CHAPTER 4 SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

SECTION 401
SCOPE

401.1 Detailed occupancy and use requirements.

In addition to the occupancy and construction requirements in this code, the provisions of this chapter apply to the occupancies and use described herein.

SECTION 402
COVERED MALL AND OPEN MALL BUILDINGS

402.1 Applicability.

The provisions of this section shall apply to buildings or structures defined herein as *covered or open mall buildings* not exceeding three floor levels at any point nor more than three *stories above grade plane*. Except as specifically required by this section, *covered and open mall buildings* shall meet applicable provisions of this code.

Exceptions:

1. Foyers and lobbies of Group B, R-1 and R-2occupancies are not required to comply with this section.
2. Buildings need not comply with the provisions of this section where they totally comply with other applicable provisions of this code.

402.1.1 Open mall building perimeter line.

For the purpose of this code, a perimeter line shall be established. The perimeter line shall encircle all buildings and structures that comprise the *open mall building* and shall encompass any open-air interior walkways, open-air courtyards or similar open-air spaces. The perimeter line shall define the extent of the *open mall building*. *Anchor buildings* and parking structures shall be outside of the perimeter line and are not considered as part of the *open mall building*.

402.2 Open space.

A *covered mall building* and attached *anchor buildings* and parking garages shall be surrounded on all sides by a permanent open space or not less than 60 feet (18 288 mm). An *open mall building* and *anchor buildings* and parking garages adjoining the perimeter line shall be surrounded on all sides by a permanent open space of not less than 60 feet (18 288 mm).

Exception: The permanent open space of 60 feet (18 288 mm) shall be permitted to be reduced to not less than 40 feet (12 192 mm), provided that the following requirements are met:

1. The reduced open space shall not be allowed for more than 75 percent of the perimeter of the *covered or open mall building* and *anchor buildings*.
2. The *exterior wall* facing the reduced open space shall have a *fire-resistance rating* of not less than 3 hours.
3. Openings in the *exterior wall* facing the reduced open space shall have opening protectives with a *fire protection rating* of not less than 3 hours.
4. Group E, H, I or R occupancies are not located within the *covered or open mall building* or *anchor buildings*.

402.3 Lease plan.

Each *owner* of a *covered mall building* or of an *open mall building* shall provide both the building and fire departments with a lease plan showing the location of each occupancy and its *exits* after the certificate of occupancy has been issued. Modifications or changes in occupancy or use from that shown on the lease plan shall not be made without prior approval of the *building official*.

402.4 Construction.

The construction of *covered and open mall buildings*, *anchor buildings* and parking garages associated with a mall building shall comply with Sections 402.4.1 through 402.4.3.

402.4.1 Area and types of construction.

The *building area* and type of construction of *covered mall* or *open mall buildings*, *anchor buildings* and parking garages shall comply with this section.

402.4.1.1 Covered and open mall buildings.

The *building area* of any *covered mall* or *open mall building* shall not be limited provided that the *covered mall* or *open mall building* does not exceed three floor levels at any point nor three *stories above grade plane*, and is of Type I, II, III or IV construction.

402.4.1.2 Anchor buildings.

The *building area* and *building height* of any *anchor building* shall be based on the type of construction as required by Section 503 as modified by Sections 504 and 506.

Exception: The *building area* of any *anchor building* shall not be limited provided that the *anchor building* is not more than three *stories above grade plane*, and is of Type I, II, III or IV construction.

402.4.1.3 Parking garage.

The *building area* and *building height* of any parking garage shall be based on the type of construction as required by

Sections 406.5 and 406.6, respectively.

402.4.2 Fire-resistance-rated separation.

Fire-resistance-rated separation is not required between tenant spaces and the *mall*. Fire-resistance-rated separation is not required between a *food court* and adjacent tenant spaces or the *mall*.

402.4.2.1 Tenant separations.

Each tenant space shall be separated from other tenant spaces by a *fire partition* complying with Section 708. A tenant separation wall is not required between any tenant space and the *mall*.

402.4.2.2 Anchor building separation.

An *anchor building* shall be separated from the *covered or open mall building* by *fire walls* complying with Section 706.

Exceptions:

1. *Anchor buildings* of not more than three stories *above grade plane* that have an occupancy classification the same as that permitted for tenants of the *mall building* shall be separated by 2-hour fire-resistance-rated *fire barriers* complying with Section 707.
2. The *exterior walls* of *anchor buildings* separated from an *open mall building* by an *open mall* shall comply with Table 705.5.

402.4.2.2.1 Openings between anchor building and mall.

Except for the separation between Group R-1 *sleeping units* and the *mall*, openings between *anchor buildings* of Type IA, IB, IIA or IIB construction and the *mall* need not be protected.

402.4.2.3 Parking garages.

An attached garage for the storage of passenger vehicles having a capacity of not more than nine persons and *open parking garages* shall be considered as a separate building where it is separated from the *covered or open mall building* or *anchor building* by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Parking garages, which are separated from *covered mall buildings*, *open mall buildings* or *anchor buildings*, shall comply with the provisions of Table 705.5.

Pedestrian walkways and tunnels that connect garages to *mall buildings* or *anchor buildings* shall be constructed in accordance with Section 3104.

402.4.3 Open mall construction.

Floor assemblies in, and roof assemblies over, the *open mall* of an *open mall building* shall be open to the atmosphere for not less than 20 feet (6096 mm), measured perpendicular from the face of the tenant spaces on the lowest level, from edge of balcony to edge of balcony on upper floors and from edge of roof line to edge of roof line. The openings within, or the unroofed area of, an *open mall* shall extend from the lowest/grade level of the open mall through the entire roof assembly. Balconies on upper levels of the *mall* shall not project into the required width of the opening.

402.4.3.1 Pedestrian walkways.

Pedestrian walkways connecting balconies in an *open mall* shall be located not less than 20 feet (6096 mm) from any other *pedestrian walkway*.

[F] 402.5 Automatic sprinkler system.

Covered and *open mall buildings* and buildings connected shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1, which shall comply with all of the following:

1. The *automatic sprinkler system* shall be complete and operative throughout occupied space in the *mall building* prior to occupancy of any of the tenant spaces. Unoccupied tenant spaces shall be similarly protected unless provided with *approved* alternative protection.
2. Sprinkler protection for the *mall* of a *covered mall building* shall be independent from that provided for tenant spaces or *anchor buildings*.
3. Sprinkler protection for the tenant spaces of an *open mall building* shall be independent from that provided for *anchor buildings*.
4. Sprinkler protection shall be provided beneath exterior circulation balconies located adjacent to an *open mall*.
5. Where tenant spaces are supplied by the same system, they shall be independently controlled.

Exception: An *automatic sprinkler system* shall not be required in spaces or areas of *open parking garages* separated from the covered or *open mall building* in accordance with Section 402.4.2.3 and constructed in accordance with Section 406.5.

402.6 Interior finishes and features.

Interior finishes within the *mall* and installations within the *mall* shall comply with Sections 402.6.1 through 402.6.4.

402.6.1 Interior finish

Interior wall and *ceiling finishes* within the *mall* of a *covered mall building* and within the *exits* of *covered or open mall buildings* shall have a minimum *flame spread index* and *smoke-developed index* of Class B in accordance with Chapter 8. *Interior floor finishes* shall meet the requirements of Section 804.

402.6.2 Kiosks.

Kiosks and similar structures (temporary or permanent) located within the *mall* of a *covered mall building* or within the perimeter line of an *open mall building* shall meet the following requirements:

1. Combustible kiosks or other structures shall not be located within a *covered* or *open mall* unless constructed of any of the following materials:
   1.1. *Fire-retardant-treated* wood complying with Section 2303.2.
   1.2. Foam plastics having a maximum heat release rate not greater than 100 kW (105 Btu/h) when tested in accordance with the exhibit booth protocol in UL 1975 or when tested in accordance with NFPA 289 using the 20 kW ignition source.
   1.3. Aluminum composite material (ACM) meeting the requirements of Class A *interior finish* in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended.
2. Kiosks or similar structures located within the *mall* shall be provided with *approved automatic sprinkler system* and detection devices.
3. The horizontal separation between kiosks or groupings thereof and other structures within the *mall* shall be not less than 20 feet (6096 mm).
4. Each kiosk or similar structure or groupings thereof shall have an area not greater than 300 square feet (28 m^2).

402.6.3 Play structures.

Play structures located within a *mall building* or within the perimeter line of an *open mall building* shall comply with Section 424. The horizontal separation between *play structures*, kiosks and similar structures within the *mall* shall be not less than 20 feet (6096 mm).

402.6.4 Plastic signs.

Plastic signs affixed to the storefront of any tenant space facing a *mall* or *open mall* shall be limited as specified in Sections 402.6.4.1 through 402.6.4.5.

402.6.4.1 Area.

Plastic signs shall be not more than 20 percent of the wall area facing the *mall*.

402.6.4.2 Height and width.

Plastic signs shall be not greater than 36 inches (914 mm) in height, except that where the sign is vertical, the height shall be not greater than 96 inches (2438 mm) and the width shall be not greater than 36 inches (914 mm).

402.6.4.3 Location.

Plastic signs shall be located not less than 18 inches (457 mm) from adjacent tenants.

402.6.4.4 Plastics other than foam plastics.

Plastics other than foam plastics used in signs shall be light-transmitting plastics complying with Section 2606.4 or shall have a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D1929, and a *flame spread index* not greater than 75 and *smoke-developed index* not greater than 450 when tested in the manner intended for use in accordance with ASTM E84 or UL 723 or meet the acceptance criteria of Section 803.1.1.1 when tested in accordance with NFPA 286.

402.6.4.4.1 Encasement.

Edges and backs of plastic signs in the *mall* shall be fully encased in metal.

402.6.4.5 Foam plastics.

Foam plastics used in signs shall have flame-retardant characteristics such that the sign has a maximum heat-release rate of 150 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289 using the 20 kW ignition source, and the foam plastics shall have the physical characteristics specified in this section. Foam plastics used in signs installed in accordance with Section 402.6.4 shall not be required to comply with the *flame spread* and *smoke-developed indices* specified in Section 2603.3.

402.6.4.5.1 Density.

The density of foam plastics used in signs shall be not less than 20 pounds per cubic foot (pcf) (320 kg/ m^3).

402.6.4.5.2 Thickness.

The thickness of foam plastic signs shall not be greater than $^1/_2$ inch (12.7 mm).

[F] 402.7 Emergency systems.

Covered and open mall buildings, *anchor buildings* and associated parking garages shall be provided with emergency systems complying with Sections 402.7.1 through 402.7.5.

[F] 402.7.1 Standpipe system.

Covered and open mall buildings shall be equipped throughout with a *standpipe system* as required by Section 905.3.3.

[F] 402.7.2 Smoke control.

Atriums connecting three or more *stories* in a *covered mall building* shall be provided with a smoke control system in accordance with Section 909.

[F] 402.7.3 Emergency power.

Covered mall buildings greater than 50,000 square feet (4645 m^2) in area and *open mall buildings* greater than 50,000 square feet (4645 m^2) within the established perimeter line shall be provided with emergency power that is capable of operating the *emergency voice/alarm communication system* in accordance with Section 2702.

[F] 402.7.4 Emergency voice/alarm communication system.

Where the total floor area is greater than 50,000 square feet (4645 m^2) within either a *covered mall building* or within the perimeter line of an *open mall building*, an *emergency voice/alarm communication system* shall be provided.

The fire department shall have access to any *emergency voice/alarm communication systems* serving a *mall*, required or otherwise. The systems shall be provided in accordance with Section 907.5.2.2.

[F] 402.7.5 Fire department access to equipment.

Rooms or areas containing controls for air-conditioning systems or *fire protection systems* shall be identified for use by the fire department.

402.8 Means of egress.

Covered mall buildings, *open mall buildings* and each tenant space within a *mall building* shall be provided with *means of egress* as required by this section and this code. Where there is a conflict between the requirements of this code and the requirements of Sections 402.8.1 through 402.8.8, the requirements of Sections 402.8.1 through 402.8.8 shall apply.

402.8.1 Mall width.

For the purpose of providing required egress, *malls* are permitted to be considered as corridors but need not comply with the requirements of Section 1005.1 of this code where the width of the *mall* is as specified in this section.

402.8.1.1 Minimum width.

The aggregate clear egress width of the *mall* in either a *covered or open mall building* shall be not less than 20 feet (6096 mm). The *mall* width shall be sufficient to accommodate the *occupant load* served. Any portion of the minimum required aggregate egress width shall be not less than 10 feet (3048 mm) measured to a height of 8 feet (2438 mm) between any projection of a tenant space bordering the *mall* and the nearest kiosk, vending machine, bench, display opening, *food court* or other obstruction to *means of egress* travel.

402.8.2 Determination of occupant load.

The *occupant load* permitted in any individual tenant space in a *covered or open mall building* shall be determined as required by this code. *Means of egress* requirements for individual tenant spaces shall be based on the *occupant load* thus determined.

402.8.2.1 Occupant formula.

In determining required *means of egress* of the *mall*, the number of occupants for whom *means of egress* are to be provided shall be based on *gross leasable area* of the *covered or open mall building* (excluding *anchor buildings*) and the *occupant load factor* as determined by Equation 4-1.

$$OLF = (0.00007)(GLA) + 25$$

(Equation 4-1)

where:

OLF = The *occupant load* factor (square feet per person).

GLA = The *gross leasable area* (square feet).

Exception: Tenant spaces attached to a *covered or open mall building* but with a *means of egress* system that is totally independent of the open mall of an *open mall building* or of a *covered mall building* shall not be considered as *gross leasable area* for determining the required *means of egress* for the *mall building*.

402.8.2.2 OLF range.

The *occupant load* factor (*OLF*) is not required to be less than 30 and shall not exceed 50.

402.8.2.3 Anchor buildings.

The *occupant load* of *anchor buildings* opening into the *mall* shall not be included in computing the total number of occupants for the *mall*.

402.8.2.4 Food courts.

The *occupant load* of a *food court* shall be determined in accordance with Section 1004. For the purposes of determining the *means of egress* requirements for the *mall*, the *food court occupant load* shall be added to the *occupant load* of the covered or *open mall building* as calculated in Section 402.8.2.1.

402.8.3 Number of means of egress.

Wherever the distance of travel to the *mall* from any location within a tenant space used by persons other than employees is greater than 75 feet (22 860 mm) or the tenant space has an *occupant load* of 50 or more, not fewer than two *means of egress* shall be provided.

402.8.4 Arrangements of means of egress.

Assembly occupancies with an *occupant load* of 500 or more located within a *covered mall building* shall be so located such that their entrance will be immediately adjacent to a principal entrance to the mall and shall have not less than one-half of their required *means of egress* opening directly to the exterior of the *covered mall building*. Assembly occupancies located within the perimeter line of an *open mall building* shall be permitted to have their main *exit* open to the *open mall*.

402.8.4.1 Anchor building means of egress.

Required *means of egress* for *anchor buildings* shall be provided independently from the *mall means of egress* system. The *occupant load* of a*nchor buildings* opening into the *mall* shall not be included in determining *means of egress* requirements for the *mall*. The path of egress travel of *malls* shall not exit through *anchor buildings*. Malls terminating at an *anchor building* where other *means of egress* has not been provided shall be considered as a dead-end *mall*.

402.8.5 Distance to exits.

Within each individual tenant space in a *covered* or *open mall building*, the distance of travel from any point to an *exit* or entrance to the *mall* shall be not greater than 200 feet (60 960 mm).

The distance of travel from any point within a *mall* of a *covered mall building* to an *exit* shall be not greater than 200 feet (60 960 mm). The maximum distance of travel from any point within an *open mall* to the perimeter line of the *open mall building* shall be not greater than 200 feet (60 960 mm).

402.8.6 Access to exits.

Where more than one *exit* is required, they shall be so arranged that it is possible to travel in either direction from any point in a *mall* of a *covered mall building* to separate *exits* or from any point in an *open mall* of an *open mall building* to two separate locations on the perimeter line, provided that neither location is an *exterior wall* of an *anchor building* or parking garage. The width of an *exit passageway* or *corridor* from a *mall* shall be not less than 66 inches (1676 mm).

Exception: Access to *exits* is permitted by way of a dead-end*mall* that does not exceed a length equal to twice the width of the *mall* measured at the narrowest location within the dead-end portion of the*mall*.

402.8.6.1 Exit passageways.

Where *exit passageways* provide a secondary *means of egress* from a tenant space, the *exit passageways* shall be constructed in accordance with Section 1024.

402.8.7 Service areas fronting on exit passageways.

Mechanical rooms, electrical rooms, building service areas and service elevators are permitted to open directly into *exit passageways*, provided that the *exit passageway* is separated from such rooms with not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire protection rating* of openings in the *fire barriers* shall be not less than 1 hour.

402.8.8 Security grilles and doors.

Horizontal sliding or vertical security grilles or doors that are a part of a required *means of egress* shall conform to the following:

1. Doors and grilles shall remain in the full open position during the period of occupancy by the general public.
2. Doors or grilles shall not be brought to the closed position when there are 10 or more persons occupying spaces served by a single *exit* or 50 or more persons occupying spaces served by more than one *exit*.
3. The doors or grilles shall be openable from within without the use of any special knowledge or effort where the space is occupied.
4. Where two or more *exits* are required, not more than one-half of the *exits* shall be permitted to include either a

horizontal sliding or vertical rolling grille or door.

2021 Virginia Construction Code

CHAPTER 4 SPECIAL DETAILED REQUIREMENTS BASED ON USE AND OCCUPANCY

SECTION 403
HIGH-RISE BUILDINGS

403.1 Applicability.

High-rise buildings shall comply with Sections 403.2 through 403.6.

Exceptions: The provisions of Sections 403.2 through 403.6 shall not apply to the following buildings and structures:

1. Airport traffic control towers in accordance with Section 412.2.
2. *Open parking garages* in accordance with Section 406.5.
3. The portion of a building containing a Group A-5 occupancy in accordance with Section 303.6.
4. Special industrial occupancies in accordance with Section 503.1.1.
5. Buildings containing any one of the following:
   5.1. A Group H-1 occupancy.
   5.2. A Group H-2 occupancy in accordance with Section 415.8, 415.9.2, 415.9.3 or 426.1.
   5.3. A Group H-3 occupancy in accordance with Section 415.8.

403.2 Construction.

The construction of *high-rise buildings* shall comply with the provisions of Sections 403.2.1 through 403.2.3.

403.2.1 Reduction in fire-resistance rating.

The *fire-resistance rating* reductions specified in Sections 403.2.1.1 and 403.2.1.2 shall be allowed in buildings that have sprinkler control valves equipped with supervisory initiating devices and water-flow initiating devices for each floor.

403.2.1.1 Type of construction.

The following reductions in the minimum *fire-resistance rating* of the *building elements* in Table 601 shall be permitted as follows:

1. For buildings not greater than 420 feet (128 m) in *building height*, the *fire-resistance rating* of the *building elements* in Type IA construction shall be permitted to be reduced to the minimum *fire-resistance ratings* for the *building elements* in Type IB.

   Exception: The required *fire-resistance rating* of columns supporting floors shall not be reduced.

