

# Assembly Occupancies

*Joseph Versteeg*

When a fire broke out in the showroom/theater of a large hotel and casino in Nevada, a sprinkler extinguished the blaze while employees safely evacuated the theater. Following the fire, an official noted that the safety evacuation plan worked exceptionally well.

The theater was part of a 17-story hotel and casino that was equipped with an automatic sprinkler system and a smoke exhaust system.

Staff watching a theatrical performance noticed flames spreading up drapes located approximately 12 ft (4 m) off the ground near the stage. Two of the employees tried to pull the burning drapes to the floor, as others activated the safety evacuation plan. Security immediately notified the fire department at 8:30 P.M., and two engines, a ladder company, and a chief officer responded. While still en route 30 seconds later, the commanding officer upgraded the response to a full assignment to include two more engines, another ladder company, and a rescue squad.

Fire fighters arrived within 5 minutes to find that the theater had been evacuated and the blaze extinguished by a sprinkler. Using the smoke exhaust system, they limited smoke damage to the theater and evaluated five employees for minor smoke inhalation.

Investigators determined that the fire began near a television monitor plugged into a wall-mounted electrical receptacle outlet. Neither the monitor, the cord, nor the plug showed signs of damage resulting from an electrical component fault or failure, however. Noting a similar monitor on the opposite wall of the stage, they found decorative drapes hanging over the monitor cord and electrical outlet. Like the fabric that had ignited, these drapes had a gold metal base, which later proved to conduct electricity. The investigators determined that the monitor's cord cap had not been completely inserted into the receptacle, exposing the blades, which energized the hanging fabric.

The hotel told the fire department that the drapes had been treated with a flame retardant. As a precaution, however, they were removed before the theater reopened.

Damage to the theater, valued at \$500,000, was estimated at \$10,000.

**Source:** "Fire Watch," *NFPA Journal*, May/June, 1999.

**T**his chapter discusses items of special interest when an assembly occupancy is inspected. General inspection principles and items covered in other chapters apply, as well.

## CHAPTER 22

### ◀ CASE STUDY

#### Drapes Ignite in Theater

*Joe Versteeg is a fire protection consultant based in Torrington, CT. He was with the Connecticut Department of Public Safety for over 20 years; most recently he was the commanding officer of the technical services section for the State Fire Marshal's Office. He also serves on several Life Safety Code® committees.*

**FIGURE 22-1** A Banquet Hall



Assembly occupancies are defined by NFPA 101<sup>®</sup>, *Life Safety Code*<sup>®</sup> as buildings or portions of buildings in which 50 or more persons gather for such purposes as deliberation, worship, entertainment, dining, amusement, or awaiting transportation (Figure 22-1). The character of an assembly occupancy should never be assumed to remain constant, and neither should the occupant load.

Because the many legal ways in which an assembly occupancy can be used are so diverse, inspectors should thoroughly review the *Life Safety Code* before beginning an inspection to ensure that they understand the proper requirements for a particular assembly occupancy. Unlike most other occupancies, assembly occupancies encompass a wide range of uses, each of which necessitates different considerations.

It is important to note that occupancy of any room or space for assembly purposes by fewer than 50 persons in a building of another occupancy, such as, for example, a 30-person conference room in an office building, is considered incidental to the predominant occupancy. Although subject to the requirements governing the predominant occupancy, the occupant load of such small assembly uses is to be calculated based on the actual use of the space. For example, a small employee breakroom containing tables and chairs within a factory is to be calculated based on 15 ft<sup>2</sup>/person (1.4 m<sup>2</sup>/person).

## OCCUPANCY CHARACTERISTICS



Changes of use, or the multiuse of assembly occupancies, could result in the application of provisions that normally might not be considered necessary. For example, a building used as a place of worship must meet certain, basic code requirements. Yet this same building also might be used for dining, dancing, or other purposes totally foreign to a place of worship, thus triggering the need to meet additional code requirements. Assembly occupancies in schools, such as multipurpose rooms, are rented or freely used for purposes other than education and often take on the character of exhibit halls. The use of available space in hotels, banquet rooms, shopping malls, and exhibit halls can also be very creative. When inspecting assembly occupancies, therefore, inspectors must be sure to ascertain all intended or possible uses.

