtain consensus regarding the information that is needed and the threshold of information that the pre-incident plan user can effectively utilize once an incident has occurred. These considerations should govern the scope of the data collection effort.

C-2 Selection and Prioritization. The collection of data may be limited by several factors such as available resources, time, proprietary information, and privacy concerns. It will be necessary for the plan developer to determine which data will be most critical and to prioritize the data collection effort to obtain the largest data set given the established constraints. A successful strategy for pre-incident plan development is an incremental process where simple pre-incident plans are developed and issued (in lieu of having none) and subsequently revised and enhanced.

As an example, a local municipality could prepare simple pre-incident plans for all of the hospitals in its community for a given resource expenditure. As additional resources become available, the pre-incident plans for all of the hospitals can be brought up to another level. This method may be preferable to expending all of the available resources to prepare a complex and comprehensive pre-incident plan for one hospital while leaving the other hospitals without any plan.

C-3 Physical Elements and Site Considerations. The objective when collecting data on physical elements and site considerations is to assess features that could be expected to influence the emergency response or incident outcome. The items identified in Chapter 3 are intended to prompt the plan developer to notice features that have been previously identified as impacting emergency responses or incident outcomes. The listing is not all-inclusive and should be supplemented with specific information for unique circumstances.

C-3.1 Building Construction and Operational Features. Data regarding building construction and operational features is important when specific features exist that would impair or impede emergency response, or protective features that have been provided and are intended to support managing an emergency, features that present danger to emergency responders, or operational considerations (e.g., process controls, life support systems) that are vital to successful incident outcome.

C-3.2 Site Conditions. Data regarding site conditions is intended to identify features that would aid or impede emergency response (e.g., security measures) and features that could affect the outcome of the incident(s) for which the pre-incident plan is being prepared.

C-4 Occupant Considerations. Data regarding the occupants that should be collected identifies unusual or unique concerns that might need to be addressed in the pre-incident plan for emergency responders' use. These concerns could vary widely depending on occupancy of the facility. Additional guidance is provided in the specific occupancy Chapters 9 through 18.

C-5 Emergency Action Plan. Sites or facilities might already have some type of emergency action plan that can become a good source of data for the pre-incident plan developer. While some duplication can be unavoidable, the pre-incident plan should dovetail existing emergency action plans.

C-6 Protection Systems and Water Supplies. Data regarding protection systems and water supplies is important to allow emergency responders to maximize their use of existing protection systems and to support the effectiveness of such systems by understanding the water supply available and needed. Recognized hazards are frequently provided with specific protection to reduce the severity potential of an incident. Knowledge of these features can reduce the risk to emergency responders and significantly affect a positive resolution of the incident.

As the risks and hazards become greater and more complex, the protection systems and their interaction become more elaborate. If necessary, additional technical assistance should be sought.

C-7 Special Hazard Considerations. Data regarding special hazards should be sought to identify unique conditions or materials that present hazards or risks to the emergency responders or incident outcome that are not commonly encountered. Items meeting this criteria will vary based on the intended user of the pre-incident plan.

For example, a pre-incident plan prepared for an industrial fire brigade at a nuclear generating facility would not necessarily identify radioactive material concerns as a special hazard. A pre-incident plan for off-site (fire department) response to the same facility would need to specify these risks or hazards at the facility and include them in the data.

Information that could mitigate the risks or hazards at a facility should be included in this data as well, such as special protective equipment, chemical neutralization techniques, purging procedures, and medical intervention.

C-8 Emergency Operations. Data regarding emergency operations should be obtained to identify the emergency response resources that are available to respond to the incident and how they are accessed.

C-9 Plan Testing and Maintenance. Testing the plan and periodic review of the plan could identify additional data that is needed.

C-10 Specific Occupancy Data. Data specific to a particular occupancy that might need to be collected is identified in the specific occupancy chapter. Pre-incident plan developers for specific occupancies should consult these chapters for guidance.

