Health Care Facilities

CHAPTER 25

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CASE STUDY

Safety Systems Limit Hospital Fire Damage

A large Illinois hospital undergoing a sprinkler retrofit quickly discovered the benefits of upgrading its system when sprinklers confined a fire caused by careless smoking to the basement storage room in which it began.

The five-story hospital, which was of unprotected, noncombustible construction, was occupied and operating at the time of the fire. Smoke and heat detectors providing full coverage were monitored by a municipal fire alarm system. The system also covered the new wet-pipe sprinkler system, 80 percent of which had been installed at the time the fire occurred. When the sprinklers activated, the smoke doors operated, the building's air-handling units shut down, and the staff initiated its emergency response plan.

The fire department received an automatic alarm, followed by a call from hospital staff reporting a working fire, at 6:00 P.M. Arriving fire fighters found a single sprinkler operating in a basement storage room that had recently been stocked with palletized cardboard boxes of toilet paper. The sprinkler had confined the fire to its area of origin, so fire fighters extended a hose line from a nearby standpipe to the area of origin and extinguished it.

Fire damage was limited to the object of origin, while smoke damage extended to the room and adjacent hallway. Some smoke also migrated to the third floor through a loose fitting on a pneumatic tube delivery system. The hospital staff quickly moved patients out of the affected area.

The fire was started by a carelessly discarded cigarette, which ignited the wooden pallets, allowing flames to spread to the boxes of toilet paper. Officials estimated the loss at $5000. There were no injuries.

The fire department stated that, "as a result of all life safety systems operating as designed, damage was held at $5000, and there was no fire extension."

Officials further noted that, had it not been for the sprinklers, "heavy smoke and fire would have filled the entire...basement and would have caused significant disruption to their operation."

Source: "Fire Watch," *NFPA Journal,* January/February, 1998.

NFPA *101®, Life Safety Code®,* defines a health care occupancy as a building, or any portion thereof, used on a 24-hour basis to house or treat four or more people who cannot escape from a fire without assistance. The reasons these people may not be able to escape include physical or mental illness, age, and security measures that the occupants cannot directly control. The buildings or portions of buildings in question include hospitals or other medical institutions, nurseries, nursing homes, and limited care facilities.

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A limited care facility is a building or part of a building that is used on a 24-hour basis to house four or more persons who are incapable of self-preservation because of age or physical limitation due to accident, illness, or mental limitations, such as mental retardation or developmental disability, mental illness, or chemical dependency, but who are not receiving medical or nursing care.

The code also addresses the ambulatory health care center, which is a building or any part of a building that provides services or treatment for four or more patients that would temporarily render them incapable of self-preservation during an emergency without assistance from others. These facilities include hemodialysis units, freestanding emergency medical units, and outpatient surgical areas in which general anesthesia is used. Ambulatory health care facilities do not provide overnight sleeping accommodations; the other categories of health care facilities do. (See Chapter 26 for a discussion of ambulatory health care occupancies.)

DEFEND-IN-PLACE THEORY

Health care facilities pose exceptional problems when it comes to moving and evacuating people, especially along great distances and down stairways from the upper floors of multistory buildings, to a safe area outdoors. The basic features of health care fire protection, therefore, involve a limited amount of patient movement.

The residents of a health care facility can remain safe even when relatively close to a fire if the corridor walls have been constructed properly, if the appropriate smoke and fire barriers have been installed, if hazardous areas that are likely to sustain a well-developed fire are protected or enclosed, and if approved fire detection and suppression systems have been installed (Figure 25-1). In many cases, this defend-in-place theory is not only desirable, it is necessary, especially in hospital intensive care units, cardiac care units, and operating room suites, where moving a patient could result in major health complications or even death.