As when they inspect any other type of facility, inspectors should be seen by the owner of the assembly occupancy as providing a service to them by conducting a fire and life safety inspection. Inspectors should always meet with the manager or owner of the establishment before beginning an inspection, and should encourage him or her to accompany them on the inspection.

Inspecting assembly occupancies is no different from inspecting other occupancies. First a general “once-over” inspection should be done to spot any immediate concerns and the floor area of the building should be determined through measurement. With this information, inspectors can figure out the occupant load of the facility. They should note any exterior violations, such as accumulations of trash or obstructed fire lanes. They should also point out to the manager or owner any misuse of extension cords, sloppy maintenance practices, or other areas of concern so that these can be corrected before the facility is reinspected.

When completing an inspection, inspectors should develop and file a sketch or drawing of the facility for future reference. This sketch should show the exterior and interior wall arrangements; the locations of all exit doors; the side yard, street, and property line clearances; and any other conditions of special hazard or consideration of special interest to assembly occupancies. The sketch should also identify any portable sliding or folding partitions used to divide rooms, as well as the occupant loads allowed for different room layouts, such as tables and chairs, theater-style seating, dancing, and so on. This sketch is essential for future use, not only as a reminder of existing conditions but, more importantly, as an easy reference to determine if any changes have occurred since the last inspection.

Inspectors should keep a permanent checklist to indicate the construction of interior and exterior walls, floor and roof coverings, the flame-spread ratings, the type of heating, the lighting and electrical systems and their conditions, and the available fire protection devices and systems. This checklist will be useful for future inspections.

## Occupant Load

The intended use of the premises and the number of exits in excess of the minimum number required will influence the maximum allowable occupant load. If the use of the occupancy has changed since the last inspection, the maximum allowable occupant load probably has changed, too. If it is a multipurpose space, the inspector should review any changes that would affect the variations described in the original sketches and should change the sketches accordingly. The *Life Safety Code* contains requirements for calculating the occupant load. If the allowable load has changed in any way, the inspector should ask the owner to provide a new “maximum occupant load” sign and display it as required, provided the means of egress are still acceptable for the new occupant load.

Established occupant loads should be posted prominently to ensure that not only the owner, but also the manager, operator, and occupants, are aware of the limitations. Occupant loads for multipurpose rooms should be posted for each approved use, such as tables and chairs, theater seating, dancing, and so on. Posting load figures will also help the inspector determine whether the occupancy is overcrowded.

## Means of Egress

Exiting is the most critical of all requirements for any assembly occupancy. While the **probability** of a fire in an assembly occupancy might be low, the **potential**

## INSPECTING THE PREMISES



for loss of life once a fire occurs is extremely high. A fire of any magnitude can easily result in a large number of injuries and deaths. Therefore, it is essential that assembly occupancies have enough egress capacity to accommodate the number of people likely to occupy the space and that they be properly located, easily accessible, and well maintained.

A life safety evaluation is an added requirement for assembly occupancies having an occupant load in excess of 6000 people. The life safety evaluation is a yearly assessment of the following conditions:

1. Nature of events and the participants and attendees
2. Access and egress movement, including crowd density problems
3. Medical emergencies
4. Fire hazards
5. Permanent and temporary structural systems
6. Severe weather conditions
7. Earthquakes
8. Civil or other disturbances
9. Hazardous material incidents within and near the facility
10. Relationships among facility management, event participants, emergency response agencies, and others having a role in the events accommodated in the facility

Inspectors must ensure that conditions altered since the last inspection have not compromised or blocked egress routes. If any alterations or renovations have been made since the last inspection, the inspector must be sure that travel distances to exits have not been increased beyond the maximum allowed. Where exit paths merge, the path of travel must be wide enough to accommodate the combined occupant load that can be expected to use the individual paths of travel before they merge.