Appendix D Data Reduction and Pre-Incident Plan Presentation

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

D-1 Data Reduction. The data collected during the initial phase of pre-incident planning will need to be evaluated to determine what data is critical to the plan user and will be included in the plan. For this effort, it is critical that the plan developer and user(s) interact. An overabundance of information can be as detrimental to a pre-incident plan user as a lack of information, if the user cannot easily distinguish critical information. Additionally, the specifics of any particular incident cannot be exhaustively anticipated. Therefore, the pre-incident plan should not attempt to perform incident command or management functions (e.g., placing apparatus, specifying attack strategies), although this could be desirable in certain instances.

D-2 Information Format. The format of the information is the culmination of the data collection and reduction process and results in the final product that will be used by the emergency responder. It cannot be understated that the pre-incident plan user should have the final say in the format. Appendix E provides several examples of pre-incident plan formats. User acceptability of the plan format is the single factor that qualifies as a satisfactory pre- incident plan format. Several points need to be identified here.

1. The pre-incident plan is intended primarily for use by the emergency responders. Because of this, it is critical that the information presented be relevant, clear, concise, and complete. It is unlikely that emergency responders will have the time to read extensive text. Information should be presented graphically (sketches and pictures), wherever possible.

2. Information that will not be of use to the emergency responder should be reserved for other uses and should not be allowed to clutter the pre-incident plan.

3. Symbols used on pre-incident plan sketches should be consistent among pre-incident plan users. The symbols provided in NFPA 170, *Standard for Fire Safety Symbols,* should be utilized where jurisdictions have not adopted an alternative set of symbols.

4. Text should utilize ''bullet'' format and be unambiguous to the user.

Appendix E Sample Pre-Incident Plans and Data Collection Forms

This appendix is not a part of the recommendations of this NFPA document but is included for informational purposes only.

E-1 Appendix E consists of six figures showing samples of completed pre-incident plans and forms with guidelines that can be used to develop a pre-incident plan.

Anytown Fire Company Pre-Incident Plan					Pre-Plan #	D – 5 – 99
Address:	1875 Robert Road	**Name:**	Manor Apartments	**District:**	1	
Emergency Contacts:	Manager: Apt. C101 James Carr 885-4444					
Occupancy and Hazards:	Apartments on 1st and 2nd floors — 1 and 2 bedrooms Basement: Used for storage and utilities					
Construction:	Roof: Shingles on wood trusses Corridor doors are wood No interior fire barriers; common attic truss space					
Protection:	Fire alarm panels for each building Detectors in common areas and basement					
Water Supplies:	Hydrant on Wanamaker Road has a low volume: < 500 gpm. Drafting supply is limited from creek. Nearest large volume supply: Robert Road and Highland Avenue — 2500 ft west					

Water Supply — Needed Fire Flow		Initial Dispatch					
Involvement	**gpm**	**Engines**	**Ladders**	**Chiefs**	**Special Units**	**EMS**	**Others**
50% Bldg. G:	1700	2	1	1		1	
100% Bldg. G:	3400						

Special Resources:	
Exposures:	Building to building exposures Railroad — East of parking lot near Buildings E and F
Strategies:	Rescue: Aerial access restricted to Buildings D and J, ground ladders needed.
Comments:	Utilities: Individual shutoffs for all buildings, boilers in basements

Figure E-1 A pre-incident plan for an apartment complex of two-stories with basement buildings.