Installing automatic sprinkler protection throughout all new health care facilities also provides enhanced protection for patients and staff who may be intimately involved with fire ignition. Sprinkler system design includes use of listed quick response

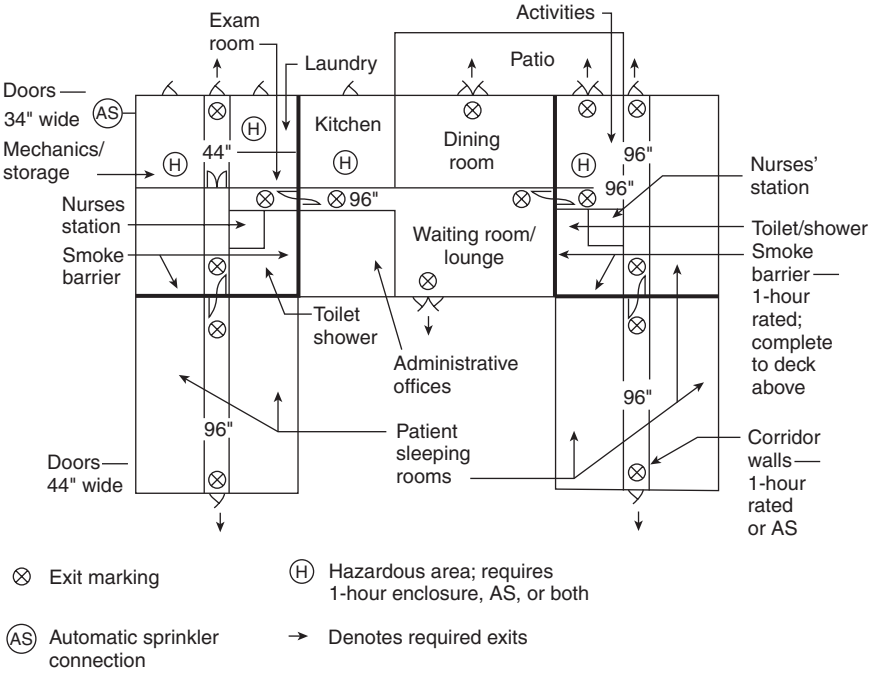

FIGURE 25-1 Typical Design of a Health Care Facility

and residential sprinklers installed throughout the smoke compartments containing patient sleeping rooms. The rapid activation of these specially designed sprinklers is intended to restrict the spread of fire and the associated products of combustion, thus reducing the need for extensive patient evacuation.

Ongoing and recently completed renovations should be reviewed for compliance with the *Life Safety Code*'s sprinkler provisions for renovated health care facilities. Each smoke compartment involved in a major renovation, alteration, or modernization requires sprinklers throughout. Listed quick response or residential sprinklers are required within those smoke compartments containing patient sleeping or treatment rooms.

PATIENT PROTECTION

The *Life Safety Code* emphasizes the protection and ultimate evacuation of persons from the immediate fire area to a safe area of refuge until the fire has been extinguished. The initial level of patient protection actually begins right in the patient's bedroom.

Draperies, curtains, furnishings, and decorations must be flame resistant. However, no restrictions currently apply to the actual clothing or bedding materials a patient may use.

If the fire is not contained within its immediate area of ignition, containment is attempted within the room. In new and sprinklered smoke compartments within existing buildings, corridors must be separated from all other areas by partitions that form a barrier to limit the transfer of smoke. In existing nonsprinklered smoke compartments, these partitions must have a fire-resistance rating of at least 30 minutes and must extend, through any concealed spaces, from the floor slab to the underside of the floor or roof slab above. Verifying the continuity of corridor walls to the floor deck above within the nonsprinklered smoke compartment will be very difficult and time consuming. Vision panels in these fire-rated walls are permitted only if they are made of approved, fixed fire window assemblies or of previously accepted wired glass construction, installed in steel or other approved metal frames, and limited in size to 1296 in^2 (8361.8 cm^2). Based on mandatory sprinkler provisions, corridor walls or associated vision panels in new buildings and sprinklered smoke compartments need not be fire rated.