All exit doors must open easily, with no more than 15 lb (6.8 kg) of force necessary on the panic bar to release the latch. Inspectors must ensure that exit doors are not chained or padlocked closed. Life safety requirements, particularly those relating to egress, must be maintained at *all* times.

Inspectors must not allow registration booths, head tables, projection screens, ticket booths, turnstiles, revolving doors, guide ropes, and so on to obstruct any means of egress. When loose chairs are provided, setting up and maintaining proper aisles is a particularly difficult problem. Normally, loose chairs must be ganged—that is, connected to each other—when the number of chairs exceeds 200.

The allowable configuration of aisles will vary depending on the type of seating provided—that is, banquet or conference-type tables, auditorium/theater seating arrangements, bleachers, grandstands, and so on. Spaces between and around such seating must be adequate to provide access to aisles.

In addition the egress routes, as well as the exit and directional exit signs, should be illuminated in both the normal and emergency modes.

## Interior Finish

Another major issue is the flame spread rating of interior finish materials and the flammability of decorative materials, curtains, drapes, and similar finishings. Interior finish in stairways should always be Class A. In corridors and lobbies, it may be Class A or B. In the general assembly area itself, it may be Class A or B; however, in assembly occupancies of 300 or fewer persons, Class C is permitted. Only rated material is allowed. See Chapter 21, “Interior Finish, Contents, and Furnishings,” for further information.

Combustible, decorative materials should be treated with a flame retardant. From a practical standpoint, flame-spread ratings are difficult to ascertain during a field inspection. If inspectors are unable to see any markings on the products, they should ask if the original construction, any subsequent installations, or manufacturers' test data are available. They should also check the inspection file for prior acceptance of existing materials.

It might be possible to obtain a sample of the decorative material from an unobtrusive location—along an inside seam, for example—and test it in a relatively wind-free location outside the building by placing the sample in a vertical position and setting a flame to the lower edge of the material. If charring does not occur beyond the flame and no flame or charring occurs after the flame has been removed, the product can be assumed to be reasonably safe. If charring, dripping, or flaming continues, however, the product is suspect and should be removed, replaced, or subjected to a standard fire test.

## Building Services

The inherent sources of ignition in assembly occupancies also include air-conditioning, heating, and refrigeration units or systems; electrical wiring; and electrical appliances; as well as conditions that exist in commercial kitchens. Frying and deep-fat cooking constitute the greatest single danger. Because hood and duct fires are very common, the operating condition of the hood and vent extinguishing and exhaust systems should be inspected carefully. Hoods and vents should be examined to determine if there has been a buildup of flammable material. These areas must be surveyed and cleaned continually, sometimes daily. The inspector should make sure that the exhaust damper opens when the exhaust fan is operated.

The inspector should determine the type of heating system used in the facility and the type of fuel used in the heating system and should ask the following questions:

- Must the heating unit be separated from the rest of the building?
- Are the walls, ceiling, and floor of proper construction?
- Are all openings, including duct openings, properly protected?
- Are there any smoke detectors on the downstream side of filters in the air supply or return system?

If the heating system fuel is LP-Gas, the inspector should find out if the system has shutoff controls that activate automatically if the pilot light goes out. Is the system located where LP-Gas will pocket or become trapped in the building in the event of a gas leak? LP-Gas cylinders should never be stored or used inside except under very limited conditions. Where is the LP-Gas supply located? If supply tanks are used, the inspector should make sure they are properly installed, secured, protected, and safeguarded against tampering or accidental damage and that the cylinders are stamped and designed for use with LP-Gas.

If the fuel is a flammable or combustible liquid, the inspector should determine whether the door opening is diked. On gravity feed systems, the inspector should verify that there is an antisiphon device and should make sure there is a fusible shutoff device that will activate in the event of fire near the heating equipment.