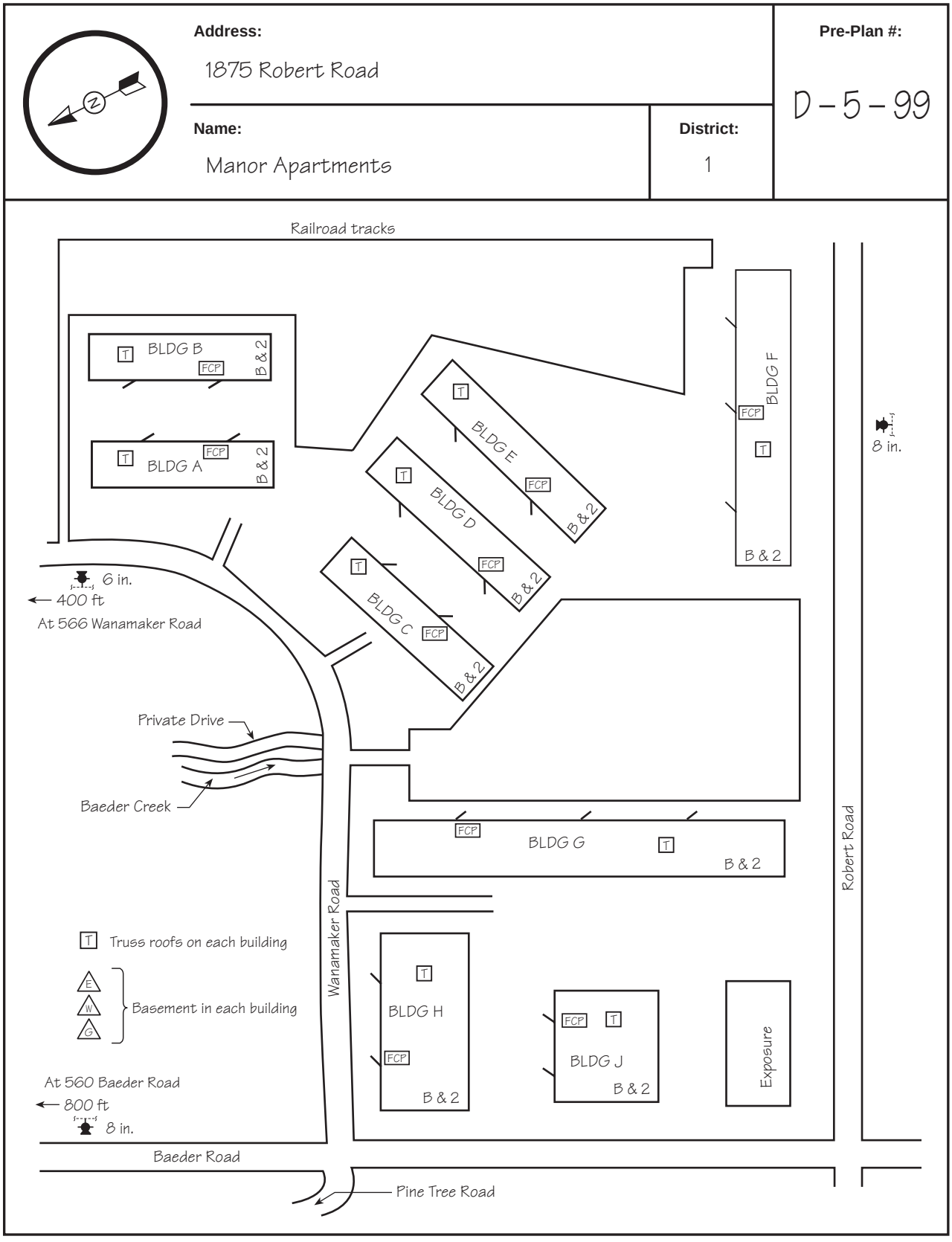

Figure E-1 *Continued*

Anytown Fire Company Pre-Incident Plan					Pre-Plan #	2 – 41 – B
Address:	479 Gilmer Road	**Name:**	Luggage Unlimited		**District:**	2
Emergency Contacts:	Manager: Kevin Thomas 713-1989 ABC Alarms 555-1234					
Occupancy and Hazards:	Luggage storage Basement unused LP-Gas tank on Rice Avenue side					
Construction:	Wood frame					
Protection:	Alarm panel on Gilmer Avenue side Heat detection throughout					
Water Supplies:	Public hydrants have limited supply. Nearest large volume supply: Apple River — drafting site 500 ft east					

Water Supply — Needed Fire Flow		**Initial Dispatch**					
Involvement	**gpm**	**Engines**	**Ladders**	**Chiefs**	**Special Units**	**EMS**	**Others**
50%	3600	2, 3		1			
100%	7200						

Special Resources:	Draft site at Apple River requires three lengths of hard suction.
Exposures:	Side 2: Severe exposure to wood frame goods warehouse Side 3: LP-Gas tank — 1000 gal
Strategies:	Exposure protection to LP-Gas tank on Side 3 and warehouse on Side 2
Comments:	

Figure E-2 A pre-incident plan for a 100-ft × 175-ft (30.5-m × 53.3-m) one-story luggage warehouse with basement.