2. In other than Group F-1, H-2, H-3, H-5, M and S-1 occupancies, the *fire-resistance rating* of the *building elements* in Type IB construction shall be permitted to be reduced to the *fire-resistance ratings* in Type IIA.
3. The *building height* and *building area* limitations of a building containing *building elements* with reduced *fire-resistance ratings* shall be permitted to be the same as the building without such reductions.

403.2.1.2 Shaft enclosures.

For buildings not greater than 420 feet (128 m) in *building height*, the required *fire-resistance rating* of the *fire barriers* enclosing vertical *shafts*, other than *interior exit stairway* and elevator hoistway enclosures, is permitted to be reduced to 1 hour where *automatic* sprinklers are installed within the *shafts* at the top and at alternate floor levels.

[BS] 403.2.2 Structural integrity of interior exit stairways and elevator hoistway enclosures.

For *high-rise buildings of Risk Category* III or IV in accordance with Section 1604.5, and for all buildings that are more than 420 feet (128 m) in *building height*, enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Sections 403.2.2.1 through 403.2.2.4.

[BS] 403.2.2.1 Wall assembly materials—soft body impact.

The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures shall meet or exceed Soft Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M when tested from the exterior side of the enclosure.

[BS] 403.2.2.2 Wall assembly materials—hard body impact.

The panels making up the enclosures for *interior exit stairways* and elevator hoistway enclosures that are not exposed to the interior of the enclosure shall be in accordance with one of the following:

1. The wall assembly shall incorporate not fewer than two layers of impact-resistant panels, each of which meets or exceeds Hard Body Impact Classification Level 2 as measured by the test method described in ASTM C1629/C1629M.
2. The wall assembly shall incorporate not fewer than one layer of impact-resistant panels that meet or exceed Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

3. The wall assembly incorporates multiple layers of any material, tested in tandem, that meets or exceeds Hard Body Impact Classification Level 3 as measured by the test method described in ASTM C1629/C1629M.

[BS] 403.2.2.3 Concrete and masonry walls.

Concrete or masonry walls shall be deemed to satisfy the requirements of Sections 403.2.2.1 and 403.2.2.2.

[BS] 403.2.2.4 Other wall assemblies.

Any other wall assembly that provides impact resistance equivalent to that required by Sections 403.2.2.1 for Soft Body Impact Classification Level 2 and 403.2.2.2 for Hard Body Impact Classification Level 3, as measured by the test method described in ASTM C1629/C1629M, shall be permitted.

403.2.3 Sprayed fire-resistant materials (SFRM).

The bond strength of the SFRM installed throughout the building shall be in accordance with Table 403.2.3.

TABLE 403.2.3
MINIMUM BOND STRENGTH

HEIGHT OF BUILDING[a]	SFRM MINIMUM BOND STRENGTH
Up to 420 feet	430 psf
Greater than 420 feet	1,000 psf

For SI: 1 foot = 304.8 mm, 1 pound per square foot (psf) = 0.0479 kW/m^2.

a. Above the lowest level of fire department vehicle access.

[F] 403.3 Automatic sprinkler system.

Buildings and structures shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 and a secondary water supply where required by Section 403.3.3.

Exception: An *automatic sprinkler system* shall not be required in spaces or areas of telecommunications equipment buildings used exclusively for telecommunications equipment, associated electrical power distribution equipment, batteries and standby engines, provided that those spaces or areas are equipped throughout with an *automatic* fire detection system in accordance with Section 907.2 and are separated from the remainder of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or not less than 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 403.3.1 Number of sprinkler risers and system design.

Each sprinkler system zone in buildings that are more than 420 feet (128 m) in *building height* shall be supplied by not fewer than two risers. Each riser shall supply sprinklers on alternate floors. If more than two risers are provided for a zone, sprinklers on adjacent floors shall not be supplied from the same riser.

[F] 403.3.1.1 Riser location.

Sprinkler risers shall be placed in *interior exit stairways* and *ramps* that are remotely located in accordance with Section 1007.1.

[F] 403.3.2 Water supply to required fire pumps.

In all buildings that are more than 420 feet (128 m) in *building height* and buildings of Type IV-A and IV-B construction that are more than 120 feet (36 576 mm) in *building height*, required fire pumps shall be supplied by connections to not fewer than two water mains located in different streets. Separate supply piping shall be provided between each connection to the water main and the pumps. Each connection and the supply piping between the connection and the pumps shall be sized to supply the flow and pressure required for the pumps to operate.

Exception: Two connections to the same main shall be permitted provided that the main is valved such that an interruption can be isolated so that the water supply will continue without interruption through not fewer than one of the connections.

[F] 403.3.3 Secondary water supply.

An *automatic* secondary on-site water supply having a capacity not less than the hydraulically calculated sprinkler demand, including the hose stream requirement, shall be provided for *high-rise buildings* assigned to *Seismic Design Category* C, D, E or F as determined by Section 1613. An additional fire pump shall not be required for the secondary water supply unless needed to provide the minimum design intake pressure at the suction side of the fire pump supplying the *automatic sprinkler system*. The secondary water supply shall have a duration of not less than 30 minutes as determined by the occupancy hazard classification in accordance with NFPA 13.

[F] 403.3.4 Fire pump room.

Fire pumps shall be located in rooms protected in accordance with Section 913.2.1.

[F] 403.4 Emergency systems.

The detection, alarm and emergency systems of *high-rise buildings* shall comply with Sections 403.4.1 through 403.4.8.

[F] 403.4.1 Smoke detection.

Smoke detection shall be provided in accordance with Section 907.2.13.1.

[F] 403.4.2 Fire alarm system.

A *fire alarm* system shall be provided in accordance with Section 907.2.13.

[F] 403.4.3 Standpipe system.

A *high-rise building* shall be equipped with a *standpipe system* as required by Section 905.3.

[F] 403.4.4 Emergency voice/alarm communication system.

An *emergency voice/alarm communication system* shall be provided in accordance with Section 907.5.2.2

[F] 403.4.5 Emergency communication coverage.

(Section deleted.)

[F] 403.4.6 Fire command.

A *fire command center* complying with Section 911 shall be provided in a location *approved* by the fire code official.

[F] 403.4.7 Smoke removal.

To facilitate smoke removal in post-fire salvage and overhaul operations, buildings and structures shall be equipped with natural or mechanical *ventilation* for removal of products of combustion in accordance with one of the following:

1. Easily identifiable, manually operable windows or panels shall be distributed around the perimeter of each floor at not more than 50-foot (15 240 mm) intervals. The area of operable windows or panels shall be not less than 40 square feet (3.7 m^2) per 50 linear feet (15 240 mm) of perimeter.

   Exceptions:

   1. In Group R-1 occupancies, each *sleeping unit* or suite having an *exterior wall* shall be permitted to be provided with 2 square feet (0.19 m^2) of venting area in lieu of the area specified in Item 1.
   2. Windows shall be permitted to be fixed provided that glazing can be cleared by fire fighters.

2. Mechanical air-handling equipment providing one exhaust air change every 15 minutes for the area involved. Return and exhaust air shall be moved directly to the outside without recirculation to other portions of the building.
3. Any other *approved* design that will produce equivalent results.

[F] 403.4.8 Standby and emergency power.

A *standby power system* complying with Section 2702 and Section 3003 shall be provided for the standby power loads specified in Section 403.4.8.3. An *emergency power system* complying with Section 2702 shall be provided for the emergency power loads specified in Section 403.4.8.4.

[F] 403.4.8.1 Equipment room.

If the *standby or emergency power system* includes a generator set inside a building, the system shall be located in a separate room enclosed with 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. System supervision with manual start and transfer features shall be provided at the *fire command center*.

Exception: In Group I-2, Condition 2, manual start and transfer features for the critical branch of the emergency power are not required to be provided at the *fire command center*.

[F] 403.4.8.2 Fuel line piping protection.

Fuel lines supplying a generator set inside a building shall be separated from areas of the building other than the room the generator is located in by one of the following methods:

1. A fire-resistant pipe-protection system that has been tested in accordance with UL 1489. The system shall be installed as tested and in accordance with the manufacturer's installation instructions, and shall have a rating of not less than 2 hours. Where the building is protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1, the required rating shall be reduced to 1 hour.
2. An assembly that has a *fire-resistance rating* of not less than 2 hours. Where the building is protected throughout with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1 or 903.3.1.2, the required fire-resistance rating shall be reduced to 1 hour.
3. Other approved methods.

[F] 403.4.8.3 Standby power loads.

The following are classified as standby power loads:

1. *Ventilation* and *automatic* fire detection equipment for *smokeproof* enclosures.
2. Elevators.
3. Where elevators are provided in a *high-rise building* for *accessible* means of egress, fire service access or occupant self-evacuation, the *standby power system* shall also comply with Sections 1009.4, 3007 or 3008, as applicable.

[F] 403.4.8.4 Emergency power loads.

The following are classified as emergency power loads:

1. Exit signs and *means of egress* illumination required by Chapter 10.
2. Elevator car lighting.
3. *Emergency voice/alarm communications systems*.
4. *Automatic* fire detection systems.
5. *Fire alarm* systems.
6. Electrically powered fire pumps.
7. Power and lighting for the *fire command center* required by Section 403.4.6.

403.5 Means of egress and evacuation.

The *means of egress* in *high-rise buildings* shall comply with Sections 403.5.1 through 403.5.5.

403.5.1 Remoteness of interior exit stairways.

Required *interior exit stairways* shall be separated by a distance not less than 30 feet (9144 mm) or not less than one-fourth of the length of the maximum overall diagonal dimension of the building or area to be served, whichever is less. The distance shall be measured in a straight line between the nearest points of the enclosure surrounding the *interior exit stairways*. In buildings with three or more *interior exit stairways*, not fewer than two of the *interior exit stairways* shall comply with this section. Interlocking or *scissor stairways* shall be counted as one *interior exit stairway*.

403.5.2 Additional interior exit stairway.

For buildings other than Group R-2 and their ancillary spaces that are more than 420 feet (128 m) in *building height*, one additional *interior exit stairway* meeting the requirements of Sections 1011 and 1023 shall be provided in addition to the minimum number of *exits* required by Section 1006.3. The total capacity of any combination of remaining *interior exit stairways* with one *interior exit stairway* removed shall be not less than the total capacity required by Section 1005.1. *Scissor stairways* shall not be considered the additional *interior exit stairway* required by this section.

Exceptions:

1. An additional *interior exit stairway* shall not be required to be installed in buildings having elevators used for occupant self-evacuation in accordance with Section 3008.
2. An additional *interior exit stairway* shall not be required for other portions of the building where the highest occupiable floor level in those areas is less than 420 feet (128 m) in *building height*.

403.5.3 Stairway door operation.

Stairway doors other than the exit discharge doors shall be permitted to be locked from the *stairway* side. *Stairway* doors that are locked from the *stairway* side shall be capable of being unlocked simultaneously without unlatching upon a signal from the *fire command center*.

403.5.3.1 Stairway communication system.

A telephone or other two-way communications system connected to an *approved constantly attended station* shall be provided at not less than every fifth floor in each *stairway* where the doors to the *stairway* are locked.

403.5.4 Smokeproof enclosures.

Every required *interior exit stairway* serving floors more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access shall be a *smokeproof enclosure* in accordance with Sections 909.20 and 1023.12.

403.5.5 Luminous egress path markings.

Luminous egress path markings shall be provided in accordance with Section 1025.

403.6 Elevators.

Elevator installation and operation in *high-rise buildings* shall comply with Chapter 30 and Sections 403.6.1 and 403.6.2.

403.6.1 Fire service access elevator.

In buildings with an occupied floor more than 120 feet (36 576 mm) above the lowest level of fire department vehicle access, not fewer than two fire service access elevators, or all elevators, whichever is less, shall be provided in accordance with Section 3007. Each fire service access elevator shall have a capacity of not less than 3,500 pounds

(1588 kg) and shall comply with Section 3002.4.

403.6.2 Occupant evacuation elevators.

Where installed in accordance with Section 3008, passenger elevators for general public use shall be permitted to be used for occupant self-evacuation.

SECTION 404
ATRIUMS

404.1 General.

The provisions of Sections 404.1 through 404.11 shall apply to buildings containing *atriums*. *Atriums* are not permitted in buildings or structures classified as Group H.

Exception: Vertical openings that comply with Sections 712.1.1 through 712.1.3, and Sections 712.1.9 through 712.1.14.

404.2 Use.

The floor of the *atrium* shall not be used for other than low fire hazard uses and only *approved* materials and decorations in accordance with the *International Fire Code* shall be used in the *atrium* space.

Exception: The *atrium* floor area is permitted to be used for any *approved* use where the individual space is provided with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 404.3 Automatic sprinkler protection.

An *approved automatic sprinkler system* shall be installed throughout the entire building.

Exceptions:

1. That area of a building adjacent to or above the *atrium* need not be sprinklered provided that portion of the building is separated from the *atrium* portion by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.
2. Where the ceiling of the *atrium* is more than 55 feet (16 764 mm) above the floor, sprinkler protection at the ceiling of the *atrium* is not required.

[F] 404.4 Fire alarm system.

A *fire alarm* system shall be provided in accordance with Section 907.2.14.

404.5 Smoke control.

A smoke control system shall be installed in accordance with Section 909.

Exceptions:

1. In other than Group I-2, and Group I-1, Condition 2, smoke control is not required for *atriums* that connect only two *stories.*
2. A smoke control system is not required for *atriums* connecting more than two *stories* when all of the following are met:
   2.1. Only the two lowest *stories* shall be permitted to be open to the *atrium*.
   2.2. All *stories* above the lowest two *stories* shall be separated from the *atrium* in accordance with the provisions for a *shaft* in Section 713.4.

404.6 Enclosure of atriums.

Atrium spaces shall be separated from adjacent spaces by a 1-hour *fire barrier* constructed in accordance with Section 707 or a *horizontal assembly* constructed in accordance with Section 711, or both.

Exceptions:

1. A *fire barrier* is not required where a glass wall forming a *smoke partition* is provided. The glass wall shall comply with all of the following:
   1.1. *Automatic* sprinklers are provided along both sides of the separation wall and doors, or on the room side only if there is not a walkway on the *atrium* side. The sprinklers shall be located between 4 inches and 12 inches (102 mm and 305 mm) away from the glass and at intervals along the glass not greater than 6 feet (1829 mm). The sprinkler system shall be designed so that the entire surface of the glass is wet upon activation of the sprinkler system without obstruction;
   1.2. The glass wall shall be installed in a gasketed frame in a manner that the framing system deflects without breaking (loading) the glass before the sprinkler system operates; and
   1.3. Where glass doors are provided in the glass wall, they shall be either *self-closing* or automatic-closing.
2. A *fire barrier* is not required where a glass-block wall assembly complying with Section 2110 and having a $^{3}/_{4}$-hour *fire protection rating* is provided.
3. A *fire barrier* is not required between the *atrium* and the adjoining spaces of up to three floors of the *atrium*

provided that such spaces are accounted for in the design of the smoke control system.

4. A *fire barrier* is not required between the *atrium* and the adjoining spaces where the *atrium* is not required to be provided with a smoke control system.
5. A *horizontal assembly* is not required between the *atrium* and openings for escalators complying with Section 712.1.3.
6. A *horizontal assembly* is not required between the *atrium* and openings for *exit access stairways* and *ramps* complying with Item 4 of Section 1019.3.

[F] 404.7 Standby power.

Equipment required to provide smoke control shall be provided with standby power in accordance with Section 909.11.

404.8 Interior finish.

The *interior finish* of walls and ceilings of the *atrium* shall be not less than Class B. Sprinkler protection shall not result in a reduction in class.

404.9 Exit access travel distance.

Exit access travel distance for areas open to an *atrium* shall comply with the requirements of Section 1017.

404.10 Exit stairways in an atrium.

Where an *atrium* contains an *interior exit stairway* all the following shall be met:

1. The entry to the exit stairway is the edge of the closest riser of the exit stairway.
2. The entry of the exit stairway shall have access from a minimum of two directions.
3. The distance between the entry to an exit stairway in an atrium and the entrance to a minimum of one exit stairway enclosed in accordance with Section 1023.2 shall comply with the separation required by Section 1007.1.1.
4. Exit access travel distance shall be measured to the closest riser of the exit stairway.
5. Not more than 50 percent of the exit stairways shall be located in the same atrium.

404.11 Interior exit stairway discharge.

Discharge of *interior exit stairways* through an *atrium* shall be in accordance with Section 1028.

SECTION 405
UNDERGROUND BUILDINGS

405.1 General.

The provisions of Sections 405.2 through 405.9 apply to building spaces having a floor level used for human occupancy more than 30 feet (9144 mm) below the finished floor of the lowest *level of exit discharge*.

Exceptions: The provisions of Section 405 are not applicable to the following buildings or portions of buildings:

1. One- and two-family *dwellings*, sprinklered in accordance with Section 903.3.1.3.
2. Parking garages provided with *automatic sprinkler systems* in compliance with Section 405.3.
3. Fixed guideway transit systems.
4. *Grandstands, bleachers*, stadiums, arenas and similar facilities.
5. Where the lowest *story* is the only *story* that would qualify the building as an underground building and has an area not greater than 1,500 square feet (139 m^2) and has an *occupant load* less than 10.
6. Pumping stations and other similar mechanical spaces intended only for limited periodic use by service or maintenance personnel.

405.2 Construction requirements.

The underground portion of the building shall be of Type I construction.

[F] 405.3 Automatic sprinkler system.

The highest *level of exit discharge* serving the underground portions of the building and all levels below shall be equipped with an *automatic sprinkler system* installed in accordance with Section 903.3.1.1. Water-flow switches and control valves shall be supervised in accordance with Section 903.4.

405.4 Compartmentation.

Compartmentation shall be in accordance with Sections 405.4.1 through 405.4.3.

405.4.1 Number of compartments.

A building having a floor level more than 60 feet (18 288 mm) below the finished floor of the lowest *level of exit discharge* shall be devided into not fewer than two compartments of approximately equal size. Such compartmentation shall extend through the highest *level of exit discharge* serving the underground portions of the building and all levels below.

Exception: The lowest *story* need not be compartmented where the area is not greater than 1,500 square feet (139 m^2) and has an *occupant load* of less than 10.

405.4.2 Smoke barrier penetration.

The compartments shall be separated from each other by a *smoke barrier* in accordance with Section 709. Penetrations between the two compartments shall be limited to plumbing and electrical piping and conduit that are firestopped in accordance with Section 714. Doorways shall be protected by *fire door assemblies* that comply with Section 716, automatic-closing by smoke detection in accordance with Section 716.2.6.6 and installed in accordance with NFPA 105 and Section 716.2.2.1. Where provided, each compartment shall have an air supply and an exhaust system independent of the other compartments.

405.4.3 Elevators.

Where elevators are provided, each compartment shall have direct access to an elevator. Where an elevator serves more than one compartment, an enclosed elevator lobby shall be provided and shall be separated from each compartment by a *smoke barrier* in accordance with Section 709. Doorways in the *smoke barrier* shall be protected by *fire door* assemblies that comply with Section 716, shall comply with the smoke and draft control assembly requirements of Section 716.2.2.1 with the UL 1784 test conducted without an artificial bottom seal, and shall be automatic-closing by smoke detection in accordance with Section 716.2.6.6.