When checking the electrical wiring and appliances, the inspector should determine whether any permanent installations have been made using temporary equipment and should ask the following questions:

- Are the electric circuits large enough to handle the expected load?
- Are the noncurrent-carrying metal parts of portable and fixed electrically operated equipment properly grounded?

- Have any electrical extension cords been approved for their intended use, and are they being used properly?

If the inspector has any doubts about these items, he or she should have the community's electrical inspector make the determination.

## Smoking

Smoking is not always prohibited in assembly occupancies, with one exception: smoking is never allowed in theaters or assembly occupancies similar to theaters, such as facilities hosting stage shows and concerts. The prohibition of smoking in restaurants is becoming more popular, but this essentially is a health-related issue, not a fire-related issue.

## SPECIAL SAFEGUARDS FOR UNIQUE OCCUPANCIES



### Stages and Projection Rooms

Stages and enclosed platforms present unique hazards associated only with assembly occupancies, and they require special safeguards, such as protection of the proscenium wall, including the proscenium curtain; automatic sprinklers above and below the stage; and automatic venting. Motion picture projection rooms require special supply and exhaust air, egress, and port openings, all of which must be protected. They also require room enclosure and proper working space. Projection machines require individual exhaust capabilities, which vary with the type of equipment. Projection rooms in which cellulose nitrate film is used must comply with NFPA 40, *Standard for the Storage and Handling of Cellulose Nitrate Motion Picture Film*.

### Exhibits and Trade Shows

Because promoters and exhibitors are often creative in what they want to do and the materials they want to use, exhibits and trade shows can be challenging to inspect (Figure 22-2). The inspector should review the products that will be displayed, as well as the exhibits, and closely review special provisions in the *Life Safety Code* for help with this difficult assignment.

FIGURE 22-2 Trade Show



When inspecting exhibits and trade shows, the inspector should make sure to have a plan that shows details of the area, the booth arrangement, the fire protection equipment, and so on. The exhibit booths' construction should be of noncombustible or limited combustible materials, and curtains, drapes, acoustical materials, decorations, and so on should be flame retardant. Multilevel booths and those over 300 ft<sup>2</sup> (27.9 m<sup>2</sup>) should be sprinklered when in sprinklered occupancies. Access must be plainly visible, and the travel distance inside a booth to an exit access aisle should not exceed 50 ft (15 m).

Cartons and crates should be stored in a room separated from other portions of the building with construction that has a 1-hour fire resistance rating and sprinkler protection. Cooking devices should be limited in number and protected with sprinklers or some other form of extinguishing agent.

The inspector may also have to deal with motor vehicles displayed in this type of occupancy. The electrical system on vehicles should be disconnected to reduce ignition sources, and fuel tanks should be sealed. Fueling and defueling should not be allowed inside the structure.

## Special Amusement Buildings

Special amusement buildings present yet another life safety problem because they generally entertain customers by confusing them. Nonetheless, the means of egress must be plainly visible and lighted during an emergency. Under certain conditions, smoke detection systems may be necessary. The *Life Safety Code* requires that every special amusement building be protected with automatic sprinklers. Moveable or portable special amusement buildings must also be protected, and the water supply must come from sources approved by the authority having jurisdiction.

The *Life Safety Code* contains specific criteria within the means of egress portion of the assembly occupancy chapters for calculating the minimum width of aisle accessways and aisles serving seating arranged in rows, as well as for seating at tables. In addition, specialized seating arrangements such as grandstands and folding and telescopic seating are contained within the special provisions portion of the assembly chapters.

The requirements governing grandstands, in addition to establishing minimum spacing dimensions to ensure safe egress, contain structural requirements for portable grandstands to safeguard against collapse; size limitations on wooden grandstands in the event of fire; and safeguards against fire for the area immediately beneath all types of grandstands.