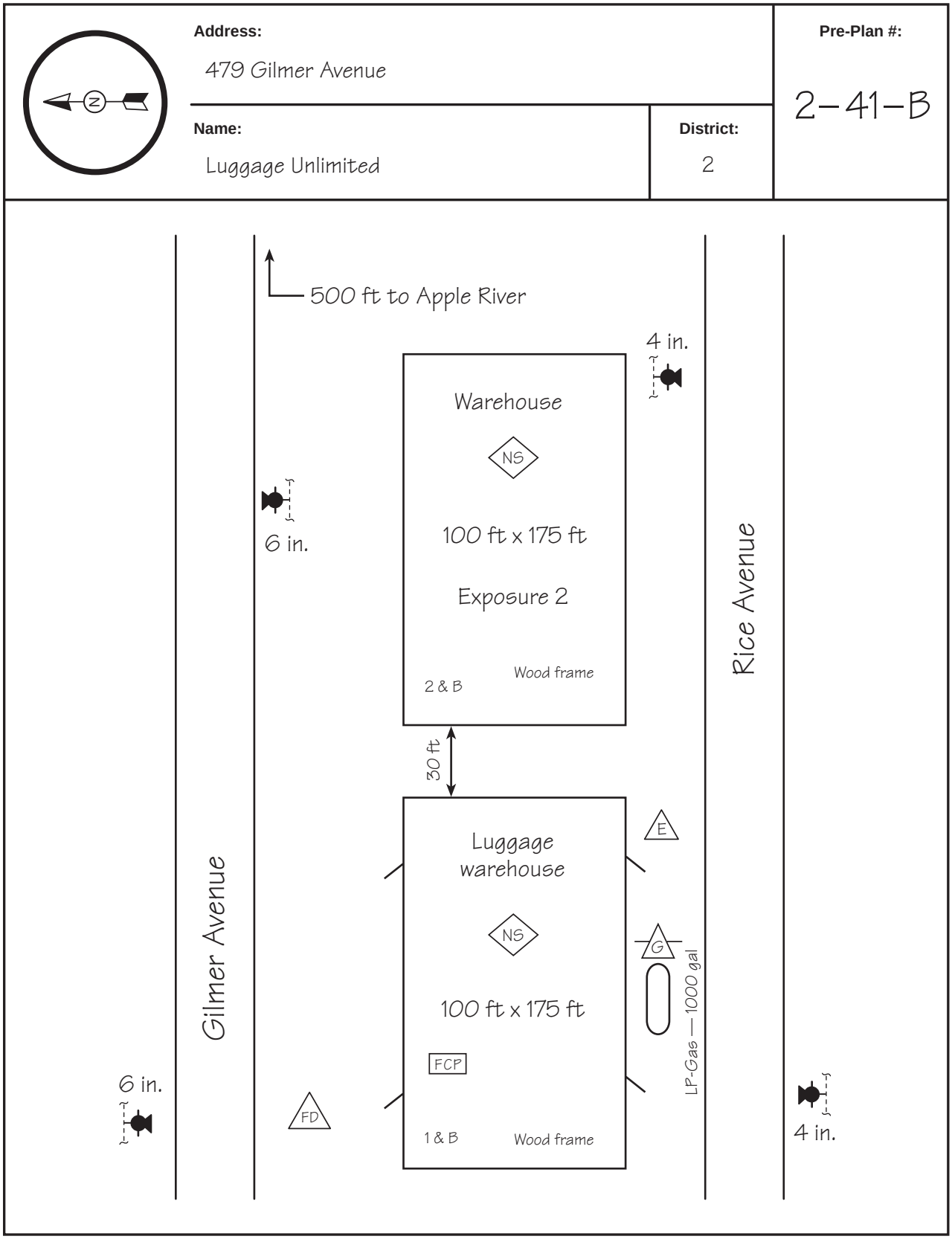

Figure E-2 *Continued*

Pre-Incident Plan							Pre-Plan #	
Address:		**Name:**				**District:**		
Emergency Contacts:								
Occupancy and Hazards:								
Construction:								
Protection:								
Water Supplies:	Nearest large volume supply:							
Water Supply — Needed Fire Flow		**Initial Dispatch**						
Involvement	**gpm**	**Engines**	**Ladders**	**Chiefs**	**Special Units**	**EMS**	**Others**	
50%								
100%								
Special Resources:								
Exposures:								
Strategies:								
Comments:								

Figure E-3 A blank copy of the form used in Figures E-1 and E-2 for use in preparing local pre-incident forms.