405.5 Smoke control system.

A smoke control system shall be provided in accordance with Sections 405.5.1 and 405.5.2.

405.5.1 Control system.

A smoke control system is required to control the migration of products of combustion in accordance with Section 909 and the provisions of this section. Smoke control shall restrict movement of smoke to the general area of fire origin and maintain *means of egress* in a usable condition.

405.5.2 Compartment smoke control system.

Where compartmentation is required, each compartment shall have an independent smoke control system. The system shall be automatically activated and capable of manual operation in accordance with Sections 907.2.18 and 907.2.19.

[F] 405.6 Fire alarm systems.

A *fire alarm* system shall be provided where required by Sections 907.2.18 and 907.2.19.

405.7 Means of egress.

Means of egress shall be in accordance with Sections 405.7.1 and 405.7.2.

405.7.1 Number of exits.

Each floor level shall be provided with not fewer than two *exits*. Where compartmentation is required by Section 405.4, each compartment shall have not fewer than one *exit* and not fewer than one *exit access* doorway into the adjoining compartment.

405.7.2 Smokeproof enclosure.

Every required *stairway* serving floor levels more than 30 feet (9144 mm) below the finished floor of its *level of exit discharge* shall comply with the requirements for a *smokeproof enclosure* as provided in Section 1023.12.

[F] 405.8 Standby and emergency power.

A *standby power system* complying with Section 2702 shall be provided for the standby power loads specified in Section 405.8.1. An *emergency power system* complying with Section 2702 shall be provided for the emergency power loads specified in Section 405.8.2.

[F] 405.8.1 Standby power loads.

The following are classified as standby power loads:

1. Smoke control system.
2. *Ventilation* and *automatic* fire detection equipment for *smokeproof* enclosures.
3. Elevators, as required in Section 3003.

[F] 405.8.2 Emergency power loads.

The following are classified as emergency power loads:

1. *Emergency voice/alarm communications systems*.
2. *Fire alarm systems*.
3. *Automatic* fire detection systems.
4. Elevator car lighting.
5. *Means of egress* and *exit* sign illumination as required by Chapter 10.
6. Fire pumps.

[F] 405.9 Standpipe system.

The underground building shall be equipped throughout with a *standpipe system* in accordance with Section 905.

SECTION 406
MOTOR-VEHICLE-RELATED OCCUPANCIES

406.1 General.

All motor-vehicle-related occupancies shall comply with Section 406.2. *Private garages* and carports shall also comply with Section 406.3. Open public parking garages shall also comply with Sections 406.4 and 406.5. Enclosed public parking garages shall also comply with Sections 406.4 and 406.6. Motor fuel-dispensing facilities shall also comply with Section 406.7. *Repair garages* shall also comply with Section 406.8.

406.2 Design.

Private garages and carports, open and enclosed public parking garages, motor fuel-dispensing facilities and *repair garages* shall comply with Sections 406.2.1 through 406.2.9.

406.2.1 Automatic garage door openers and *vehicular gates*.

Automatic garage door openers shall be listed and labeled in accordance with UL 325. Where provided, *automatic vehicular gates* shall comply with Section 3110.

406.2.2 Clear height.

The clear height of each floor level in vehicle and pedestrian traffic areas shall be not less than 7 feet (2134 mm). Canopies under which fuels are dispensed shall have a clear height in accordance with Section 406.7.2.

Exception: A lower clear height is permitted for a parking tier in *mechanical-access open parking garages* where approved by the *building official.*

406.2.3 Accessible parking spaces.

Where parking is provided, accessible parking spaces, access aisles and vehicular routes serving accessible parking shall be provided in accordance with Section 1106.

406.2.4 Floor surfaces.

Floor surfaces shall be of concrete or similar approved noncombustible and nonabsorbent materials. The area of floor used for the parking of automobiles or other vehicles shall be sloped to facilitate the movement of liquids to a drain or toward the main vehicle entry doorway. The surface of vehicle fueling pads in motor fuel-dispensing facilities shall be in accordance with Section 406.7.1.

Exceptions:

1. Asphalt parking surfaces shall be permitted at ground level for public parking garages and private carports.
2. Slip-resistant, nonabsorbent, *interior floor finishes* having a critical radiant flux not more than 0.45 W/cm^2, as determined by ASTM E648 or NFPA 253, shall be permitted in *repair garages.*

406.2.5 Sleeping rooms.

Openings between a motor vehicle-related occupancy and a room used for sleeping purposes shall not be permitted.

406.2.6 Fuel dispensing.

The dispensing of fuel shall only be permitted in motor fuel-dispensing facilities in accordance with Section 406.7.

406.2.7 Electric vehicle charging stations and systems.

Where provided, electric vehicle charging systems shall be installed in accordance with NFPA 70. Electric vehicle charging system equipment shall be *listed* and labeled in accordance with UL 2202. Electric vehicle supply equipment shall be *listed* and labeled in accordance with UL 2594. Accessibility to *electric vehicle charging stations* shall be provided in accordance with Section 1107.

406.2.8 Mixed occupancies and uses.

Mixed uses shall be allowed in the same building as public parking garages and *repair garages* in accordance with Section 508.1. Mixed uses in the same building as an *open parking garage* are subject to Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

406.2.9 Equipment and appliances.

Equipment and appliances shall be installed in accordance with Sections 406.2.9.1 through 406.2.9.3 and the *International Mechanical Code*, *International Fuel Gas Code* and NFPA 70.

406.2.9.1 Elevation of ignition sources.

Equipment and appliances having an ignition source and located in hazardous locations and public garages, *private garages*, *repair garages*, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the

source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a *dwelling unit* and that communicate directly with a *private garage* through openings shall be considered to be part of the *private garage*.

Exception: Elevation of the ignition source is not required for appliances that are listed as flammable vapor ignition resistant.

406.2.9.1.1 Parking garages.

Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 406.2.9.

Exception: This section shall not apply to appliance installations complying with Section 406.2.9.2 or 406.2.9.3.

406.2.9.2 Public garages.

Appliances located in public garages, motor fuel-dispensing facilities, *repair garages* or other areas frequented by motor vehicles shall be installed not less than 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearances required by the appliance manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 406.2.9.1 and NFPA 30A.

406.2.9.3 Private garages.

Appliances located in *private garages* and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and are installed in accordance with Section 406.2.9.1.

406.3 Private garages and carports.

Private garages and carports shall comply with Sections 406.2 and 406.3, or they shall comply with Sections 406.2 and 406.4.

406.3.1 Classification.

Private garages and carports shall be classified as Group U occupancies. Each *private garage* shall be not greater than 1,000 square feet (93 m^2) in area. Multiple *private garages* are permitted in a building where each *private garage* is separated from the other *private garages* by 1-hour *fire barriers* in accordance with Section 707, or 1-hour *horizontal assemblies* in accordance with Section 711, or both.

406.3.2 Separation.

For other than *private garages* adjacent to dwelling units, the separation of *private garages* from other occupancies shall comply with Section 508. Separation of *private garages* from *dwelling units* shall comply with Sections 406.3.2.1 and 406.3.2.2.

406.3.2.1 Dwelling unit separation.

The *private garage* shall be separated from the *dwelling unit* and its *attic* area by means of *gypsum board*, not less than $^1/_2$ inch (12.7 mm) in thickness, applied to the garage side. Garages beneath habitable rooms shall be separated from all habitable rooms above by not less than a $^5/_8$-inch (15.9 mm) Type X *gypsum board* or equivalent and $^1/_2$-inch (12.7 mm) *gypsum board* applied to structures supporting the separation from habitable rooms above the garage. Door openings between a *private garage* and the *dwelling unit* shall be equipped with either solid wood doors or solid or honeycomb core steel doors not less than $1^3/_8$ inches (34.9 mm) in thickness, or doors in compliance with Section 716.2.2.1 with a *fire protection rating* of not less than 20 minutes. Doors shall be *self-closing* and self-latching.

406.3.2.2 Ducts.

Ducts in a *private garage* and ducts penetrating the walls or ceilings separating the *dwelling unit* from the garage, including its *attic* area, shall be constructed of sheet steel of not less than 0.019 inch (0.48 mm) in thickness and shall not have openings into the garage.

406.3.3 Carports.

Carports shall be open on not fewer than two sides. Carports open on fewer than two sides shall be considered to be a garage and shall comply with the requirements for *private garages*.

406.3.3.1 Carport separation.

A separation is not required between a Group R-3 and U carport, provided that the carport is entirely open on two or more sides and there are not enclosed areas above.

406.4 Public parking garages.

Parking garages, other than *private garages*, shall be classified as public parking garages and shall comply with the provisions of Sections 406.2 and 406.4 and shall be classified as either an *open parking garage* or an enclosed parking garage. *Open parking garages* shall also comply with Section 406.5. Enclosed parking garages shall also comply with Section 406.6. See Section 510 for special provisions for parking garages.

406.4.1 Guards.

Guards shall be provided in accordance with Section 1015. *Guards* serving as *vehicle barriers* shall comply with Sections 406.4.2 and 1015.

406.4.2 Vehicle barriers.

Vehicle barriers not less than 2 feet 9 inches (835 mm) in height shall be placed where the vertical distance from the floor of a drive lane or parking space to the ground or surface directly below is greater than 1 foot (305 mm). *Vehicle barriers* shall comply with the loading requirements of Section 1607.10.

Exception: *Vehicle barriers* are not required in vehicle storage compartments in a mechanical access parking garage.

406.4.3 Ramps.

Vehicle ramps shall not be considered as required *exits* unless pedestrian facilities are provided. Vehicle ramps that are utilized for vertical circulation as well as for parking shall not exceed a slope of 1 unit vertical in 15 units horizontal (6.67-percent slope).

406.5 Open parking garages.

Open parking garages shall comply with Sections 406.2, 406.4 and 406.5.

406.5.1 Construction.

Open parking garages shall be of Type I, II or IV construction. *Open parking garages* shall meet the design requirements of Chapter 16. For *vehicle barriers*, see Section 406.4.2.

406.5.2 Openings.

For natural *ventilation* purposes, the exterior side of the structure shall have uniformly distributed openings on two or more sides. The area of such openings in *exterior walls* on a tier shall be not less than 20 percent of the total perimeter wall area of each tier. The aggregate length of the openings considered to be providing natural *ventilation* shall be not less than 40 percent of the perimeter of the tier. Interior walls shall be not less than 20 percent open with uniformly distributed openings.

Exception: Openings are not required to be distributed over 40 percent of the building perimeter where the required openings are uniformly distributed over two opposing sides of the building.

406.5.2.1 Openings below grade.

Where openings below grade provide required natural *ventilation*, the outside horizontal clear space shall be one and one-half times the depth of the opening. The width of the horizontal clear space shall be maintained from grade down to the bottom of the lowest required opening.

406.5.3 Mixed occupancies and uses.

Mixed uses shall be allowed in the same building as an *open parking garage* subject to the provisions of Sections 402.4.2.3, 406.5.11, 508.1, 510.3, 510.4 and 510.7.

406.5.4 Area and height.

Area and height of *open parking garages* shall be limited as set forth in Chapter 5 for Group S-2 occupancies and as further provided for in Section 508.1.

TABLE 406.5.4
OPEN PARKING GARAGES AREA AND HEIGHT

TYPE OF CONSTRUCTION	AREA PER TIER (square feet)	HEIGHT (in tiers)		
		Ramp access	Mechanical access	
			Automatic sprinkler system	
			No	Yes
IA	Unlimited	Unlimited	Unlimited	Unlimited
IB	Unlimited	12 tiers	12 tiers	18 tiers
IIA	50,000	10 tiers	10 tiers	15 tiers
IIB	50,000	8 tiers	8 tiers	12 tiers
IV	50,000	4 tiers	4 tiers	4 tiers

For SI: 1 square foot = 0.0929 m^2.

406.5.4.1 Single use.

Where the *open parking garage* is used exclusively for the parking or storage of private motor vehicles, and the building is without other uses, the area and height shall be permitted to comply with Table 406.5.4, along with increases allowed by Section 406.5.5.

Exception: The grade-level tier is permitted to contain an office, waiting and toilet rooms having a total combined area of not more than 1,000 square feet (93 m^2). Such area need not be separated from the *open parking garage*.

In *open parking garages* having a spiral or sloping floor, the horizontal projection of the structure at any cross section shall not exceed the allowable area per parking tier. In the case of an *open parking garage* having a continuous spiral floor, each 9 feet 6 inches (2896 mm) of height, or portion thereof, shall be considered under these provisions to be a tier.

406.5.5 Area and height increases.

The allowable area and height of *open parking garages* shall be increased in accordance with the provisions of this section. Garages with sides open on three-fourths of the building's perimeter are permitted to be increased by 25 percent in area and one tier in height. Garages with sides open around the entire building's perimeter are permitted to be increased by 50 percent in area and one tier in height. For a side to be considered open under these provisions, the total area of openings along the side shall be not less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm).

Allowable tier areas in Table 406.5.4 shall be increased for *open parking garages* constructed to heights less than the table maximum. The gross tier area of the garage shall not exceed that permitted for the higher structure. Not fewer than three sides of each such larger tier shall have continuous horizontal openings not less than 30 inches (762 mm) in clear height extending for not less than 80 percent of the length of the sides. All parts of such larger tier shall be not more than 200 feet (60 960 mm) horizontally from such an opening. In addition, each such opening shall face a street or *yard* with access to a street with a width of not less than 30 feet (9144 mm) for the full length of the opening, and *standpipes* shall be provided in each such tier.

Open parking garages of Type II construction, with all sides open, shall be unlimited in allowable area where the *building height* does not exceed 75 feet (22 860 mm). For a side to be considered open, the total area of openings along the side shall be not less than 50 percent of the interior area of the side at each tier and such openings shall be equally distributed along the length of the tier. For purposes of calculating the interior area of the side, the height shall not exceed 7 feet (2134 mm). All portions of tiers shall be within 200 feet (60 960 mm) horizontally from such openings or other natural *ventilation* openings as defined in Section 406.5.2. These openings shall be permitted to be provided in *courts* with a minimum dimension of 20 feet (6096 mm) for the full width of the openings.

406.5.6 Fire separation distance.

Exterior walls and openings in *exterior walls* shall comply with Table 601 and Table 705.5. The distance to an adjacent *lot line* shall be determined in accordance with Section 705 and Table 705.5.

406.5.7 Means of egress.

Where persons other than parking attendants are permitted, *open parking garages* shall meet the *means of egress* requirements of Chapter 10. Where persons other than parking attendants are not permitted, there shall be not fewer than two exit stairways. Each *exit stairway* shall be not less than 36 inches (914 mm) in width. Lifts shall be permitted to be installed for use of employees only, provided that they are completely enclosed by noncombustible materials.

[F] 406.5.8 Standpipe system.

An *open parking garage* shall be equipped with a *standpipe system* as required by Section 905.3.

406.5.9 Enclosure of vertical openings.

Enclosure shall not be required for vertical openings except as specified in Section 406.5.7.

406.5.10 Ventilation.

Ventilation, other than the percentage of openings specified in Section 406.5.2, shall not be required.

406.5.11 Prohibitions.

The following uses and alterations are not permitted:

1. Vehicle repair work.
2. Parking of buses, trucks and similar vehicles.
3. Partial or complete closing of required openings in *exterior walls* by tarpaulins or any other means.
4. Dispensing of fuel.

406.6 Enclosed parking garages.

Enclosed parking garages shall comply with Sections 406.2, 406.4 and 406.6.

406.6.1 Heights and areas.

Enclosed vehicle parking garages and portions thereof that do not meet the definition of *open parking garages* shall be limited to the allowable heights and areas specified in Sections 504 and 506 as modified by Section 507. Roof parking is permitted.

406.6.2 Ventilation.

A mechanical *ventilation* system and exhaust system shall be provided in accordance with Chapters 4 and 5 of the International Mechanical Code.

> **Exception:** Mechanical *ventilation* shall not be required for enclosed parking garages that are accessory to one- and two-family *dwellings.*

[F] 406.6.3 Automatic sprinkler system.

An enclosed parking garage shall be equipped with an *automatic sprinkler system* in accordance with Section 903.2.10.

406.6.4 Mechanical-access enclosed parking garages.

Mechanical-access enclosed parking garages shall be in accordance with Sections 406.6.4.1 through 406.6.4.4.

406.6.4.1 Separation.

Mechanical-access enclosed parking garages shall be separated from other occupancies and accessory uses by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or by not less than 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

406.6.4.2 Smoke removal.

A mechanical smoke removal system, installed in accordance with Section 910.4, shall be provided for all areas containing a *mechanical-access enclosed parking garage*.

406.6.4.3 Fire control equipment room.

Fire control equipment, consisting of the *fire alarm* control unit, mechanical *ventilation* controls and an emergency shutdown switch, shall be provided in a room located where the equipment is able to be accessed by the fire service from a secured exterior door of the building. The room shall be not less than 50 square feet (4.65 m^2) in area and shall be in a location that is approved by the fire code official.

406.6.4.3.1 Emergency shutdown switch.

The mechanical parking system shall be provided with a manually activated emergency shutdown switch for use by emergency personnel. The switch shall be clearly identified and shall be in a location approved by the fire code official.

406.6.4.4 Fire department access doors.

Access doors shall be provided in accordance with Section 3206.7 of the *International Fire Code.*

406.7 Motor fuel-dispensing facilities.

Motor fuel-dispensing facilities shall comply with the *International Fire Code* and Sections 406.2 and 406.7.

406.7.1 Vehicle fueling pad.

The vehicle shall be fueled on noncoated concrete or other *approved* paving material having a resistance not exceeding 1 megohm as determined by the methodology in CEN EN 1081.

406.7.2 Canopies.

Canopies under which fuels are dispensed shall have a clear, unobstructed height of not less than 13 feet 6 inches (4115 mm) to the lowest projecting element in the vehicle drive-through area. Canopies and their supports over pumps shall be of noncombustible materials, *fire-retardant-treated wood* complying with Chapter 23, heavy timber complying with Section 2304.11 or construction providing 1-hour *fire resistance*. Combustible materials used in or on a *canopy* shall comply with one of the following:

1. Shielded from the pumps by a noncombustible element of the *canopy*, or heavy timber complying with Section 2304.11.
2. Plastics covered by aluminum facing having a thickness of not less than 0.010 inch (0.30 mm) or corrosion-resistant steel having a base metal thickness of not less than 0.016 inch (0.41 mm). The plastic shall have a *flame spread index* of 25 or less and a *smoke-developed index* of 450 or less when tested in the form intended for use in accordance with ASTM E84 or UL 723 and a self-ignition temperature of 650°F (343°C) or greater when tested in accordance with ASTM D1929.
3. Panels constructed of light-transmitting plastic materials shall be permitted to be installed in *canopies* erected over motor vehicle fuel-dispensing station fuel dispensers, provided that the panels are located not less than 10 feet (3048 mm) from any building on the same *lot* and face *yards* or streets not less than 40 feet (12 192 mm) in width on the other sides. The aggregate areas of plastics shall be not greater than 1,000 square feet (93 m^2). The

maximum area of any individual panel shall be not greater than 100 square feet (9.3 m^2).