Protection of Openings

Door openings in fire-rated corridor walls must be protected by solid bonded wood-core doors or approved assemblies that will resist the passage of fire for at least 20 minutes. These doors need not be fire-rated door assemblies, nor do they have to be equipped with self-closing devices. However, they must be equipped with approved positive latching hardware that will keep the door tightly closed. Vision panels for these doors can only be approved fixed fire window assemblies or previously accepted ¼-in. (0.64-cm) thick wired glass mounted in approved frames no larger than 1296 in^2. (8361.8 cm^2). As with corridor walls, corridor doors in fully sprinklered buildings need not be fire resistance rated, but they must be constructed so as to limit the transfer of smoke and be equipped with positive latches.

When other fire protection features are provided, fire ratings and, in some cases, the partitions themselves may be eliminated. Even in existing facilities, the installation of approved automatic sprinkler protection throughout the smoke compartment permits corridor partitions and the door openings within that compartment to be constructed of materials that resist only the passage of smoke; thus, they need not have a fire resistance rating. In addition, each smoke compartment may contain treatment rooms, spaces that are not used for patient sleeping rooms, hazardous areas, lounges, or waiting areas that may open directly to the exit corridor, provided the size of these areas is limited, they are supervised directly by the facility staff or by an electrically supervised automatic smoke detection system, and

their furnishings are arranged so as not to obstruct access to the exits. However, devices that permit the passage of smoke, such as transfer grills or undercuts, can be installed only in doors to small areas, such as sink closets or bathrooms, that are unlikely to contain flammable or combustible materials. Small miscellaneous openings, including mail slots and pass-through windows, are also permitted in corridor vision panels or doors in smoke compartments that do not contain sleeping rooms, provided their size is limited and they are located in the lower portions of the wall.

During the fire safety inspection, the inspector should check the integrity of all the required fire-rated and smoke-resistant corridor wall and door assemblies and verify that all spaces open to the egress corridors are adequately arranged and protected.

Compartmentation

Because history has shown that smoke is the cause of most fire deaths, proper protection against smoke must be installed and properly maintained in a health care facility. All health care buildings must be subdivided into separate smoke compartments into which patients can be moved without having to leave the building or change floors. This requirement reduces the distance persons with limited mobility must be moved in order to be protected adequately.

In new facilities smoke barriers should be found on each floor used for inpatient sleeping or treatment as well as each floor with an occupant load of 50 or more (regardless of use). Existing facilities are required to subdivide every floor housing more than 30 sleeping patients.

In new buildings smoke barriers should have at least a 1-hour fire resistance rating; in existing buildings, they should have at least a 30-minute fire resistance rating. Smoke barriers must extend uninterrupted from outside wall to outside wall and from floor slab to floor or roof slab above, passing through all concealed spaces. A major problem in many health care facility inspections is verifying that unsealed penetrations have not smoke barriers. Smoke barriers must be positioned to provide at least 30 net ft^2 (2.79 m^2) per nursing home or hospital patient or 15 net ft^2 (1.39 m^2) per limited-care facility resident in a public access area. Each smoke compartment must be no larger than 22,500 ft^2 (2090 m^2), and the travel distance from any point in the building to a smoke barrier door must be no farther than 200 ft (61 m).

Openings in smoke barriers must be protected by substantial doors that are 1¾-in. (4.45-cm) solid bonded wood-core doors or are constructed to resist fire for at least 20 minutes. In new buildings these doors must be equipped with vision panels of approved fixed fire windows. Although these doors must be self-closing, they need not be a part of a rated fire door assembly and are not required to have positive latches. However, in new construction, appropriate rabbets, bevels, or astragals are required along the edges where the doors meet to prevent smoke from crossing the barrier. In most cases, these doors are held open by electromagnetic devices, which must be arranged to release when any component of the fire alarm system, including an approved smoke detector located near the doorway opening, activates. The inspector should check the construction, arrangement, and operation of all smoke-barrier doors and their associated release devices and automatic closers as part of each routine inspection.

Smoke dampers are required in nonfully ducted smoke barrier penetrations in both new and existing facilities, as well as in those ducted smoke barrier penetrations where sprinkler protection is not provided in each adjacent smoke compartment. The inspector should visually examine the smoke damper installations, and, if possible, check their operation. Specific requirements for these smoke barriers may be modified when an engineering smoke-control system is installed in accordance with NFPA 92A, *Recommended Practice for Smoke-Control Systems*.