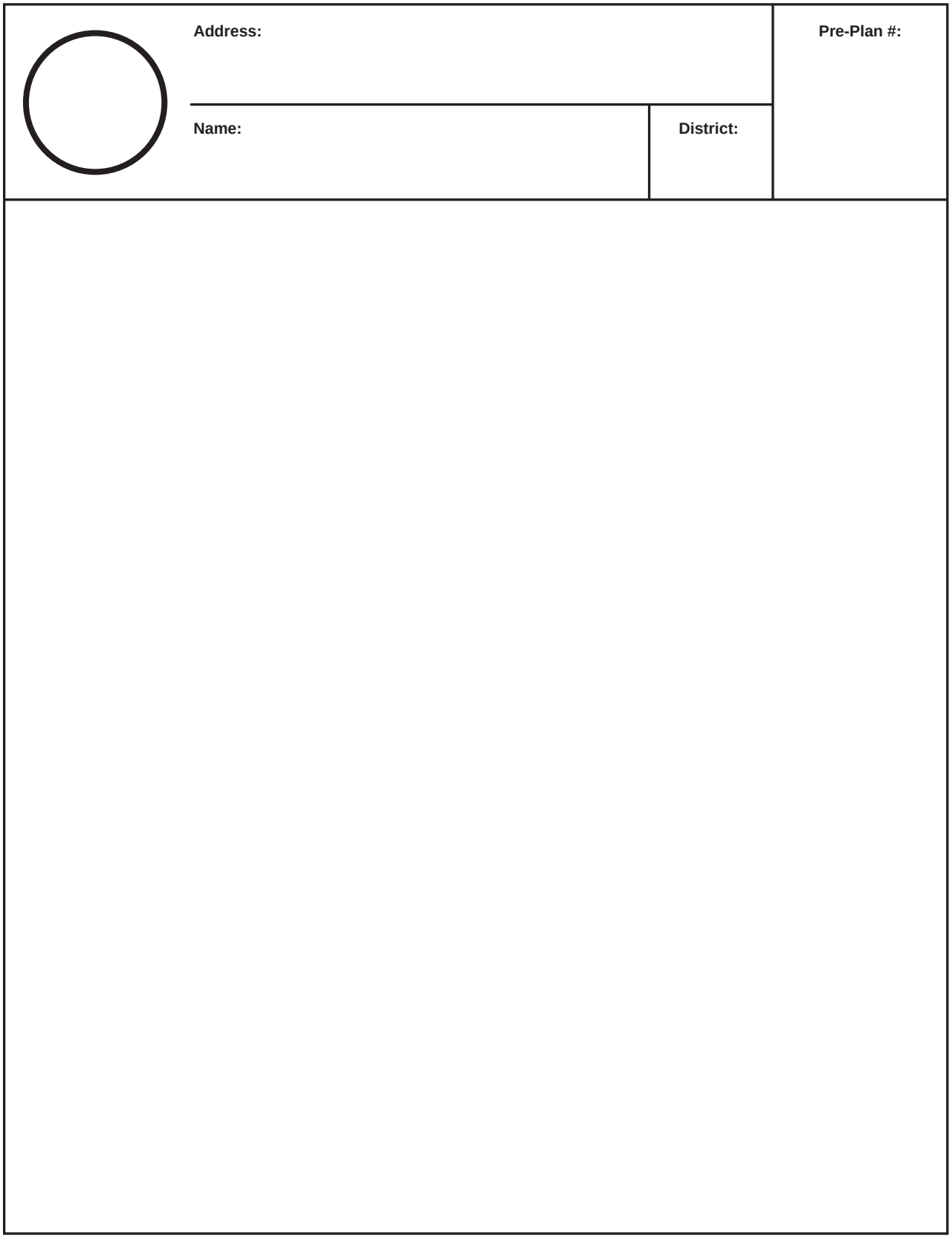

Figure E-3 *Continued*

Pre-Incident Planning Form

Company Name: **Date:**

Street Address: **Telephone:**

Site Access and Restrictions:

Fences: Height and construction

Security: Guard services

Guard House Location: Number on duty, knowledge, areas where guards do NOT have access

Guard Dogs:

Lockbox:

Fire Command Center:

Emergency Operations Center:

Remote Annunciator:

Fire Alarm Panel:

Life Safety and Occupant Considerations

Hours of Operation:

Number of Occupants: Days (8–4), evenings (4–12), nights (12–8)

Handicapped/Special Needs:

Areas of Refuge: (defend in place strategy)

Emergency Contacts: Name, title, telephone

Site Emergency Response Plan

Emergency Coordinator:

Occupancy or Special Hazards

Type of Hazard and Location:

Special Shutdown Procedures: (complex or extended operations)

Controlled Environments:

Building Construction

Building Access: Doorways, locking devices, accessible windows, fire escapes, tunnels, breechable walls

Length: Width: Height: Number of Stories:

Walls: Interior finish materials

Floors: (raised floors)

Ceilings: (multiple/suspended ceilings)

Roof and Roof Covering: (concealed spaces/multiple levels)

Vertical and Horizontal Openings: Large undivided areas, unprotected openings between floors, stairwells, elevator shafts, utility shafts, escalators, type of fire doors

Smoke and Heat Venting or Smoke Management: (manual or automatic), control locations

Atriums: Location in the building, number of stories connected, number of stories open to atrium

Figure E-4 Topics that should be considered and guidance as to the type of information that could be provided in a pre-incident plan.

Building Utilities

Electricity: Enters property (overhead or underground) at, disconnects located at, transformers: (PCB)