406.7.2.1 Canopies used to support gaseous hydrogen systems.

Canopies that are used to shelter dispensing operations where flammable compressed gases are located on the roof of the *canopy* shall be in accordance with the following:

1. The *canopy* shall meet or exceed Type I construction requirements.
2. Operations located under *canopies* shall be limited to refueling only.
3. The *canopy* shall be constructed in a manner that prevents the accumulation of hydrogen gas.

406.8 Repair garages.

Repair garages shall be constructed in accordance with the *International Fire Code* and Sections 406.2 and 406.8. This occupancy shall not include motor fuel-dispensing facilities, as regulated in Section 406.7.

406.8.1 Ventilation.

Repair garages shall be mechanically ventilated in accordance with the *International Mechanical Code*. The *ventilation* system shall be controlled at the entrance to the garage.

[F] 406.8.2 Gas detection system.

Repair garages used for repair of vehicles fueled by nonodorized gases including but not limited to hydrogen and nonodorized LNG, shall be provided with a *gas detection system* that complies with Section 916. The *gas detection system* shall be designed to detect leakage of nonodorized gaseous fuel. Where lubrication or chassis service pits are provided in garages used for repairing nonodorized LNG-fueled vehicles, gas sensors shall be provided in such pits.

[F] 406.8.2.1 System activation.

Activation of a gas detection alarm shall result in all of the following:

1. Initiation of distinct audible and visual alarm signals in the *repair garage*, where the *ventilation* system is interlocked with gas detection.
2. Deactivation of all heating systems located in the *repair garage*.
3. Activation of the mechanical *ventilation* system, where the system is interlocked with gas detection.

[F] 406.8.2.2 Failure of the gas detection system.

Failure of the *gas detection system* shall automatically deactivate the heating system, activate the mechanical ventilation system where the system is interlocked with the *gas detection system*, and cause a trouble signal to sound at an *approved* location.

[F] 406.8.3 Automatic sprinkler system.

A *repair garage* shall be equipped with an *automatic sprinkler system* in accordance with Section 903.2.9.1.

SECTION 407
GROUP I-2

407.1 General.

Occupancies in Group I-2 shall comply with the provisions of Sections 407.1 through 407.11 and other applicable provisions of this code.

407.2 Corridors continuity and separation.

Corridors in occupancies in Group I-2 shall be continuous to the *exits* and shall be separated from other areas in accordance with Section 407.3 except spaces conforming to Sections 407.2.1 through 407.2.6.

407.2.1 Waiting and similar areas.

Waiting areas, public-use areas or group meeting spaces constructed as required for *corridors* shall be permitted to be open to a *corridor*, only where all of the following criteria are met:

1. The spaces are not occupied as care recipient's sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
2. The open space is protected by an *automatic* fire detection system installed in accordance with Section 907.
3. The *corridors* onto which the spaces open, in the same *smoke compartment*, are protected by an *automatic* fire detection system installed in accordance with Section 907, or the *smoke compartment* in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
4. The space is arranged so as not to obstruct access to the required *exits*.

407.2.2 Care providers' stations.

Spaces for care providers', supervisory staff, doctors' and nurses' charting, communications and related clerical areas shall be permitted to be open to the *corridor*, where such spaces are constructed as required for *corridors*.

407.2.3 Psychiatric treatment areas.

Areas wherein psychiatric care recipients who are *incapable of self-preservation* are housed, or group meeting or multipurpose therapeutic spaces other than incidental uses in accordance with Section 509, under continuous supervision by facility staff, shall be permitted to be open to the *corridor*, where the following criteria are met:

1. Each area does not exceed 1,500 square feet (140 m^2).
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required *exits*.
4. The area is equipped with an *automatic* fire detection system installed in accordance with Section 907.2.
5. Not more than one such space is permitted in any one *smoke compartment*.
6. The walls and ceilings of the space are constructed as required for *corridors*.

407.2.4 Gift shops.

Gift shops and associated storage that are less than 500 square feet (455 m^2) in area shall be permitted to be open to the *corridor* where such spaces are constructed as required for *corridors*.

407.2.5 Nursing home housing units.

In Group I-2, Condition 1 occupancies, in areas where *nursing home* residents are housed, shared living spaces, group meeting or multipurpose therapeutic spaces shall be permitted to be open to the *corridor*, where all of the following criteria are met:

1. The walls and ceilings of the space are constructed as required for *corridors*.
2. The spaces are not occupied as resident sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
3. The open space is protected by an *automatic* fire detection system installed in accordance with Section 907.
4. The *corridors* onto which the spaces open, in the same *smoke compartment*, are protected by an *automatic* fire detection system installed in accordance with Section 907, or the *smoke compartment* in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
5. The space is arranged so as not to obstruct access to the required *exits*.

407.2.6 Nursing home cooking facilities.

In Group I-2, Condition 1 occupancies, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted to be open to the *corridor* where all of the following criteria are met:

1. The number of care recipients housed in the *smoke compartment* shall not be greater than 30.
2. The number of care recipients served by the cooking facility shall not be greater than 30.
3. Not more than one cooking facility area shall be permitted in a *smoke compartment*.
4. The *corridor* shall be a clearly identified space delineated by construction or floor pattern, material or color.
5. The space containing the domestic cooking facility shall be arranged so as not to obstruct access to the required *exit*.
6. The cooking appliance shall comply with Section 407.2.7.

407.2.7 Domestic cooking appliances.

In Group I-2 occupancies, installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the *International Mechanical Code* shall be provided over cooktops and ranges.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. A shut-off for the fuel and electrical power supply to the cooking equipment shall be provided in a location to which only staff has access.
5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906, and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

Exceptions:

1. Cooktops and ranges located within smoke compartments with no patient sleeping or patient care areas are not required to comply with this section.
2. Cooktops and ranges used for care recipient training or nutritional counseling are not required to comply with Item 3 of this section.

407.3 Corridor wall construction.

Corridor walls shall be constructed as *smoke partitions* in accordance with Section 710.

407.3.1 Corridor doors.

Corridor doors, other than those in a wall required to be rated by Section 509.4 or for the enclosure of a vertical opening or an *exit*, shall not have a required *fire protection rating* and shall not be required to be equipped with *self-closing* or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching. Roller latches are not permitted. Other doors shall conform to Section 716.

407.3.1.1 Door construction.

Doors in *corridors* not required to have a *fire protection rating* shall comply with the following:

1. Solid doors shall have close-fitting operational tolerances, head and jamb stops.
2. Dutch-style doors shall have an astragal, rabbet or bevel at the meeting edges of the upper and lower door sections. Both the upper and lower door sections shall have latching hardware. Dutch-style doors shall have hardware that connects the upper and lower sections to function as a single leaf.
3. To provide makeup air for exhaust systems in accordance with Section 1020.6, Exception 1, doors are permitted to have louvers or to have a clearance between the bottom of the door and the floor surface that is $^2/_3$ inch (19.1 mm) maximum.

407.4 Means of egress.

Group I-2 occupancies shall be provided with means of egress complying with Sections 407.4.1 through 407.4.4 and Chapter 10.

407.4.1 Direct access to a corridor.

Habitable rooms in Group I-2 occupancies shall have an exit access door leading directly to a *corridor*.

Exceptions:

1. Rooms with *exit* doors opening directly to the outside at ground level.
2. Rooms arranged as *care suites* complying with Section 407.4.4.

407.4.1.1 Special locking arrangement.

Means of egress doors shall be permitted to contain locking devices restricting the means of egress in areas in which the clinical needs of the patients require restraint of movement, where all of the following conditions are met:

1. The locks release upon activation of the fire alarm system or the loss of power.
2. The *building* is equipped with an approved automatic sprinkler system in accordance with Section 903.3.1.1.
3. A manual release device is provided at a nursing station responsible for the area.
4. A key-operated switch or other manual device is provided adjacent to each door equipped with the locking device. Such switch or other device, when operated, shall result in direct interruption of power to the lock—independent of the control system electronics
5. All staff shall have keys or other means to unlock the switch or other device or each door provided with the locking device.

407.4.2 Distance of travel.

The distance of travel between any point in a Group I-2 occupancy sleeping room, not located in a *care suite*, and an *exit access* door in that room shall be not greater than 50 feet (15 240 mm).

407.4.3 Projections in nursing home corridors.

In Group I-2, Condition 1 occupancies, where the *corridor* width is not less than 96 inches (2440 mm), projections shall be permitted for furniture where all of the following criteria are met:

1. The furniture is attached to the floor or to the wall.
2. The furniture does not reduce the clear width of the *corridor* to less than 72 inches (1830 mm) except where other encroachments are permitted in accordance with Section 1005.7.
3. The furniture is positioned on only one side of the *corridor.*
4. Each arrangement of furniture is 50 square feet (4.6 m^2) maximum in area.
5. Furniture arrangements are separated by 10 feet (3048 mm) minimum.
6. Placement of furniture is considered as part of the fire and safety plans in accordance with Section 1002.2.

407.4.4 Group I-2 care suites.

Care suites in Group I-2 shall comply with Sections 407.4.4.1 through 407.4.4.4 and either Section 407.4.4.5 or 407.4.4.6.

407.4.4.1 Exit access through care suites.

Exit access from all other portions of a building not classified as a *care suite* shall not pass through a *care suite*.

407.4.4.2 Separation.

Care suites shall be separated from other portions of the building, including other *care suites*, by a *smoke partition* complying with Section 710.

407.4.4.3 Access to corridor.

Every *care suite* shall have a door leading directly to an *exit access corridor* or *horizontal exit*. Movement from habitable rooms within a *care suite* shall not require more than 100 feet (30 480 mm) of travel within the *care suite* to a door leading to the *exit access corridor* or *horizontal exit*. Where a *care suite* is required to have more than one *exit access* door by Section 407.4.4.5.2 or 407.4.4.6.2, the additional door shall lead directly to an *exit access corridor*, *exit* or an adjacent suite.

407.4.4.4 Doors within care suites.

Doors in *care suites* serving habitable rooms shall be permitted to comply with one of the following:

1. Manually operated horizontal sliding doors permitted in accordance with Exception 9 to Section 1010.1.2.
2. *Power-operated* doors permitted in accordance with Section 1010.1.2, Exception 7.
3. *Means of egress* doors complying with Section 1010.

407.4.4.5 Care suites containing sleeping room areas.

Sleeping rooms shall be permitted to be grouped into *care suites* where one of the following criteria is met:

1. The *care suite* is not used as an *exit access* for more than eight care recipient beds.
2. The arrangement of the *care suite* allows for direct and constant visual supervision into the sleeping rooms by care providers.
3. An *automatic* smoke detection system is provided in the sleeping rooms and installed in accordance with NFPA 72.

407.4.4.5.1 Area.

Care suites containing sleeping rooms shall be not greater than 7,500 square feet (696 m^2) in area.

Exception: *Care suites* containing sleeping rooms shall be permitted to be not greater than 10,000 square feet (929 m^2) in area where an *automatic* smoke detection system is provided throughout the *care suite* and installed in accordance with NFPA 72.

407.4.4.5.2 Exit access.

Any sleeping room, or any *care suite* that contains sleeping rooms, of more than 1,000 square feet (93 m^2) shall have not fewer than two *exit access* doors from the *care suite* located in accordance with Section 1007.

407.4.4.6 Care suites not containing sleeping rooms.

Areas not containing sleeping rooms, but only treatment areas and the associated rooms, spaces or circulation space, shall be permitted to be grouped into *care suites* and shall conform to the limitations in Sections 407.4.4.6.1 and 407.4.4.6.2.

407.4.4.6.1 Area.

Care suites of rooms, other than sleeping rooms, shall have an area not greater than 12,500 square feet (1161 m^2).

Exception: *Care suites* not containing sleeping rooms shall be permitted to be not greater than 15,000 square feet (1394 m^2) in area where an *automatic* smoke detection system is provided throughout the *care suite* in accordance with Section 907.

407.4.4.6.2 Exit access.

Care suites, other than sleeping rooms, with an area of more than 2,500 square feet (232 m^2) shall have not fewer than two *exit access* doors from the *care suite* located in accordance with Section 1007.

407.5 Smoke barriers.

Smoke barriers shall be provided to subdivide every *story* used by persons receiving care, treatment or sleeping into not fewer than two *smoke compartments*. *Smoke barriers* shall be provided to subdivide other *stories* with an *occupant load* of 50 or more persons, into not fewer than two *smoke compartments*. The *smoke barrier* shall be in accordance with Section 709.

407.5.1 Smoke compartment size.

Stories shall be divided into *smoke compartments* with an area of not more than 22,500 square feet (2092 m^2) in Group I-2 occupancies.

Exceptions:

1. A *smoke compartment* in Group I-2, Condition 2 is permitted to have an area of not more than 40,000 square feet (3716 m^2) provided that all patient sleeping rooms within that *smoke compartment* are configured for single patient occupancy and any suite within the *smoke compartment* complies with Section 407.4.4.
2. A *smoke compartment* in Group I-2, Condition 2 without patient sleeping rooms is permitted to have an area of not more than 40,000 square feet (3716 m^2).

407.5.2 Exit access travel distance.

The distance of travel from any point in a *smoke compartment* to a *smoke barrier* door shall be not greater than 200 feet (60 960 mm).

407.5.3 Refuge area.

Refuge areas shall be provided within each *smoke compartment*. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining *smoke compartment*. Where a *smoke compartment* is adjoined by two or more *smoke compartments*, the minimum area of the refuge area shall accommodate the largest *occupant load* of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 30 net square feet (2.8 m^2) for each care recipient confined to bed or stretcher.
2. Not less than 6 square feet (0.56 m^2) for each ambulatory care recipient not confined to bed or stretcher and for other occupants.

Areas or spaces permitted to be included in the calculation of refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

407.5.4 Independent egress.

A *means of egress* shall be provided from each *smoke compartment* created by *smoke barriers* without having to return through the *smoke compartment* from which *means of egress* originated. *Smoke compartments* that do not contain an *exit* shall be provided with *direct access* to not less than two adjacent *smoke compartments*.

407.5.5 Horizontal assemblies.

Horizontal assemblies supporting *smoke barriers* required by this section shall be designed to resist the movement of smoke. Elevator lobbies shall be in accordance with Section 3006.2.

407.6 Automatic-closing doors.

Automatic-closing doors with hold-open devices shall comply with Sections 709.5 and 716.2.

407.6.1 Activation of automatic-closing doors.

Automatic-closing doors on hold-open devices in accordance with Section 716.2.6.6 shall also close upon activation of a *fire alarm* system, an *automatic sprinkler system*, or both. The *automatic* release of the hold-open device on one door shall release all such doors within the same *smoke compartment.*

[F] 407.7 Automatic sprinkler system.

Smoke compartments containing sleeping rooms shall be equipped throughout with an *automatic sprinkler* system in accordance with Sections 903.3.1.1 and 903.3.2.

[F] 407.8 Fire alarm system.

A *fire alarm* system shall be provided in accordance with Section 907.2.6.

[F] 407.9 Automatic fire detection.

Corridors in Group I-2, Condition 1 occupancies and spaces permitted to be open to the *corridors* by Section 407.2 shall be equipped with an *automatic* fire detection system.

Group I-2, Condition 2 occupancies shall be equipped with smoke detection as required in Section 407.2.

Exceptions:

1. Corridor smoke detection is not required where sleeping rooms are provided with *smoke detectors* that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each sleeping room and an audible and visual alarm at the care provider's station attending each unit.
2. *Corridor* smoke detection is not required where sleeping room doors are equipped with automatic door-closing devices with integral *smoke detectors* on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.

407.10 Secured yards.

Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet (2.8 m^2) for bed and stretcher care recipients and 6 net square feet (0.56 m^2) for ambulatory care recipients and other occupants are located between the building and the fence. Such provided safe dispersal areas shall be located not less than 50 feet (15 240 mm) from the building they serve.

[F] 407.11 Electrical systems.

In Group I-2 occupancies, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.

407.12 Emergency power systems.

Emergency power shall be provided for medical life support *equipment*, operating, recovery, intensive care, emergency rooms, fire detection and alarm systems in any Group I-2 occupancy licensed by the Virginia Department of Health as a hospital, nursing home or *hospice facility*.

SECTION 408
GROUP I-3

408.1 General.

Occupancies in Group I-3 shall comply with the provisions of Sections 408.1 through 408.11 and other applicable provisions of this code (see Section 308.5).

408.2 Other occupancies.

Buildings or portions of buildings in Group I-3 occupancies where security operations necessitate the locking of required *means of egress* shall be permitted to be classified as a different occupancy. Occupancies classified as other than Group I-3 shall meet the applicable requirements of this code for that occupancy where provisions are made for the release of occupants at all times.

Means of egress from detention and correctional occupancies that traverse other use areas shall, as a minimum, conform to requirements for detention and correctional occupancies.

Exception: It is permissible to exit through a *horizontal exit* into other contiguous occupancies that do not conform to detention and correctional occupancy egress provisions but that do comply with requirements set forth in the appropriate occupancy, as long as the occupancy is not a Group H use.

408.2.1 Short-term holding areas.

Short-term holding areas shall be permitted to comply with Section 431.

408.3 Means of egress.

Except as modified or as provided for in this section, the *means of egress* provisions of Chapter 10 shall apply.

408.3.1 Door width.

Doors to resident *sleeping units* shall have a clear width of not less than 28 inches (711 mm).

408.3.2 Sliding doors.

Where doors in a *means of egress* are of the horizontal-sliding type, the force to slide the door to its fully open position shall be not greater than 50 pounds (220 N) with a perpendicular force against the door of 50 pounds (220 N).

408.3.3 Guard tower doors.

A hatch or trap door not less than 16 square feet (610 m^2) in area through the floor and having dimensions of not less than 2 feet (610 mm) in any direction shall be permitted to be used as a portion of the *means of egress* from guard towers.

408.3.4 Spiral stairways.

Spiral stairways that conform to the requirements of Section 1011.10 are permitted for access to and between staff locations.

408.3.5 Ship's ladders.

Ship's ladders shall be permitted for egress from control rooms or elevated facility observation rooms in accordance with Section 1011.15.

408.3.6 Exit discharge.

Exits are permitted to discharge into a fenced or walled courtyard. Enclosed *yards* or *courts* shall be of a size to accommodate all occupants, be located not less than 50 feet (15 240 mm) from the building and have an area of not less than 15 square feet (1.4 m^2) per person.

408.3.7 Sallyports.

A *sallyport* shall be permitted in a *means of egress* where there are provisions for continuous and unobstructed passage through the *sallyport* during an emergency egress condition.

408.3.8 Interior exit stairway and ramp construction.

One *interior exit stairway* or *ramp* in each building shall be permitted to have glazing installed in doors and interior walls at each landing level providing access to the *interior exit stairway* or *ramp*, provided that the following conditions are met:

1. The *interior exit stairway or ramp* shall not serve more than four floor levels.
2. *Exit* doors shall be not less than $^3/_4$-hour *fire door assemblies* complying with Section 716.
3. The total area of glazing at each floor level shall not exceed 5,000 square inches (3.2 m^2) and individual panels of glazing shall not exceed 1,296 square inches (0.84 m^2).

4. The glazing shall be protected on both sides by an *automatic sprinkler system*. The sprinkler system shall be designed to wet completely the entire surface of any glazing affected by fire when actuated.
5. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
6. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.4 Locks.