In some cases subdividing a building into separate fire as well as smoke zones may be necessary. This is particularly true when buildings are of differing construction types, when existing portions of a building must be segregated from new additions, and when a building is more than one story high. These separations basically are the same as, and can be incorporated into, the smoke barrier, although the fire wall must be constructed to prevent the passage of fire as well as smoke. This requires the use of approved, labeled fire door and damper assemblies and is particularly important for vertical openings, such as stairways and service shafts; in some cases, they also are used to enclose hazardous areas. The inspector must examine the construction of horizontal and vertical opening protection to ensure that doors are equipped with self-closers and positive latching hardware and that doors are indeed closed, not wedged open.

The actual construction type of a building—that is, the combustibility and the fire resistance of the structure—plays a very important role in ensuring building integrity during a fire and allowing time to move and evacuate patients. The two major aspects of such construction involve the enclosure of hazardous areas and means of egress and the protection of building structural elements. Because actual construction specifications are developed when a building is designed, it the inspector's duty to ensure that design features are adhered to, the specified construction types are maintained, and alterations or modifications have not compromised any of the fire protection features, including construction type, fire-rated and smoke-resistant barriers and door assemblies.

A common maintenance issue has been the integrity of the structural fire protection. Often the concrete steel encasing or the sprayed-on fireproofing has been removed during renovations. The inspector should check for missing ceiling tiles because these are integral to the floor–ceiling and roof–ceiling assembly ratings. Sprinkler protection is also compromised when ceiling panels are not in place.

In each inspection, the inspector should check for the proper certification of all new interior finish materials, such as wall coverings and carpet, to ensure that they comply with the appropriate flame spread ratings and smoke developed values based on the area of installation and other fire protection features.

MEANS OF EGRESS

Although the objective of *Life Safety Code* requirements for health care facilities is basically to protect patients in place, the importance of required exits cannot be ignored. Each floor or fire section of the building must have at least two exits. Travel distances and egress capacities are contained in 18/19.2.6 of the code; increases are allowed for travel distance and capacities in fully sprinklered buildings.

Exits throughout the building should be accessible so that persons with impaired mobility can be moved in the event of a fire. Corridors should be clear and wide enough to relocate patients. New hospitals and nursing homes are required to provide corridors with 8 ft (2.4 m) of clear width; new psychiatric hospitals and limited care facilities need provide only 6-ft (1.8-m) wide corridors. Existing health care facilities are required to provide corridors with 4 ft (1.2 m) of clear width.

Corridor use should be restricted to pedestrian circulation. A pervasive problem is storage in the corridor. Generally, patients' charting stations, mobile medical carts, and wheeled waste and linen carts are acceptable within the corridor. However, the inspector should be wary of what appear to be permanently stored items such as spare beds and broken biomedical equipment.

The exit discharge must remain unobstructed. The use of exterior stairways and ramps and the operation of exterior doors must not be compromised by accumulations of snow, ice, or any type of exterior storage or parking.

Locks installed on exit doors must be of an approved type, and the staff must be able to open them quickly and easily for the rapid removal of occupants, either

with the keys they carry at all times or by remote control. Thus the inspector must make sure that keys or some other means of unlocking secured egress doors are available to an appropriate number of on-duty staff to permit unimpeded relocation.

FIRE PROTECTION

Besides building construction features that serve to protect occupants from fire, all health care facilities must have a combination of systems to warn occupants, detect fires, and aid in fire control and extinguishment. Appropriate exit illumination, emergency lighting, and exit markings must be provided along all means of egress, and an approved manual fire alarm system must be installed. A special exception to the fire alarm requirements for health care facilities permits the installation of manual fire alarm boxes at nurses' control stations or other continuously attended staff locations, as long as such fire alarm boxes are visible, are continuously accessible, and meet all travel distance requirements (Figure 25-2). Although zoned and coded systems can be used, the operation of any fire alarm device must automatically provide a general alarm, perform all the control functions the device requires, and transmit an alarm automatically to the fire department by the most direct and reliable method approved by local regulations. The inspector should make an operational check of these systems or, at the very least, review their maintenance and test records.