In addition to the sources of heat and open flame previously discussed, restaurant owners often use table candles to enhance the atmosphere. This practice should be discouraged. When it is permitted, however, the candles should be placed in stable containers or holders of noncombustible construction that are designed not to tip over easily. The inspector should test one of the typical candle holders to ensure that the flame does not come in contact with other combustible materials if it does tip over.

Table carts with open flames used as food warmers or for actual cooking are another potential source of ignition. In many cases, food on these tables is saturated with alcohol, which is then ignited. This activity is generally conducted very close to the restaurant patrons. There is no established means of protection against the obvious hazards of this practice, except prohibition.

Both the *Life Safety Code* and NFPA 58, *Liquefied Petroleum Gas Code*, limit the indoor use of portable butane-fueled appliances in restaurants and in attended commercial food catering operations where fueled by not more than two 10-oz (0.28-kg) LP-Gas capacity, nonrefillable butane containers that have a water capacity not exceeding 1.08 lb (0.4 kg) per container. Storage of cylinders is also limited

## OPEN FLAMES AND PYROTECHNICS



to 24 containers, with an additional 24 permitted where protected by a 2-hour fire resistance-rated barrier. The practice of bringing large propane or butane containers indoors is common in restaurants and presents an extreme life safety hazard.

In places of worship, the congregation occasionally holds lighted candles and sometimes marches in procession with them. While limited use of candles by designated officials can be permitted for religious purposes, the general assembly should not be allowed to hold any open flame devices.

Pyrotechnics traditionally have been used on the stages and platforms of assembly occupancies particularly during magic acts or shows. With the advent of discos and rock concerts, however, there has been a dramatic increase in the use of pyrotechnic devices. This practice can create extremely hazardous conditions, depending on the type, volume, setting, and control exercised when they are used. See NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*, for more information on this subject. There is also the tendency to overcrowd such facilities beyond the occupant load allowed by permit. Limiting both of these conditions is essential to minimum life safety and this limitation must be enforced on a performance-by-performance basis.

## FIRE PROTECTION SYSTEMS



On-site or built-in fire protection equipment includes portable fire extinguishers, interior standpipes and hose lines, automatic sprinkler systems, and fire alarm systems. New assembly occupancies with occupant loads in excess of 300 persons are required by the *Life Safety Code* to be fully sprinklered. Other methods of on-site or built-in fire protection may also be used, and each system or item should be reviewed to determine whether it is an approved method for the hazard protected. Inspectors should also review the general condition of fire protection systems and, where applicable, supervise performance tests.

When located in a building of mixed occupancy, the assembly occupancy might require separation from the remaining occupancies by fire-resistive assemblies of various ratings. Under these circumstances, openings in such assemblies must also be protected. In some instances, however, no separation is needed because the exposure hazard is low or nonexistent. In other instances, a 1-, 2-, 3-, or even a 4-hour fire resistance-rated separation will be necessary. The specifics of these requirements will depend on the applicable building code.

## SUMMARY

This chapter has identified the criteria necessary for properly classifying assembly occupancies as well as having provided a discussion on aspects of occupant loads, means of egress, interior finish requirements, and fire protection systems. In addition, the chapter has examined areas requiring special attention, such as stages, exhibits and trade shows, special amusement buildings, the use of open flame devices and/or pyrotechnics.

## BIBLIOGRAPHY

### NFPA Codes, Standards, and Recommended Practices

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

NFPA 40, *Standard for the Storage and Handling of Cellulose Nitrate Motion Picture Film*

NFPA 58, *Liquefied Petroleum Gas Code*

NFPA 96, *Standard for Ventilation, Control and Fire Protection of Commercial Cooking Operations*

NFPA 101<sup>®</sup>, *Life Safety Code*<sup>®</sup>

NFPA 102, *Standard for Grandstands, Folding and Telescopic seating, Tents and Membrane Structures*

NFPA 1126, *Standard for the Use of Pyrotechnics before a Proximate Audience*