Egress doors are permitted to be locked in accordance with the applicable use condition. Doors from a refuge area to the outside are permitted to be locked with a key in lieu of locking methods described in Section 408.4.1. The keys to unlock the exterior doors shall be available at all times and the locks shall be operable from both sides of the door.

408.4.1 Remote release.

Remote release of locks on doors in a *means of egress* shall be provided with reliable means of operation, remote from the resident living areas, to release locks on all required doors. In Occupancy Condition 3 or 4, the arrangement, accessibility and security of the release mechanisms required for egress shall be such that with the minimum available staff at any time, the lock mechanisms are capable of being released within 2 minutes.

Exception: Provisions for remote locking and unlocking of occupied rooms in Occupancy Condition 4 are not required provided that not more than 10 locks are necessary to be unlocked in order to move occupants from one *smoke compartment* to a refuge area within 3 minutes. The opening of necessary locks shall be accomplished with not more than two separate keys.

[F] 408.4.2 Power-operated doors and locks.

Power-operated sliding doors or *power-operated* locks for swinging doors shall be operable by a manual release mechanism at the door. Emergency power shall be provided for the doors and locks in accordance with Section 2702.

Exceptions:

1. Emergency power is not required in facilities with 10 or fewer locks complying with the exception to Section 408.4.1.
2. Emergency power is not required where remote mechanical operating releases are provided.

408.4.3 Redundant operation.

Remote release, mechanically operated sliding doors or remote release, mechanically operated locks shall be provided with a mechanically operated release mechanism at each door, or shall be provided with a redundant remote release control.

408.4.4 Relock capability.

Doors remotely unlocked under emergency conditions shall not automatically relock when closed unless specific action is taken at the remote location to enable doors to relock.

408.5 Protection of vertical openings.

Any vertical opening shall be protected by a shaft enclosure in accordance with Section 713, or shall be in accordance with Section 408.5.1.

408.5.1 Floor openings.

Openings in floors within a *housing unit* are permitted without a shaft enclosure, provided that all of the following conditions are met:

1. The entire normally occupied areas so interconnected are open and unobstructed so as to enable observation of the areas by supervisory personnel.
2. *Means of egress* capacity is sufficient for all occupants from all interconnected *cell tiers* and areas.
3. The height difference between the floor levels of the highest and lowest *cell tiers* shall not exceed 23 feet (7010 mm).
4. Egress from any portion of the *cell tier* to an *exit* or *exit access* door shall not require travel on more than one additional floor level within the *housing unit*.

408.5.2 Shaft openings in communicating floor levels.

Where a floor opening is permitted between communicating floor levels of a *housing unit* in accordance with Section 408.5.1, plumbing chases serving vertically stacked individual cells contained with the *housing unit* shall be permitted without a shaft enclosure.

408.6 Smoke barrier.

Occupancies classified as Group I-3 shall have smoke barriers complying with Sections 408.8 and 709 to divide every story occupied by residents for sleeping, or any other story having an occupant load of 50 or more persons, into no fewer

than two smoke compartments.

408.6.1 Smoke compartments.

The number of residents in any *smoke compartment* shall be not more than 200. The distance of travel to a door in a *smoke barrier* from any room door required as *exit access* shall be not greater than 150 feet (45 720 mm). The distance of travel to a door in a *smoke barrier* from any point in a room shall be not greater than 200 feet (60 960 mm).

408.6.2 Refuge area.

Not less than 6 net square feet (0.56 m^2) per occupant shall be provided on each side of each *smoke barrier* for the total number of occupants in adjoining *smoke compartments*. This space shall be readily available wherever the occupants are moved across the *smoke barrier* in a fire emergency.

408.6.3 Independent egress.

A *means of egress* shall be provided from each *smoke compartment* created by *smoke barriers* without having to return through the *smoke compartment* from which *means of egress* originates.

408.7 Security glazing.

In occupancies in Group I-3, windows and doors in 1-hour *fire barriers* constructed in accordance with Section 707, *fire partitions* constructed in accordance with Section 708 and *smoke barriers* constructed in accordance with Section 709 shall be permitted to have security glazing installed provided that the following conditions are met.

1. Individual panels of glazing shall not exceed 1,296 square inches (0.84 m^2).
2. The glazing shall be protected on both sides by an *automatic sprinkler system*. The sprinkler system shall be designed to, when actuated, wet completely the entire surface of any glazing affected by fire.
3. The glazing shall be in a gasketed frame and installed in such a manner that the framing system will deflect without breaking (loading) the glass before the sprinkler system operates.
4. Obstructions, such as curtain rods, drapery traverse rods, curtains, drapes or similar materials shall not be installed between the automatic sprinklers and the glazing.

408.8 Subdivision of resident housing areas.

Sleeping areas and any contiguous day room, group activity space or other common spaces where residents are housed shall be separated from other spaces in accordance with Sections 408.8.1 through 408.8.4.

408.8.1 Occupancy Conditions 3 and 4.

Each sleeping area in Occupancy Conditions 3 and 4 shall be separated from the adjacent common spaces by a smoke-tight partition where the distance of travel from the sleeping area through the common space to the *corridor* exceeds 50 feet (15 240 mm).

408.8.2 Occupancy Condition 5.

Each sleeping area in Occupancy Condition 5 shall be separated from adjacent sleeping areas, *corridors* and common spaces by a smoke-tight partition. Additionally, common spaces shall be separated from the *corridor* by a smoke-tight partition.

408.8.3 Openings in room face.

The aggregate area of openings in a solid sleeping room face in Occupancy Conditions 2, 3, 4 and 5 shall not exceed 120 square inches (0.77 m^2). The aggregate area shall include all openings including door undercuts, food passes and grilles. Openings shall be not more than 36 inches (914 mm) above the floor. In Occupancy Condition 5, the openings shall be closeable from the room side.

408.8.4 Smoke-tight doors.

Doors in openings in partitions required to be smoke tight by Section 408.8 shall be substantial doors, of construction that will resist the passage of smoke. Latches and door closures are not required on *cell* doors.

408.9 Smoke control.

Smoke control for each smoke compartment shall be in accordance with Sections 408.9.1 through 408.9.3.

Exception: Smoke compartments with operable windows or windows that are readily breakable.

408.9.1 Locations.

An engineered smoke control system shall comply with Section 909 and shall be provided in the following locations:

1. Dormitory areas.
2. Celled areas.
3. General housing areas.
4. Intake areas.
5. Medical celled or medical dormitory areas.

6. Interior recreation areas.

408.9.2 Compliance.

The engineered smoke control system shall provide and maintain a *tenable environment* in the area of origin and shall comply with all of the following:

1. Shall facilitate the timely evacuation and relocation of occupants from the area of origin.
2. Shall be independent of exhaust systems under Chapter 5 of the *Virginia Mechanical Code*.
3. Duration of operation in accordance with Section 909.4.6.
4. The pressurization method shall be permitted and shall provide a minimum of 24 air changes per hour of exhaust, and 20 air changes per hour of makeup, and shall comply with Section 909.6. If the pressurization method is not utilized, the exhaust method shall be provided and shall comply with Section 909.8.

408.9.3 Corridors.

Egress corridors within smoke compartments shall be kept free and clear of smoke.

[F] 408.10 Fire alarm system.

A *fire alarm* system shall be provided in accordance with Section 907.2.6.3.

[F] 408.11 Automatic sprinkler system.

Group I-3 occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.6.

SECTION 409
MOTION PICTURE PROJECTION ROOMS

409.1 General.

The provisions of Sections 409.1 through 409.5 shall apply to rooms in which ribbon-type cellulose acetate or other safety film is utilized in conjunction with electric arc, xenon or other light-source projection equipment that develops hazardous gases, dust or radiation. Where cellulose nitrate film is utilized or stored, such rooms shall comply with NFPA 40.

409.1.1 Projection room required.

Every motion picture machine projecting film as mentioned within the scope of this section shall be enclosed in a projection room. Appurtenant electrical equipment, such as rheostats, transformers and generators, shall be within the projection room or in an adjacent room of equivalent construction.

409.2 Construction of projection rooms.

Every projection room shall be of permanent construction consistent with the construction requirements for the type of building in which the projection room is located. Openings are not required to be protected.

The room shall have a floor area of not less than 80 square feet (7.44 m^2) for a single machine and not less than 40 square feet (3.7 m^2) for each additional machine. Each motion picture projector, floodlight, spotlight or similar piece of equipment shall have a clear working space of not less than 30 inches by 30 inches (762 mm by 762 mm) on each side and at the rear thereof, but only one such space shall be required between two adjacent projectors. The projection room and the rooms appurtenant thereto shall have a ceiling height of not less than 7 feet 6 inches (2286 mm). The aggregate of openings for projection equipment shall not exceed 25 percent of the area of the wall between the projection room and the auditorium. Openings shall be provided with glass or other *approved* material, so as to close completely the opening.

409.3 Projection room and equipment ventilation.

Ventilation shall be provided in accordance with the *International Mechanical Code*.

409.3.1 Supply air.

Each projection room shall be provided with adequate air supply inlets so arranged as to provide well-distributed air throughout the room. Air inlet ducts shall provide an amount of air equivalent to the amount of air being exhausted by projection equipment. Air is permitted to be taken from the outside; from adjacent spaces within the building, provided that the volume and infiltration rate are sufficient; or from the building air-conditioning system, provided that it is so arranged as to provide sufficient air when other systems are not in operation.

409.3.2 Exhaust air.

Projection rooms are permitted to be exhausted through the lamp exhaust system. The lamp exhaust system shall be positively interconnected with the lamp so that the lamp will not operate unless there is the required airflow. Exhaust air ducts shall terminate at the exterior of the building in such a location that the exhaust air cannot be readily recirculated into any air supply system. The projection room *ventilation* system is permitted to also serve appurtenant rooms, such as the generator and rewind rooms.

409.3.3 Projection machines.

Each projection machine shall be provided with an exhaust duct that will draw air from each lamp and exhaust it directly to the outside of the building. The lamp exhaust is permitted to serve to exhaust air from the projection room to provide room air circulation. Such ducts shall be of rigid materials, except for a flexible connector *approved* for the purpose. The projection lamp or projection room exhaust system, or both, is permitted to be combined but shall not be interconnected with any other exhaust or return system, or both, within the building.

409.4 Lighting control.

Provisions shall be made for control of the auditorium lighting and the *means of egress* lighting systems of theaters from inside the projection room and from not less than one other convenient point in the building.

409.5 Miscellaneous equipment.

Each projection room shall be provided with rewind and film storage facilities.

SECTION 410
STAGES, PLATFORMS AND TECHNICAL PRODUCTION AREAS

410.1 Applicability.

The provisions of Sections 410.1 through 410.7 shall apply to all parts of buildings and structures that contain *stages* or *platforms* and similar appurtenances as herein defined.

410.2 Stages.

Stage construction shall comply with Sections 410.2.1 through 410.2.7.

410.2.1 Stage construction.

Stages shall be constructed of materials as required for floors for the type of construction of the building in which such *stages* are located.

Exception: *Stages* need not be constructed of the same materials as required for the type of construction provided that the construction complies with one of the following:

1. *Stages* of Type IIB or IV construction with a nominal 2-inch (51 mm) wood deck, provided that the *stage* is separated from other areas in accordance with Section 410.2.4.
2. In buildings of Type IIA, IIIA and VA construction, a fire-resistance-rated floor is not required, provided that the space below the *stage* is equipped with an *automatic sprinkler system* or *fire-extinguishing system* in accordance with Section 903 or 904.
3. In all types of construction, the finished floor shall be constructed of wood or *approved* noncombustible materials. Openings through stage floors shall be equipped with tight-fitting, solid wood trap doors with *approved* safety locks.

410.2.1.1 Stage height and area.

Stage areas shall be measured to include the entire performance area and adjacent backstage and support areas not separated from the performance area by fire-resistance-rated construction. *Stage* height shall be measured from the lowest point on the *stage* floor to the highest point of the roof or floor deck above the *stage*.

410.2.2 Technical production areas: galleries, gridirons and catwalks.

Beams designed only for the attachment of portable or fixed theater equipment, gridirons, galleries and catwalks shall be constructed of *approved* materials consistent with the requirements for the type of construction of the building; and a *fire-resistance rating* shall not be required. These areas shall not be considered to be floors, *stories, mezzanines* or levels in applying this code.

Exception: Floors of fly galleries and catwalks shall be constructed of any *approved* material.

410.2.3 Exterior stage doors.

Where protection of openings is required, exterior *exit* doors shall be protected with *fire door assemblies* that comply with Section 716. Exterior openings that are located on the *stage* for *means of egress* or loading and unloading purposes, and that are likely to be open during occupancy of the theater, shall be constructed with vestibules to prevent air drafts into the auditorium.

410.2.4 Proscenium wall.

Where the *stage* height is greater than 50 feet (15 240 mm), all portions of the *stage* shall be completely separated from the seating area by a *proscenium wall* with not less than a 2-hour *fire-resistance rating* extending continuously from the foundation to the roof.

410.2.5 Proscenium curtain.

Where a *proscenium wall* is required to have a *fire-resistance rating*, the *stage* opening shall be provided with a fire curtain complying with NFPA 80, horizontal sliding doors complying with Section 716 having a *fire protection rating* of not less than 1 hour, or an *approved* water curtain complying with Section 903.3.1.1 or, in facilities not utilizing the provisions of *smoke-protected assembly seating* in accordance with Section 1030.6.2, a smoke control system complying with Section 909 or natural *ventilation* designed to maintain the smoke level not less than 6 feet (1829 mm) above the floor of the *means of egress*.

410.2.6 Scenery.

Combustible materials used in sets and scenery shall meet the fire propagation performance criteria of Test Method 1 or Test Method 2, as appropriate, of NFPA 701, in accordance with Section 806 and the *International Fire Code*. Foam plastics and materials containing foam plastics shall comply with Section 2603 and the *International Fire Code*.

410.2.7 Stage ventilation.

Emergency *ventilation* shall be provided for *stages* larger than 1,000 square feet (93 m^2) in floor area, or with a *stage* height greater than 50 feet (15 240 mm). Such *ventilation* shall comply with Section 410.2.7.1 or 410.2.7.2.

410.2.7.1 Roof vents.

Two or more vents constructed to open automatically by *approved* heat-activated devices and with an aggregate clear opening area of not less than 5 percent of the area of the *stage* shall be located near the center and above the highest part of the *stage area*. Supplemental means shall be provided for manual operation of the ventilator. Curbs shall be provided as required for skylights in Section 2610.2. Vents shall be *labeled*.

[F] 410.2.7.2 Smoke control.

Smoke control in accordance with Section 909 shall be provided to maintain the smoke layer interface not less than 6 feet (1829 mm) above the highest level of the assembly seating or above the top of the proscenium opening where a *proscenium wall* is provided in compliance with Section 410.2.4.

410.3 Platform construction.

Permanent *platforms* shall be constructed of materials as required for the type of construction of the building in which the permanent *platform* is located. Permanent *platforms* are permitted to be constructed of *fire-retardant-treated wood* for Types I, II and IV construction where the *platforms* are not more than 30 inches (762 mm) above the main floor, and not more than one-third of the room floor area and not more than 3,000 square feet (279 m^2) in area. Where the space beneath the permanent *platform* is used for storage or any purpose other than equipment, wiring or plumbing, the floor assembly shall be not less than 1-hour fire-resistance-rated construction. Where the space beneath the permanent *platform* is used only for equipment, wiring or plumbing, the underside of the permanent *platform* need not be protected.

410.3.1 Temporary platforms.

Platforms installed for a period of not more than 30 days are permitted to be constructed of any materials permitted by this code. The space between the floor and the *platform* above shall only be used for plumbing and electrical wiring to *platform* equipment.

410.4 Dressing and appurtenant rooms.

Dressing and appurtenant rooms shall comply with Sections 410.4.1 and 410.4.2.

410.4.1 Separation from stage.

The *stage* shall be separated from dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the *stage* and other parts of the building by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire-resistance rating* shall be not less than 2 hours for *stage* heights greater than 50 feet (15 240 mm) and not less than 1 hour for *stage* heights of 50 feet (15 240 mm) or less.

410.4.2 Separation from each other.

Dressing rooms, scene docks, property rooms, workshops, storerooms and compartments appurtenant to the *stage* shall be separated from each other by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

410.5 Means of egress.

Except as modified or as provided for in this section, the provisions of Chapter 10 shall apply.

410.5.1 Arrangement.

Where two or more *exits* or *exit access doorways* from the *stage* are required in accordance with Section 1006.2, not fewer than one *exit* or *exit access doorway* shall be provided on each side of a *stage*.

410.5.2 Stairway and ramp enclosure.

Exit access stairways and *ramps* serving a *stage* or *platform* are not required to be enclosed. *Exit access stairways* and *ramps* serving *technical production areas* are not required to be enclosed.

410.5.3 Technical production areas.

Technical production areas shall be provided with *means of egress* and means of escape in accordance with Sections 410.5.3.1 through 410.5.3.5.

410.5.3.1 Number of means of egress.

Not fewer than one *means of egress* shall be provided from *technical production areas*.

410.5.3.2 Exit access travel distance.

The *exit access* travel distance shall be not greater than 300 feet (91 440 mm) for buildings without a sprinkler system and 400 feet (122 mm) for buildings equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

410.5.3.3 Two means of egress.

Where two *means of egress* are required, the *common path of travel* shall be not greater than 100 feet (30 480 mm).

Exception: A means of escape to a roof in place of a second *means of egress* is permitted.

410.5.3.4 Path of egress travel.

The following *exit access* components are permitted where serving *technical production areas*:

1. *Stairways*.
2. *Ramps*.
3. *Spiral stairways*.
4. Catwalks.
5. *Alternating tread devices*.
6. Permanent ladders.

410.5.3.5 Width.

The path of egress travel within and from technical support areas shall be not less than 22 inches (559 mm).

[F] 410.6 Automatic sprinkler system.

Stages shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1. Sprinklers shall be installed under the roof and gridiron and under all catwalks and galleries over the *stage*. Sprinklers shall be installed in dressing rooms, performer lounges, shops and storerooms accessory to such *stages*.

Exceptions:

1. Sprinklers are not required under *stage* areas less than 4 feet (1219 mm) in clear height that are utilized exclusively for storage of tables and chairs, provided that the concealed space is separated from the adjacent spaces by Type X *gypsum board* not less than $^5/_8$-inch (15.9 mm) in thickness.
2. Sprinklers are not required for *stages* 1,000 square feet (93 m^2) or less in area and 50 feet (15 240 mm) or less in height where curtains, scenery or other combustible hangings are not retractable vertically. Combustible hangings shall be limited to a single main curtain, borders, legs and a single backdrop.
3. Sprinklers are not required within portable orchestra enclosures on *stages*.

[F] 410.7 Standpipes.

Standpipe systems shall be provided in accordance with Section 905.

SECTION 411
SPECIAL AMUSEMENT AREAS

411.1 General.

Special amusement areas having an *occupant load* of 50 or more shall comply with the requirements for the appropriate Group A occupancy and Sections 411.1 through 411.7. *Special amusement areas* having an *occupant load* of less than 50 shall comply with the requirements for a Group B occupancy and Sections 411.1 through 411.7.