Complete automatic sprinkler protection is required for all new facilities. Listed quick response or residential sprinklers should be installed throughout the smoke compartments containing patient sleeping rooms. Sprinkler protection is also required in smoke compartments in all existing facilities that have undergone renovation. Partial systems can be installed in place of the fire-rated enclosures of hazardous areas in existing facilities. However, areas housing high hazard contents in new and existing buildings must be separated by 1-hour construction and must be sprinklered. In existing unsprinklered facilities that are being renovated, altered, or modernized, complete sprinkler protection need only extend to the smoke compartments in which the work is being done.

Because so much depends on sprinkler operation, it is vital to install and maintain these systems correctly. Essentially, they must be installed in accordance with NFPA 13, *Standard for the Installation of Sprinkler Systems*, for light-hazard challenges.

(a) (b)

FIGURE 25-2 Manual Fire Alarm Boxes
Source: *National Fire Alarm Code® Handbook*, NFPA, 1999, Exhibit 2.37; (a) SimplexGrinnell LP, Houston, TX, and Westminster, MA; (b) Edwards Systems Technology/EST, Cheshire, CT

Special installation specifications are permitted for systems with six sprinklers or less. All components, including the supervision of the main sprinkler control valves, must be interconnected electrically to the proper components of the fire alarm system.

To ensure an adequate means of first-aid fire fighting, portable fire extinguishers of an appropriate size and type should be provided at locations that are accessible to staff at all times. All building fire protection equipment, including fixed fire extinguishing systems for particular hazards such as kitchen hoods, cooking equipment, and specialized computer equipment must be marked to indicate that it has been inspected, tested, and maintained in accordance with fire code requirements and accepted engineering practices.

Health care fire safety depends on proper maintenance of all exits and fire protection equipment and on proper staff preparation. All utility, HVAC, and other service equipment should be installed and maintained in accordance with the applicable standards of the *National Fire Codes®*. Smoking regulations and evacuation plans must be adopted, implemented, and prominently posted throughout the facility. Fire exit drills must be conducted quarterly on each shift to familiarize facility personnel with the signals and the emergency actions required under varied conditions.

The inspector should review logbooks or databases that document fire protection systems inspection testing and maintenance and should ensure that the facility is keeping records concerning the required staff training and drill requirements. The inspector should also ensure the existence and proper location of the facility's written fire safety plan and he or she should review this plan.

Health care facilities may contain several other occupancies. For example, auditoriums, chapels, and cafeterias are considered assembly occupancies; laundries, boiler rooms, and maintenance shops are categorized as industrial occupancies. Other occupancies that are a section of, or are contiguous to, health care facilities may be classified as other occupancy types provided they are not meant to house, treat, or provide customary access to health care patients and are adequately separated from the health care occupancies by construction with a fire reistance rating of at least 2 hours. Consult the appropriate chapters in this book for help in inspecting these and the business occupancies—office and administration areas—of any health care facility. Because of the number and nature of the occupants, health care fire protection features must be maintained stringently to protect those who are unable to protect themselves.

SUMMARY

Patients within health care facilities are presumed to be incapable of self-preservation. Therefore, their safety depends on an appropriate combination of in-place fire and life safety features along with an acceptable staff response. In addition to verifying the adequacy of built-in features and systems, fire safety inspectors must carefully assess the facilities fire safety plan, paying particular attention to fire safety training and staff drilling. Accordingly, documentation of staff participation in drills along with inspection and maintenance logs must be reviewed.

BIBLIOGRAPHY

NFPA Codes, Standards, and Recommendations

See the latest version of The NFPA Catalog for availability of current editions of the following documents.

NFPA 13, *Standard for the Installation of Sprinkler Systems*
NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*
NFPA 72®, National Fire Alarm Code®

NFPA 90A, *Standard for the Installation of Air Conditioning and Ventilating Systems*
NFPA 92A, *Recommended Practice for Smoke-Control Systems*
NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*
NFPA 99, *Standard for Health Care Facilities*
NFPA *101®, Life Safety Code®*