Emergency Power Supplies:

Natural Gas: For (building heat) (processes), shutoff located at

LP-Gas: For (building heat) (processes), storage tank(s) located at, shutoff located at

Domestic Water:

Steam:

Elevators: Number, floors served, type, restrictions and location, fire service override, location of keys

Compressed Air:

Exposures

North:
South:
East:
West:

Environmental Concerns:

Protection Systems

Automatic Sprinklers: Ceiling/roof systems, in-rack systems, other systems, system demand (gpm @ psi)

Water Supplies: Type of supply, fire pump (diesel) (electric), rating (gpm @ psi)

Available Flow: Static, residual, flow available, gpm @ psi residual

Required Fire Flow:

Hydrants:

Fire Department Connection: Location, FDC supplies

Standpipes and Inside Hose Connections: Type of system, hose outlets, pressure available, control and sectional valves, FDC, risers

Fire Extinguishers:

Special Protection Systems: Type of system (CO_2, halon, gaseous extinguishing agents, foam-water, dry chemical and wet chemical), hazard or area protected by the system, location of control panels, location of all protective agent supply and reserve containers, activation method, personnel hazards of protective agent

Fire Alarm and Communication Systems

Detection System: Method of system activation (manual, automatic), area of coverage, fire alarm control panel (FACP) and remote annunciator panels, type of automatic detectors provided (smoke, heat, other), off-site alarm transmission, name of and contact number for off-site monitoring agency

Occupant Notification: Voice alarm or public address system, method and extent of occupant notification

On-Site Communication System: Stairway telephone system, radios

Contact Person or Company Responsible for System Maintenance: (telephone number)

Figure E-4 *Continued*