Exception: *Special amusement areas* that are without walls or a roof and constructed to prevent the accumulation of smoke need not comply with this section.

[F] 411.2 Automatic sprinkler system.

Buildings containing *special amusement areas* shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1. Where the *special amusement area* is temporary, the sprinkler water supply shall be of an *approved* temporary means.

Exception: *Automatic* sprinklers are not required where the total floor area of a temporary *special amusement area* is less than 1,000 square feet (93 m^2) and the *exit access* travel distance from any point in the *special amusement area* to an exit is less than 50 feet (15 240 mm).

[F] 411.3 Automatic smoke detection.

Buildings containing *special amusement areas* shall be equipped with an *automatic smoke detection system* in accordance with Section 907.2.12.

[F] 411.4 Emergency voice/alarm communications system.

An *emergency voice/alarm communications system* shall be provided in accordance with Section 907.2.12.

411.5 Puzzle room exiting.

Puzzle room exiting shall comply with one of the following:

1. Exiting in accordance with Chapter 10.
2. An alternative design approved by the building official.
3. Exits shall be open and readily available upon activation by the automatic fire alarm system, automatic sprinkler system, and a manual control at a constantly attended location.

411.6 Exit marking.

Exit signs shall be installed at the required *exit* or *exit access doorways* serving *special amusement areas* in accordance with this section and Section 1013. *Approved* directional exit markings shall be provided. Where mirrors, mazes or other designs are utilized that disguise the path of egress travel such that they are not apparent, *approved* and *listed* low-level exit signs that comply with Section 1013.5, and directional path markings *listed* in accordance with UL 1994, shall be provided and located not more than 8 inches (203 mm) above the walking surface and on or near the path of egress travel. Such markings shall become visible in an emergency. The directional exit marking shall be activated by the *automatic smoke detection system* and the *automatic sprinkler system* in accordance with Section 907.2.12.

411.6.1 Photoluminescent exit signs.

Where *photoluminescent exit* signs are installed, activating light source and viewing distance shall be in accordance with the listing and markings of the signs.

411.7 Interior finish.

The *interior finish* in *special amusement areas* shall be Class A in accordance with Section 803.1.

SECTION 412
AIRCRAFT-RELATED OCCUPANCIES

412.1 General.

Aircraft-related occupancies shall comply with Sections 412.1 through 412.7 and the *International Fire Code*.

412.2 Airport traffic control towers.

The provisions of Sections 412.2.1 through 412.2.6 shall apply to airport traffic control towers occupied only for the following uses:

1. Airport traffic control cab.
2. Electrical and mechanical equipment rooms.
3. Airport terminal radar and electronics rooms.
4. Office spaces incidental to the tower operation.
5. Lounges for employees, including sanitary facilities.

412.2.1 Construction.

The construction of airport traffic control towers shall comply with the provisions of Sections 412.2.1.1 through 412.2.1.3.

412.2.1.1 Type of construction.

Airport traffic control towers shall be constructed to comply with the height limitations of Table 412.2.1.1.

TABLE 412.2.1.1
HEIGHT LIMITATIONS FOR AIRPORT TRAFFIC CONTROL TOWERS

TYPE OF CONSTRUCTION	HEIGHT[a] (feet)
IA	Unlimited
IB	240
IIA	100
IIB	85
IIIA	65

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Height to be measured from *grade plane* to cab floor.

[BS] 412.2.1.2 Structural integrity of interior exit stairways and elevator hoistway enclosures.

Enclosures for *interior exit stairways* and elevator hoistway enclosures shall comply with Section 403.2.2 in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.1.3 Sprayed fire-resistant materials (SFRM).

The bond strength of the SFRM installed in airport traffic control towers shall be in accordance with Section 403.2.3 where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access.

412.2.2 Means of egress and evacuation.

The *means of egress* in airport traffic control towers shall comply with Sections 412.2.2.1 through 412.2.2.3.

412.2.2.1 Stairways.

Stairways in airport traffic control towers shall be in accordance with Section 1011. *Exit stairways* shall be *smokeproof enclosures* complying with one of the alternatives provided in Section 909.20.

Exception: *Stairways* in airport traffic control towers are not required to comply with Section 1011.12.

412.2.2.2 Exit access.

From observation levels, airport traffic control towers shall be permitted to have a single means of *exit access* for a distance of travel not greater than 100 feet (30 480 mm). *Exit access stairways* from the observation level need not be enclosed.

412.2.2.3 Number of exits.

Not less than one *exit stairway* shall be permitted for airport traffic control towers of any height provided that the *occupant load* per floor is not greater than 15 and the area per floor does not exceed 1,500 square feet (140 m^2).

412.2.2.3.1 Interior finish.

Where an airport traffic control tower is provided with only one *exit stairway*, *interior wall and ceiling finishes* shall be either Class A or Class B.

412.2.2.3.2 Exit separation.

Where an airport traffic control tower is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1 and two *exits* are required, the exit separation distance required by Section 1007 shall be not less than one-fourth of the length of the maximum overall dimension of the area served.

[F] 412.2.3 Emergency systems.

The detection, alarm and emergency systems of airport traffic control towers shall comply with Sections 412.2.3.1 through 412.2.3.3.

[F] 412.2.3.1 Automatic smoke detection systems.

Airport traffic control towers shall be provided with an *automatic* smoke detection system installed in accordance with Section 907.2.22.

[F] 412.2.3.2 Fire command center.

A *fire command center* shall be provided in airport traffic control towers where the control cab is located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access. The *fire command center* shall comply with Section 911.

Exceptions:

1. The *fire command center* shall be located in the airport control tower or an adjacent contiguous building where building functions are interdependent.
2. The room shall be not less than 150 square feet (14 m^2) in area with a minimum dimension of 10 feet (3048 mm).
3. The following features shall not be required in an airport traffic control tower *fire command center.*
   - 3.1. Emergency voice/alarm control unit.
   - 3.2. Public address system.
   - 3.3. Status indicators and controls for the air distributions centers.
   - 3.4. Generator supervision devices, manual start and transfer features.
   - 3.5. Elevator emergency or standby power switches where emergency or standby power is provided.

[F] 412.2.3.3 Smoke removal.

Smoke removal in airport traffic control towers shall be provided in accordance with Section 403.4.7.

[F] 412.2.4 Automatic sprinkler system.

Where an occupied floor is located more than 35 feet (10 668 mm) above the lowest level of fire department vehicle access, airport traffic control towers shall be equipped with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 412.2.4.1 Fire pump room.

Fire pumps shall be located in rooms that are separated from all other areas of the building by 2-hour *fire barriers* constructed in accordance with Section 707 or 2-hour *horizontal assemblies* constructed in accordance with Section 711, or both.

Exception: Separation is not required for fire pumps physically separated in accordance with NFPA 20.

[F] 412.2.5 Protection of elevator wiring and cables.

Wiring and cables serving elevators in airport traffic control towers shall be protected in accordance with Section 3007.8.1.

412.2.5.1 Elevators for occupant evacuation.

Where provided in addition to an exit stairway, occupant evacuation elevators shall be in accordance with Section 3008.

412.2.6 Accessibility.

Airport traffic control towers shall be *accessible* except as specified in Section 1104.4.

412.3 Aircraft hangars.

Aircraft hangars shall be in accordance with Sections 412.3.1 through 412.3.6.

412.3.1 Exterior walls.

Exterior walls located less than 30 feet (9144 mm) from *lot lines* or a *public way* shall have a *fire-resistance rating* not less than 2 hours.

412.3.2 Basements.

Where hangars have *basements*, floors over *basements* shall be of Type IA construction and shall be made tight against seepage of water, oil or vapors. There shall not be openings or communication between *basements* and the hangar. Access to *basements* shall be from outside only.

412.3.3 Floor surface.

Floors shall be graded and drained to prevent water or fuel from remaining on the floor. Floor drains shall discharge through an oil separator to the sewer or to an outside vented sump.

Exception: Aircraft hangars with individual lease spaces not exceeding 2,000 square feet (186 m^2) each in which servicing, repairing or washing is not conducted and fuel is not dispensed shall have floors that are graded toward the door, but shall not require a separator.

412.3.4 Heating equipment.

Heating equipment shall be placed in another room separated by 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Entrance shall be from the outside or by means of a vestibule providing a two-doorway separation.

Exceptions:

1. Unit heaters and vented infrared radiant heating equipment suspended not less than 10 feet (3048 mm) above the upper surface of wings or engine enclosures of the highest aircraft that are permitted to be housed in the hangar need not be located in a separate room provided that they are mounted not less than 8 feet (2438 mm) above the floor in shops, offices and other sections of the hangar communicating with storage or service areas.
2. Entrance to the separated room shall be permitted by a single interior door provided that the sources of ignition in the appliances are not less than 18 inches (457 mm) above the floor.

412.3.5 Finishing.

The process of "doping," involving use of a volatile flammable solvent, or of painting, shall be carried on in a separate *detached building* equipped with *automatic fire-extinguishing equipment* in accordance with Section 903.

[F] 412.3.6 Fire suppression.

Aircraft hangars shall be provided with a fire suppression system designed in accordance with NFPA 409, based on the classification for the hangar given in Table 412.3.6.

Exception: Where a *fixed base operator* has separate repair facilities on site, Group II hangars operated by a *fixed base operator* used for storage of *transient aircraft* only shall have a fire suppression system, but the system is exempt from foam requirements.

[F] TABLE 412.3.6
HANGAR FIRE SUPPRESSION REQUIREMENTS[a, b, c]

MAXIMUM SINGLE FIRE AREA (square feet)	TYPE OF CONSTRUCTION								
	IA	IB	IIA	IIB	IIIA	IIIB	IV	VA	VB
≥ 40,001	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I	Group I
40,000	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
30,000	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II	Group II
20,000	Group III	Group III	Group II	Group II	Group II	Group II	Group II	Group II	Group II
15,000	Group III	Group III	Group III	Group II	Group III	Group II	Group III	Group II	Group II
12,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II	Group II
8,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group II
5,000	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III	Group III

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2.

a. Aircraft hangars with a door height greater than 28 feet shall be provided with fire suppression for a Group I hangar regardless of maximum fire area.
b. Groups shall be as classified in accordance with NFPA 409.
c. Membrane structures complying with Section 3102 shall be classified as a Group IV hangar.

[F] 412.3.6.1 Hazardous operations.

Any Group III aircraft hangar according to Table 412.3.6 that contains hazardous operations including, but not limited to,

the following shall be provided with a Group I or II fire suppression system in accordance with NFPA 409 as applicable:

1. Doping.
2. Hot work including, but not limited to, welding, torch cutting and torch soldering.
3. Fuel transfer.
4. Fuel tank repair or maintenance not including defueled tanks in accordance with NFPA 409, inerted tanks or tanks that have never been fueled.
5. Spray finishing operations.
6. Total fuel capacity of all aircraft within the unsprinklered single *fire area* in excess of 1,600 gallons (6057 L).
7. Total fuel capacity of all aircraft within the maximum single *fire area* in excess of 7,500 gallons (28 390 L) for a hangar with an *automatic sprinkler system* in accordance with Section 903.3.1.1.

[F] 412.3.6.2 Separation of maximum single fire areas.

Maximum single *fire areas* established in accordance with hangar classification and construction type in Table 412.3.6 shall be separated by 2-hour *fire walls* constructed in accordance with Section 706. In determining the maximum single *fire area* as set forth in Table 412.3.6, ancillary uses that are separated from aircraft servicing areas by a *fire barrier* of not less than 1 hour, constructed in accordance with Section 707, shall not be included in the area.

412.4 Residential aircraft hangars.

Residential aircraft hangars shall comply with Sections 412.4.1 through 412.4.5.

412.4.1 Fire separation.

A hangar shall not be attached to a *dwelling* unless separated by a *fire barrier* having a *fire-resistance rating* of not less than 1 hour. Such separation shall be continuous from the foundation to the underside of the roof and unpierced except for doors leading to the *dwelling unit*. Doors into the *dwelling unit* shall be equipped with *self-closing* devices and conform to the requirements of Section 716 with a noncombustible raised sill not less than 4 inches (102 mm) in height. Openings from a hangar directly into a room used for sleeping purposes shall not be permitted.

412.4.2 Egress.

A hangar shall provide two *means of egress*. One of the doors into the dwelling shall be considered as meeting only one of the two *means of egress*.

[F] 412.4.3 Smoke alarms.

Smoke alarms shall be provided within the hangar in accordance with Section 907.2.22.

412.4.4 Independent systems.

Electrical, mechanical and plumbing drain, waste and vent (DWV) systems installed within the hangar shall be independent of the systems installed within the dwelling. Building sewer lines shall be permitted to be connected outside the structures.

Exception: *Smoke detector* wiring and feed for electrical subpanels in the hangar.

412.4.5 Height and area limits.

Residential aircraft hangars shall be not greater than 2,000 square feet (186 m^2) in area and 20 feet (6096 mm) in *building height*.

[F] 412.5 Aircraft paint hangars.

Aircraft painting operations shall be conducted in an aircraft paint hangar that complies with the provisions of Sections 412.5.1 through 412.5.8. Buildings and structures, or parts thereof, used for the application of flammable finishes shall comply with the applicable provisions of Section 416.

[F] 412.5.1 Occupancy classification.

Aircraft paint hangars shall be classified in accordance with the provisions of Section 307.1. Aircraft paint hangars shall comply with the applicable requirements of this code and the *International Fire Code* for such occupancy.

412.5.2 Construction.

Aircraft paint hangars shall be of Type I or II construction.

[F] 412.5.3 Spray equipment cleaning operations.

Spray equipment cleaning operations shall be conducted in a liquid use, dispensing and mixing room.

[F] 412.5.4 Operations.

Only those *flammable liquids* necessary for painting operations shall be permitted in quantities less than the maximum allowable quantities per *control area* in Table 307.1(1). Spray equipment cleaning operations exceeding the maximum allowable quantities per *control area* in Table 307.1(1) shall be conducted in a liquid use, dispensing and mixing room.

[F] 412.5.5 Storage.

Storage of *flammable or combustible liquids* exceeding the maximum allowable quantities per *control area* in Table 307.1(1) shall be in a *liquid storage room*.

[F] 412.5.6 Fire suppression.

Aircraft paint hangars shall be provided with fire suppression as required by NFPA 409.

[F] 412.5.7 Ventilation.

Aircraft paint hangars shall be provided with *ventilation* as required in the *International Mechanical Code*.

[F] 412.5.8 Electrical.

Electrical equipment and devices within the aircraft paint hangar shall comply with NFPA 70.

[F] 412.5.8.1 Class I, Division I hazardous locations.

The area within 10 feet (3048 mm) horizontally from aircraft surfaces and from the floor to 10 feet (3048 mm) above the aircraft surface shall be classified as a Class I, Division I location.

[F] 412.5.8.2 Class I, Division 2 hazardous locations.

The area horizontally from aircraft surfaces between 10 feet (3048 mm) and 30 feet (9144 mm) and from the floor to 30 feet (9144 mm) above the aircraft surface shall be classified as a Class I, Division 2 location.

412.6 Aircraft manufacturing facilities.

In buildings used for the manufacturing of aircraft, *exit access* travel distances indicated in Section 1017.1 shall be increased in accordance with the following:

1. The building shall be of Type I or II construction.
2. *Exit access* travel distance shall not exceed the distances given in Table 412.6.

TABLE 412.6
AIRCRAFT MANUFACTURING EXIT ACCESS TRAVEL DISTANCE

HEIGHT (feet)[b]	MANUFACTURING AREA (square feet)[a]					
	≥ 150,000	≥ 200,000	≥ 250,000	≥ 500,000	≥ 750,000	≥ 1,000,000
≥ 25	400	450	500	500	500	500
≥ 50	400	500	600	700	700	700
≥ 75	400	500	700	850	1,000	1,000
≥ 100	400	500	750	1,000	1,250	1,500

For SI: 1 foot = 304.8 mm.

a. Contiguous floor area of the aircraft manufacturing facility having the indicated height.

b. Minimum height from finished floor to bottom of ceiling or roof slab or deck.

412.6.1 Ancillary areas.

Rooms, areas and spaces ancillary to the primary manufacturing area shall be permitted to egress through such area having a minimum height as indicated in Table 412.6. *Exit access* travel distance within the ancillary room, area or space shall not exceed that indicated in Table 1017.2 based on the occupancy classification of that ancillary area. Total *exit access* travel distance shall not exceed that indicated in Table 412.6.

[F] 412.7 Heliports and helistops.

Heliports and *helistops* shall be permitted to be erected on buildings or other locations where they are constructed in accordance with Sections 412.7.1 through 412.7.5.

[F] 412.7.1 Size.

The landing area for helicopters less than 3,500 pounds (1588 kg) shall be not less than 20 feet (6096 mm) in length and width. The landing area shall be surrounded on all sides by a clear area having an average width at roof level of 15 feet (4572 mm), and all widths shall be not less than 5 feet (1524 mm).

[F] 412.7.2 Design.

Helicopter landing areas and the supports thereof on the roof of a building shall be noncombustible construction. Landing areas shall be designed to confine any flammable liquid spillage to the landing area itself and provisions shall be made to drain such spillage away from any *exit* or *stairway* serving the helicopter landing area or from a structure housing such *exit* or *stairway*. For structural design requirements, see Section 1607.6.

412.7.3 Means of egress.

The *means of egress* from *heliports* and *helistops* shall comply with the provisions of Chapter 10. Landing areas located

on buildings or structures shall have two or more *exits or access to exits*. For landing areas less than 60 feet (18 288 mm) in length or less than 2,000 square feet (186 m^2) in area, the second *means of egress* is permitted to be a fire escape, *alternating tread device* or ladder leading to the floor below.

[F] 412.7.4 Rooftop heliports and helistops.

Rooftop *heliports* and *helistops* shall comply with NFPA 418.

[F] 412.7.5 Standpipe system.

In buildings equipped with a *standpipe system*, the standpipe shall extend to the roof level in accordance with Section 905.3.6.

SECTION 413
COMBUSTIBLE STORAGE

413.1 General.

High-piled stock or rack storage in any occupancy group shall comply with the *International Fire Code*.

413.2 Attic, under-floor and concealed spaces.

Attic, under-floor and concealed spaces used for storage of combustible materials shall be protected on the storage side as required for 1-hour fire-resistance-rated construction. Openings shall be protected by assemblies that are *self-closing* and are of noncombustible construction or solid wood core not less than $1^3/_4$ inches (45 mm) in thickness.

Exception: Neither fire-resistance-rated construction nor opening protectives are required in any of the following locations:

1. Areas protected by *approved automatic sprinkler systems*.
2. Group R-3 and U occupancies.

SECTION 414
HAZARDOUS MATERIALS

[F] 414.1 General.

The provisions of Sections 414.1 through 414.6 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of *hazardous materials.*

[F] 414.1.1 Other provisions.

Buildings and structures with an occupancy in Group H shall comply with this section and the applicable provisions of Section 415 and the *International Fire Code*.

[F] 414.1.2 Materials.

The safe design of hazardous material occupancies is material dependent. Individual material requirements are found in Sections 307 and 415, the *International Mechanical Code* and the *International Fire Code*.

[F] 414.1.2.1 Aerosol products, aerosol cooking spray products and plastic aerosol 3 products.

Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 productsshall be stored and displayed in accordance with the *International Fire Code*. See Section 311.2 and the *International Fire Code* for occupancy group requirements.

[F] 414.1.3 Information required.

A report shall be submitted to the *building official* identifying the maximum expected quantities of *hazardous materials* to be stored, used in a *closed system* and used in an *open system*, and subdivided to separately address *hazardous material* classification categories based onTables 307.1(1) and 307.1(2). The methods of protection from such hazards, including but not limited to *control areas*, fire protection systems and Group H occupancies shall be indicated in the report and on the *construction documents*. The opinion and report shall be prepared by a qualified person, firm or corporation *approved* by the *building official* and provided without charge to the enforcing agency.

For buildings and structures with an occupancy in Group H, separate floor plans shall be submitted identifying the locations of anticipated contents and processes so as to reflect the nature of each occupied portion of every building and structure.

[F] 414.2 Control areas.

Control areas shall comply with Sections 414.2.1 through 414.2.5 and the *International Fire Code*.

Exception: *Higher education laboratories* in accordance with Section 428 and Chapter 38 of the *International Fire Code*.

[F] 414.2.1 Construction requirements.

Control areas shall be separated from each other by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 414.2.2 Percentage of maximum allowable quantities.

The percentage of maximum allowable quantities of *hazardous materials* per *control area* permitted at each floor level within a building shall be in accordance with Table 414.2.2.

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

STORY		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA[a]	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS[b]
Above grade plane	Higher than 9	5	1	2
	7−9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1

Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.

b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

[F] 414.2.3 Number.

The maximum number of *control areas* within a building shall be in accordance with Table 414.2.2. For the purposes of determining the number of *control areas* within a building, each portion of a building separated by one or more *fire walls* complying with Section 706 shall be considered a separate building.

[F] 414.2.4 Fire-resistance rating requirements.

The required *fire-resistance rating* for *fire barriers* shall be in accordance with Table 414.2.2. The floor assembly of the *control area* and the construction supporting the floor of the *control area* shall have a *fire-resistance rating* of not less than 2 hours.

Exception: The floor assembly of the *control area* and the construction supporting the floor of the *control area* are allowed to be 1-hour fire-resistance-rated in buildings of Types IIA, IIIA, IV and VA construction, provided that both of the following conditions exist:

1. The building is equipped throughout with an *automatic sprinkler system* in accordance with Section 903.3.1.1.
2. The building is three or fewer *stories above grade plane*.

[F] 414.2.5 Hazardous material in Group M display and storage areas and in Group S storage areas.

Hazardous materials located in Group M and Group S occupancies shall be in accordance with Sections 414.2.5.1 through 414.2.5.3.

[F] TABLE 414.2.5(1)
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES OF NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS[d, e, f]

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material[a]	**Class**	**Solids (pounds)**	**Liquids (gallons)**
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
1. Corrosives[b, c]	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20[b, c]	2[b, c]
3. Toxics[b, c]	Not Applicable	1,000[k]	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers[b, c]	4	Not Allowed	Not Allowed
	3	1,350[g]	115
	2	2,250[h]	225
	1	18,000[i, j]	1,800[i, j]
2. Unstable (reactives)[b, c]	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3[b, c]	550	55
	2[b, c]	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. Hazard categories are as specified in the *International Fire Code*.

b. Maximum allowable quantities shall be increased 100 percent in buildings that are sprinklered in accordance with Section 903.3.1.1. Where Note c also applies, the increase for both notes shall be applied accumulatively.

c. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, in accordance with the *International Fire Code*. Where Note b also applies, the increase for both notes shall be applied accumulatively.

d. See Table 414.2.2 for design and number of control areas.

e. Allowable quantities for other hazardous material categories shall be in accordance with Section 307.

f. Maximum quantities shall be increased 100 percent in outdoor control areas.

g. Maximum amounts shall be increased to 2,250 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

h. Maximum amounts shall be increased to 4,500 pounds where individual packages are in the original sealed containers from the manufacturer or packager and do not exceed 10 pounds each.

i. The permitted quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

j. Quantities are unlimited in an outdoor control area.

k. Maximum allowable quantities of consumer products shall be increased to 10,000 pounds where individual packages are in the original, sealed containers from the manufacturer and the toxic classification is exclusively based on the LC threshold and no other hazardous materials classifications apply.

[F] TABLE 414.2.5(2)
MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA[a]

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with Note b densities and arrangements	Sprinklered in accordance with Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1 of the *International Fire Code*	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500[c]	15,000[c]	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m^2, 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m^2.

a. Control areas shall be separated from each other by not less than a 1-hour *fire barrier* wall.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:

1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.
2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to not more than 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

[F] 414.2.5.1 Nonflammable solids and nonflammable and noncombustible liquids.

The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single *control area* of a Group M display and storage area, a Group S storage area or an outdoor *control area i*s permitted to exceed the maximum allowable quantities per *control area* specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the *International Fire Code* and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

[F] 414.2.5.2 Flammable and combustible liquids.

In Group M occupancy wholesale and retail sales uses, indoor storage of *flammable and combustible liquids* shall not exceed the maximum allowable quantities per *control area* as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the *International Fire Code*.

[F] 414.2.5.3 Aerosol products, aerosol cooking spray products or plastic aerosol 3 products.

The maximum quantity of *aerosol products*, aerosol cooking spray products or plastic aerosol 3 productsin Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the *International Fire Code*.

[F] 414.3 Ventilation.

Rooms, areas or spaces in which *explosive*, *corrosive*, combustible, flammable or highly *toxic* dusts, mists, fumes, vapors or gases are or have the potential to be emitted due to the processing, *use*, handling or storage of materials shall be mechanically ventilated where required by this code, the *International Fire Code* or the *International Mechanical Code*.

Emissions generated at workstations shall be confined to the area in which they are generated as specified in the *International Fire Code* and the *International Mechanical Code*.

[F] 414.4 Hazardous material systems.

Systems involving *hazardous materials* shall be suitable for the intended application. Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path. *Automatic* controls, where provided, shall be designed to be fail safe.

[F] 414.5 Inside storage, dispensing and use.

The inside storage, dispensing and *use* of *hazardous materials* shall be in accordance with Sections 414.5.1 through 414.5.3 of this code and the *International Fire Code*.

[F] 414.5.1 Explosion control.

Explosion control shall be provided in accordance with the *International Fire Code* as required by Table 414.5.1 where quantities of *hazardous materials* specified in that table exceed the maximum allowable quantities in Table 307.1(1) or

where a structure, room or space is occupied for purposes involving *explosion* hazards as required by Section 415 or the *International Fire Code*.

[F] TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS[a, h]

MATERIAL	CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems[b]
HAZARD CATEGORY			
Combustible dusts[c]	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA[d]	Not Required	Required
	IB[e]	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable	Required	Not Permitted
	3 Nondetonable	Not Required	Required
Water-reactive liquids and solids	3	Not Required	Required
	2[g]	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Electrochemical energy storage system[i]	—	Not Required	Required
Energy storage system[i]	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist[f]	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

a. See Section 414.1.3.

b. See the *International Fire Code*.

c. Combustible dusts where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 104.8.2 of the *International Fire Code*. See definition of "Combustible dust" in Chapter 2.

d. Storage or use.

e. In open use or dispensing.

f. Rooms containing dispensing and use of hazardous materials where an explosive environment can occur because of the characteristics or nature of the hazardous materials or as a result of the dispensing or use process.

g. A method of explosion control shall be provided where Class 2 water-reactive materials can form potentially explosive mixtures.

h. Explosion venting is not required for Group H-5 fabrication areas complying with Section 415.11.1 and the International Fire Code.

i. Where explosion control is required in Section 1207 of the *International Fire Code*.

[F] 414.5.2 Emergency or standby power.

Where required by the *International Fire Code* or this code, mechanical *ventilation*, treatment systems, temperature control, alarm, detection or other electrically operated systems shall be provided with emergency or standby power in accordance with Section 2702. For storage and use areas for *highly toxic or toxic* materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the *International Fire Code*.

[F] 414.5.2.1 Exempt applications.

Emergency or standby power is not required for the mechanical *ventilation* systems provided for any of the following:

1. Storage of Class IB and IC flammable and combustible liquids in closed containers not exceeding 6.5 gallons (25 L) capacity.
2. Storage of Class 1 and 2 oxidizers.
3. Storage of Class II, III, IV and V organic peroxides.
4. Storage of asphyxiant, irritant and radioactive gases.

[F] 414.5.2.2 Fail-safe engineered systems.

Standby power for mechanical ventilation, treatment systems and temperature control systems shall not be required where an approved fail-safe engineered system is installed.

[F] 414.5.3 Spill control, drainage and containment.

Rooms, buildings or areas occupied for the storage of solid and liquid *hazardous materials* shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the *International Fire Code*. The methods of spill control shall be in accordance with the *International Fire Code*.

[F] 414.6 Outdoor storage, dispensing and use.

The outdoor storage, dispensing and use of *hazardous materials* shall be in accordance with the *International Fire Code*.

[F] 414.6.1 Weather protection.

Where weather protection is provided for sheltering outdoor *hazardous material* storage or use areas, such areas shall be considered outdoor storage or *use* where the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.

[F] 414.6.1.1 Walls.

Walls shall not obstruct more than one side of the structure.

Exception: Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area is not greater than 25 percent of the structure's perimeter.

[F] 414.6.1.2 Separation distance.

The distance from the structure to buildings, *lot lines*, *public ways* or *means of egress* to a *public way* shall be not less than the distance required for an outside *hazardous material* storage or use area without weather protection.

[F] 414.6.1.3 Noncombustible construction.

The overhead structure shall be of *approved* noncombustible construction with a maximum area of 1,500 square feet (140 m^2).

Exception: The maximum area is permitted to be increased as provided by Section 506.

414.6.2 Other regulations.

The installation, repair, upgrade, and closure of underground and aboveground storage tanks subject to the Virginia State Water Control Board regulations 9VAC25-91 and 9VAC25-580 shall be governed by those regulations, which are hereby incorporated by reference to be an enforceable part of this code. Where differences occur between the provisions of this code and the incorporated provisions of the State Water Control Board regulations, the provisions of the State Water Control Board regulations shall apply. Provisions of the *International Fire Code* addressing closure of such tanks that are subject to the Virginia State Water Control Board regulations 9VAC25-91 and 9VAC25-580 shall not be applicable.

SECTION 415
GROUPS H-1, H-2, H-3, H-4 AND H-5

[F] 415.1 General.

The provisions of Sections 415.1 through 415.11 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per *control area* listed in Section 307.1.

[F] 415.2 Compliance.

Buildings and structures with an occupancy in Group H shall comply with the applicable provisions of Section 414 and the *International Fire Code*.

[F] 415.3 Automatic fire detection systems.

Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.

[F] 415.4 Automatic sprinkler system.

Group H occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.5.

[F] 415.5 Emergency alarms.

Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.

[F] 415.5.1 Storage.

An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials. Emergency alarm-initiating devices shall be installed outside of each interior *exit* or exit access door of storage buildings, rooms or areas. Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.

[F] 415.5.2 Dispensing, use and handling.

Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through *corridors*, *interior exit stairways* or *ramps*, or exit passageways, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot (45 720 mm) intervals and at each exit and *exit access doorway* throughout the transport route. The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall initiate a local audible alarm.

[F] 415.5.3 Supervision.

Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be electrically supervised and monitored by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.

[F] 415.5.4 Emergency alarm systems.

Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be provided with emergency or standby power in accordance with Section 2702.2.

[F] 415.6 Fire separation distance.

Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an *exterior wall*.

[F] 415.6.1 Rooms for flammable or combustible liquid use, dispensing or mixing in open systems.

Rooms for *flammable or combustible liquid* use, dispensing or mixing in open systems having a floor area of not more than 500 square feet (46.5 m^2) need not be located on the outer perimeter of the building where they are in accordance with the *International Fire Code* and NFPA 30.

[F] 415.6.2 Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems.

Liquid storage rooms and rooms for *flammable or combustible liquid* use in closed systems, having a floor area of not more than 1,000 square feet (93 m^2) need not be located on the outer perimeter where they are in accordance with the *International Fire Code* and NFPA 30.

[F] 415.6.3 Spray paint booths.

Spray paint booths that comply with the *International Fire Code* need not be located on the outer perimeter.

[F] 415.6.4 Group H occupancy minimum fire separation distance.

Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the *minimum fire separation distance* as set forth in Sections 415.6.4.1 through 415.6.4.4. Distances shall be measured from the walls enclosing the occupancy to *lot lines*, including those on a public way. Distances to assumed *lot lines* established for the purpose of determining *exterior wall* and opening protection are not to be used to establish the minimum *fire separation distance* for buildings on sites where explosives are manufactured or used where separation is provided in accordance with the quantity distance tables specified for *explosive* materials in the *International Fire Code*.

[F] 415.6.4.1 Group H-1.

Group H-1 occupancies shall be set back not less than 75 feet (22 860 mm) and not less than required by the *International Fire Code*.

Exception: *Fireworks* manufacturing buildings separated in accordance with NFPA 1124.

[F] 415.6.4.2 Group H-2.

Group H-2 occupancies shall be set back not less than 30 feet (9144 mm) where the area of the occupancy is greater than 1,000 square feet (93 m^2) and it is not required to be located in a *detached building*.

[F] 415.6.4.3 Groups H-2 and H-3.

Group H-2 and H-3 occupancies shall be set back not less than 50 feet (15 240 mm) where a *detached building* is required (see Table 415.6.5).

[F] 415.6.4.4 Explosive materials.

Group H-2 and H-3 occupancies containing materials with *explosive* characteristics shall be separated as required by the *International Fire Code*. Where separations are not specified, the distances required shall be determined by a technical report issued in accordance with Section 414.1.3.

[F] 415.6.5 Detached buildings for Group H-1, H-2 or H-3 occupancy.

The storage or use of hazardous materials in excess of those amounts specified in Table 415.6.5 shall be in accordance with the applicable provisions of Sections 415.7 and 415.8.

[F] TABLE 415.6.5
DETACHED BUILDING REQUIRED

A DETACHED BUILDING IS REQUIRED WHERE THE QUANTITY OF MATERIAL EXCEEDS THAT SPECIFIED HEREIN			
Material	**Class**	**Solids and Liquids (tons)[a, b]**	**Gases (cubic feet)[a, b]**
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4[c]	1	
	Division 1.5	Maximum Allowable Quantity	
	Division 1.6	Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II	25	Not Applicable
	Class III	50	Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrophoric gases[d]	Not Applicable	Not Applicable	2,000

For SI: 1 ton = 906 kg, 1 cubic foot = 0.02832 m^3, 1 pound = 0.454 kg.

a. For materials that are detonable, the distance to other buildings or lot lines shall be in accordance with Section 415.6 of this code or Chapter 56 of the *International Fire Code* based on trinitrotoluene (TNT) equivalence of the material, whichever is

greater.

b. “Maximum Allowable Quantity” means the maximum allowable quantity per control area set forth in Table 307.1(1).

c. Limited to pision 1.4 materials and articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco, Firearms and Explosives (BATF) regulations or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles, provided that the net explosive weight of individual articles does not exceed 1 pound.

d. Detached buildings are not required, for gases in gas rooms that support H-5 fabrication facilities where the gas room is separated from other areas by a fire barrier with a fire-resistance rating of not less than 2 hours and the gas is located in a gas cabinet that is internally sprinklered, equipped with continuous leak detection, automatic shutdown and is not manifolded upstream of pressure controls. Additionally, the gas supply is limited to cylinders that do not exceed 125 pounds (57 kg) water capacity in accordance with 49 CFR 173.192 for Hazard Zone A toxic gases.

[F] 415.6.5.1 Wall and opening protection.

Where a *detached building* is required by Table 415.6.5, wall and opening protection based on *fire separation distance* is not required.

[F] 415.7 Special provisions for Group H-1 occupancies.

Group H-1 occupancies shall be in detached buildings not used for other purposes. Roofs shall be of lightweight construction with suitable thermal insulation to prevent sensitive material from reaching its decomposition temperature. Group H-1 occupancies containing materials that are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per *control area* in Table 307.1(2) shall comply with requirements for both Group H-1 and H-4 occupancies.

[F] 415.7.1 Floors in storage rooms.

Floors in storage areas for organic peroxides, *pyrophoric* materials and unstable (reactive) materials shall be of liquid-tight, noncombustible construction.

[F] 415.8 Special provisions for Group H-2 and H-3 occupancies.

Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in Table 415.6.5 shall be in *detached buildings* used for manufacturing, processing, dispensing, use or storage of hazardous materials. Materials specified for Group H-1 occupancies in Section 307.3 are permitted to be located within Group H-2 or H-3 *detached buildings* provided that the amount of materials per *control area* do not exceed the maximum allowed quantity specified in Table 307.1(1).

[F] 415.8.1 Multiple hazards.

Group H-2 or H-3 occupancies containing materials that are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per *control area* in Table 307.1(2) shall comply with requirements for Group H-2, H-3 or H-4 occupancies as applicable.

[F] 415.8.2 Separation of incompatible materials.

Hazardous materials other than those specified in Table 415.6.5 shall be allowed in manufacturing, processing, dispensing, use or storage areas when separated from *incompatible materials* in accordance with the provisions of the *International Fire Code*.

[F] 415.8.3 Water reactives. Group H-2 and H-3 occupancies containing water-reactive materials shall be resistant to water penetration.

Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by *approved* liquid-tight construction.

Exception: Fire protection piping shall be permitted over or through areas containing water reactives without isolating it with liquid-tight construction.

[F] 415.8.4 Floors in storage rooms.

Floors in storage areas for organic peroxides, oxidizers, *pyrophoric* materials, unstable (reactive) materials and water-

reactive solids and liquids shall be of liquid-tight, noncombustible construction.

[F] 415.8.5 Waterproof room.

Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than *approved automatic sprinkler systems* shall not be within such rooms or areas.

[F] 415.9 Group H-2.

Occupancies in Group H-2 shall be constructed in accordance withSections 415.9.1 through 415.9.3 and the *International Fire Code*.

[F] 415.9.1 Flammable and combustible liquids.

The storage, handling, processing and transporting of flammable and combustible liquids in Group H-2 and H-3 occupancies shall be in accordance with Sections 415.9.1.1 through 415.9.1.9, the *International Mechanical Code* and the *International Fire Code*.

[F] 415.9.1.1 Mixed occupancies.

Where the storage tank area is located in a building of two or more occupancies and the quantity of liquid exceeds the maximum allowable quantity for one *control area*, the use shall be completely separated from adjacent occupancies in accordance with the requirements of Section 508.4.

[F] 415.9.1.1.1 Height exception.

Where storage tanks are located within a building not more than one *story above grade plane*, the height limitation of Section 504 shall not apply for Group H.

[F] 415.9.1.2 Tank protection.

Storage tanks shall be noncombustible and protected from physical damage. *Fire barriers* or *horizontal assemblies* or both around the storage tanks shall be permitted as the method of protection from physical damage.

[F] 415.9.1.3 Tanks.

Storage tanks shall be approved tanks conforming to the requirements of the *International Fire Code*.

[F] 415.9.1.4 Leakage containment.

A liquid-tight containment area compatible with the stored liquid shall be provided. The method of spill control, drainage control and secondary containment shall be in accordance with the *International Fire Code*.

> **Exception:** Rooms where only double-wall storage tanks conforming to Section 415.9.1.3 are used to store Class I, II and IIIA flammable and combustible liquids shall not be required to have a leakage containment area.

[F] 415.9.1.5 Leakage alarm.

An *approved* automatic alarm shall be provided to indicate a leak in a storage tank and room. The alarm shall sound an audible signal, 15 dBa above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located. An *approved* sign shall be posted on every entry door to the tank storage room indicating the potential hazard of the interior room environment, or the sign shall state, “WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS.” The leakage alarm shall be supervised in accordance with Chapter 9 to transmit a trouble signal.

[F] 415.9.1.6 Tank vent.

Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the *International Fire Code*.

[F] 415.9.1.7 Room ventilation.

Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical *ventilation*. The mechanical *ventilation* system shall be in accordance with the *International Mechanical Code* and the *International Fire Code*.

[F] 415.9.1.8 Explosion venting.

Where Class I liquids are being stored, explosion venting shall be provided in accordance with the *International Fire Code*.

[F] 415.9.1.9 Tank openings other than vents.

Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.

[F] 415.9.2 Liquefied petroleum gas facilities.

The construction and installation of liquefied petroleum gas facilities shall be in accordance with the requirements of this code, the *International Fire Code*, the *International Fuel Gas Code*, the *International Mechanical Code* and NFPA 58.

[F] 415.9.3 Dry cleaning plants.

The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, the

International Mechanical Code, the *International Plumbing Code* and NFPA 32. Dry cleaning solvents and systems shall be classified in accordance with the *International Fire Code*.

[F] 415.10 Groups H-3 and H-4.

Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the *International Fire Code*.

[F] 415.10.1 Flammable and combustible liquids.

The storage, handling, processing and transporting of flammable and combustible liquids in Group H-3 occupancies shall be in accordance with Section 415.9.1.

[F] 415.10.2 Gas rooms.

Where gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 415.10.3 Floors in storage rooms.

Floors in storage areas for *corrosive* liquids and *highly toxic* or toxic materials shall be of liquid-tight, noncombustible construction.

[F] 415.10.4 Separation of highly toxic solids and liquids.

Highly toxic solids and liquids not stored in *approved* hazardous materials storage cabinets shall be isolated from other hazardous materials storage by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 415.11 Group H-5.

In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Sections 415.11.1 through 415.11.12 and the *International Fire Code*.

[F] 415.11.1 Fabrication areas.

Fabrication areas shall comply with Sections 415.11.1.1 through 415.11.1.8.

[F] 415.11.1.1 Hazardous materials.

Hazardous materials and hazardous production materials (HPM) shall comply with Sections 415.11.1.1.1 and 415.11.1.1.2.

[F] 415.11.1.1.1 Aggregate quantities.

The aggregate quantities of hazardous materials stored and used in a single *fabrication area* shall not exceed the quantities set forth in Table 415.11.1.1.1.

Exception: The quantity limitations for any hazard category in Table 415.11.1.1.1 shall not apply where the *fabrication area* contains quantities of hazardous materials not exceeding the maximum allowable quantities per *control area* established by Tables 307.1(1) and 307.1(2).

[F] TABLE 415.11.1.1.1
QUANTITY LIMITS FOR HAZARDOUS MATERIALS IN A SINGLE FABRICATION AREA IN GROUP H-5 [a]

HAZARD CATEGORY		SOLIDS (pounds per square foot)	LIQUIDS (gallons per square foot)	GAS (cubic feet @ NTP/square foot)
PHYSICAL-HAZARD MATERIALS				
Combustible dust		Note b	Not Applicable	Not Applicable
Combustible fiber	Loose	Note b	Not Applicable	Not Applicable
	Baled	Notes b and c		
Combustible liquid	II	Not Applicable	0.01	Not Applicable
	IIIA		0.02	
	IIIB		Not Limited	
Combination Class	I, II and IIIA		0.04	
Cryogenic gas	Flammable	Not Applicable	Not Applicable	Note d
	Oxidizing			1.25
Explosives		Note b	Note b	Note b
Flammable gas	Gaseous	Not Applicable	Not Applicable	Note d
	Liquefied			Note d
Flammable liquid	IA	Not Applicable	0.0025	Not Applicable
	IB		0.025	
	IC		0.025	

Combination Class	IA, IB and IC		0.025	
Combination Class	I, II and IIIA		0.04	
Flammable solid		0.001	Not Applicable	Not Applicable
Organic peroxide	Unclassified detonable	Note b	Not Applicable	Not Applicable
	Class I	Note b		
	Class II	0.025		
	Class III	0.1		
	Class IV	Not Limited		
	Class V	Not Limited		
Oxidizing gas	Gaseous	Not Applicable	Not Applicable	1.25
	Liquefied			1.25
Combination of gaseous and liquefied				1.25
Oxidizer	Class 4	Note b	Note b	Not Applicable
	Class 3	0.003	0.03	
	Class 2	0.003	0.03	
	Class 1	0.003	0.03	
Combination Class	1, 2, 3	0.003	0.03	
Pyrophoric materials		0.01	0.00125	Notes d and e
Unstable (reactive)	Class 4	Note b	Note b	Note b
	Class 3	0.025	0.0025	Note b
	Class 2	0.1	0.01	Note b
	Class 1	Not Limited	Not Limited	Not Limited
Water reactive	Class 3	0.01[f]	0.00125	Not Applicable
	Class 2	0.25	0.025	
	Class 1	Not Limited	Not Limited	
HEALTH-HAZARD MATERIALS				
Corrosives		Not Limited	Not Limited	Not Limited
Highly toxic		Not Limited	Not Limited	Note d
Toxics		Not Limited	Not Limited	Note d

For SI: 1 pound = 0.454 kg, 1 pound per square foot = 4.882 kg/m^2, 1 gallon per square foot = 40.7 L/m^2, 1 cubic foot @ NTP/square foot = 0.305 m^3 @ NTP/m^2, 1 cubic foot = 0.02832 m^3.

a. Hazardous materials within piping shall not be included in the calculated quantities.

b. Quantity of hazardous materials in a single fabrication shall not exceed the maximum allowable quantities per control area in Tables 307.1(1) and 307.1(2).

c. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.

d. The aggregate quantity of flammable, pyrophoric, toxic and highly toxic gases shall not exceed the greater of 0.2 cubic feet at NTP/square foot or 9,000 cubic feet at NTP.

e. The aggregate quantity of pyrophoric gases in the building shall not exceed the amounts set forth in Table 415.6.5.

f. Quantity of Class 3 water-reactive solids in a single tool shall not exceed 1 pound.

[F] 415.11.1.1.2 Hazardous production materials.

The maximum quantities of hazardous production materials (HPM) stored in a single *fabrication area* shall not exceed the

maximum allowable quantities per *control area* established by Table 307.1(1) and Table 307.1(2).

[F] 415.11.1.2 Separation.

Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.11.1.1.1, shall be separated from each other, from *corridors* and from other parts of the building by not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Exceptions:

1. Doors within such *fire barrier* walls, including doors to *corridors*, shall be only *self-closing fire door assemblies* having a *fire protection rating* of not less than $^3/_4$ hour.
2. Windows between *fabrication areas* and *corridors* are permitted to be fixed glazing *listed* and labeled for a *fire protection rating* of not less than $^3/_4$ hour in accordance with Section 716.

[F] 415.11.1.3 Location of occupied levels.

Occupied levels of *fabrication areas* shall be located at or above the first *story above grade plane*.

[F] 415.11.1.4 Floors.

Except for surfacing, floors within *fabrication areas* shall be of noncombustible construction.

Openings through floors of *fabrication areas* are permitted to be unprotected where the interconnected levels are used solely for mechanical equipment directly related to such *fabrication areas* (see Section 415.11.1.5).

Floors forming a part of an occupancy separation shall be liquid tight.

[F] 415.11.1.5 Shafts and openings through floors.

Elevator hoistways, vent *shafts* and other openings through floors shall be enclosed where required by Sections 712 and 713. Mechanical, duct and piping penetrations within a *fabrication area* shall not extend through more than two floors. The *annular space* around penetrations for cables, cable trays, tubing, piping, conduit or ducts shall be sealed at the floor level to restrict the movement of air. The *fabrication area*, including the areas through which the ductwork and piping extend, shall be considered to be a single conditioned environment.

[F] 415.11.1.6 Ventilation.

Mechanical exhaust *ventilation* at the rate of not less than 1 cubic foot per minute per square foot [0.0051 $m^3/(s \times m^2)$] of floor area shall be provided throughout the portions of the *fabrication area* where HPM are used or stored. The exhaust air duct system of one *fabrication area* shall not connect to another duct system outside that *fabrication area* within the building.

A *ventilation* system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

Two or more operations at a *workstation* shall not be connected to the same exhaust system where either one or the combination of the substances removed could constitute a fire, explosion or hazardous chemical reaction within the exhaust duct system.

Exhaust ducts penetrating *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711 shall be contained in a *shaft* of equivalent fire-resistance-rated construction. Exhaust ducts shall not penetrate *fire walls*.

Fire dampers shall not be installed in exhaust ducts.

[F] 415.11.1.7 Transporting hazardous production materials to fabrication areas.

HPM shall be transported to *fabrication areas* through enclosed piping or tubing systems that comply with Section 415.11.7, through *service corridors* complying with Section 415.11.3, or in *corridors* as permitted in the exception to Section 415.11.2. The handling or transporting of HPM within *service corridors* shall comply with the *International Fire Code*.

[F] 415.11.1.8 Electrical.

Electrical equipment and devices within the *fabrication area* shall comply with NFPA 70. The requirements for hazardous locations need not be applied where the average air change is not less than four times that set forth in Section 415.11.1.6 and where the number of air changes at any location is not less than three times that required by Section 415.11.1.6. The use of recirculated air shall be permitted.

[F] 415.11.1.8.1 Workstations.

Workstations shall not be energized without adequate exhaust *ventilation*. See Section 415.11.1.6 for workstation exhaust *ventilation requirements*.

[F] 415.11.2 Corridors.

Corridors shall comply with Chapter 10 and shall be separated from *fabrication areas* as specified in Section 415.11.1.2. *Corridors* shall not contain HPM and shall not be used for transporting such materials except through closed piping

systems as provided in Section 415.11.7.4.

Exception: Where existing *fabrication areas* are altered or modified, HPM is allowed to be transported in existing *corridors*, subject to the following conditions:

1. Nonproduction HPM is allowed to be transported in *corridors* if utilized for maintenance, lab work and testing.
2. Where existing *fabrication areas* are altered or modified, HPM is allowed to be transported in existing *corridors*, subject to the following conditions:
   2.1. Corridors. *Corridors* adjacent to the *fabrication area* where the alteration work is to be done shall comply with Section 1020 for a length determined as follows:
      2.1.1. The length of the common wall of the *corridor* and the *fabrication area*; and
      2.1.2. For the distance along the *corridor* to the point of entry of HPM into the *corridor* serving that *fabrication area*.
   2.2. *Emergency alarm system*. There shall be an emergency telephone system, a local manual alarm station or other *approved* alarm-initiating device within corridors at not more than 150-foot (45 720 mm) intervals and at each exit and doorway. The signal shall be relayed to an *approved* central, proprietary or remote station service or the *emergency control station* and shall initiate a local audible alarm.
   2.3. Pass-throughs. *Self-closing* doors having a *fire protection rating* of not less than 1 hour shall separate pass-throughs from existing *corridors*. Pass-throughs shall be constructed as required for the corridors and protected by an *approved automatic sprinkler system*.

[F] 415.11.3 Service corridors.

Service corridors within a Group H-5 occupancy shall comply with Sections 415.11.3.1 through 415.11.3.4.

[F] 415.11.3.1 Use conditions.

Service corridors shall be separated from *corridors* as required by Section 415.11.1.2. *Service corridors* shall not be used as a required *corridor*.

[F] 415.11.3.2 Mechanical ventilation.

Service corridors shall be mechanically ventilated as required by Section 415.11.1.6 or at not less than six air changes per hour.

[F] 415.11.3.3 Means of egress.

The distance of travel from any point in a *service corridor* to an *exit*, *exit access corridor* or door into a *fabrication area* shall be not greater than 75 feet (22 860 mm). Dead ends shall be not greater than 4 feet (1219 mm) in length. There shall be not less than two *exits*, and not more than one-half of the required *means of egress* shall require travel into a *fabrication area*. Doors from *service corridors* shall swing in the direction of egress travel and shall be *self-closing*.

[F] 415.11.3.4 Minimum width.

The clear width of a *service corridor* shall be not less than 5 feet (1524 mm), or 33 inches (838 mm) wider than the widest cart or truck used in the *service corridor*, whichever is greater.

[F] 415.11.4 Emergency alarm system.

Emergency alarm systems shall be provided in accordance with this section and Sections 415.5.1 and 415.5.2. The maximum allowable quantity per *control area* provisions shall not apply to *emergency alarm systems* required for HPM.

[F] 415.11.4.1 Service corridors.

An *emergency alarm system* shall be provided in *service corridors*, with not fewer than one alarm device in each *service corridor*.

[F] 415.11.4.2 Corridors and interior exit stairways and ramps.

Emergency alarms for *corridors, interior exit stairways* and *ramps* and *exit passageways* shall comply with Section 415.5.2.

[F] 415.11.4.3 Liquid storage rooms, HPM rooms and gas rooms.

Emergency alarms for liquid storage rooms, HPM rooms and gas rooms shall comply with Section 415.5.1.

[F] 415.11.4.4 Alarm-initiating devices.

An *approved* emergency telephone system, local alarm manual pull stations, or other *approved* alarm-initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] 415.11.4.5 Alarm signals.

Activation of the *emergency alarm system* shall sound a local alarm and transmit a signal to the *emergency control station*.

[F] 415.11.5 Storage of hazardous production materials.

Storage of hazardous production materials (HPM) in *fabrication areas* shall be within *approved* or *listed* storage cabinets or gas cabinets or within a *workstation*. The storage of HPM in quantities greater than those specified in Section 5004.2 of the *International Fire Code* shall be in liquid storage rooms, HPM rooms or gas rooms as appropriate for the materials stored. The storage of other hazardous materials shall be in accordance with other applicable provisions of this code and the *International Fire Code*.

[F] 415.11.6 HPM rooms, gas rooms, *liquid storage room* construction.

HPM rooms, gas rooms and liquid shall be constructed in accordance with Sections 415.11.6.1 through 415.11.6.9.

[F] 415.11.6.1 HPM rooms and gas rooms.

HPM rooms and gas rooms shall be separated from other areas by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire-resistance rating* shall be not less than 2 hours where the area is 300 square feet (27.9 m^2) or more and not less than 1 hour where the area is less than 300 square feet (27.9 m^2).

[F] 415.11.6.2 Liquid storage rooms.

Liquid storage rooms shall be constructed in accordance with the following requirements:

1. Rooms greater than 500 square feet (46.5 m^2) in area, shall have not fewer than one exterior door *approved* for fire department access.
2. Rooms shall be separated from other areas by *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. The *fire-resistance rating* shall be not less than 1 hour for rooms up to 150 square feet (13.9 m^2) in area and not less than 2 hours where the room is more than 150 square feet (13.9 m^2) in area.
3. Shelving, racks and wainscotting in such areas shall be of noncombustible construction or wood of not less than 1-inch (25 mm) nominal thickness or *fire-retardant-treated wood* complying with Section 2303.2.
4. Rooms used for the storage of Class I flammable liquids shall not be located in a *basement*.

[F] 415.11.6.3 Floors.

Except for surfacing, floors of HPM rooms and liquid storage rooms shall be of noncombustible liquid-tight construction. Raised grating over floors shall be of noncombustible materials.

[F] 415.11.6.4 Location.

Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have not fewer than one *exterior wall* and such wall shall be not less than 30 feet (9144 mm) from *lot lines*, including *lot lines* adjacent to *public ways*.

[F] 415.11.6.5 Explosion control.

Explosion control shall be provided where required by Section 414.5.1.

[F] 415.11.6.6 Exits.

Where two *exits* are required from HPM rooms, liquid storage rooms and gas rooms, one shall be directly to the outside of the building.

[F] 415.11.6.7 Doors.

Doors in a *fire barrier* wall, including doors to *corridors*, shall be *self-closing fire door assemblies* having a *fire protection rating* of not less than $^3/_4$ hour.

[F] 415.11.6.8 Ventilation.

Mechanical exhaust ventilation shall be provided in liquid storage rooms, HPM rooms and gas rooms at the rate of not less than 1 cubic foot per minute per square foot (0.044 L/s/m^2) of floor area or six air changes per hour.

Exhaust ventilation for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding areas and direct the exhaust ventilation to an exhaust system.

[F] 415.11.6.9 Emergency alarm system.

An *approved emergency alarm system* shall be provided for HPM rooms, liquid storage rooms and gas rooms.

Emergency alarm-initiating devices shall be installed outside of each interior exit door of such rooms.

Activation of an emergency alarm-initiating device shall sound a local alarm and transmit a signal to the *emergency control station*.

An *approved* emergency telephone system, local alarm manual pull stations or other *approved* alarm initiating devices are allowed to be used as emergency alarm-initiating devices.

[F] 415.11.7 Piping and tubing.

Hazardous production materials piping and tubing shall comply with this section and ASME B31.3.

[F] 415.11.7.1 HPM having a health-hazard ranking of 3 or 4.

Systems supplying HPM liquids or gases having a health-hazard ranking of 3 or 4 shall be welded throughout, except for connections, to the systems that are within a ventilated enclosure if the material is a gas, or an *approved* method of drainage or containment is provided for the connections if the material is a liquid.

[F] 415.11.7.2 Location in service corridors.

Hazardous production materials supply piping or tubing in *service corridors* shall be exposed to view.

[F] 415.11.7.3 Excess flow control.

Where HPM gases or liquids are carried in pressurized piping above 15 pounds per square inch gauge (psig) (103.4 kPa), excess flow control shall be provided. Where the piping originates from within a *liquid storage room*, *HPM room* or *gas room*, the excess flow control shall be located within the *liquid storage room*, *HPM room* or *gas room*. Where the piping originates from a bulk source, the excess flow control shall be located as close to the bulk source as practical.

[F] 415.11.7.4 Installations in corridors and above other occupancies.

The installation of HPM piping and tubing within the space defined by the walls of corridors and the floor or roof above, or in concealed spaces above other occupancies, shall be in accordance with Sections 415.11.7.1 through 415.11.7.3 and the following conditions:

1. Automatic sprinklers shall be installed within the space unless the space is less than 6 inches (152 mm) in the least dimension.
2. *Ventilation* not less than six air changes per hour shall be provided. The space shall not be used to convey air from any other area.
3. Where the piping or tubing is used to transport HPM liquids, a receptor shall be installed below such piping or tubing. The receptor shall be designed to collect any discharge or leakage and drain it to an *approved* location. The 1-hour enclosure shall not be used as part of the receptor.
4. HPM supply piping and tubing and nonmetallic waste lines shall be separated from the corridor and from occupancies other than Group H-5 by *fire barriers* or by an approved method or assembly that has a *fire-resistance rating* of not less than 1 hour. Access openings into the enclosure shall be protected by approved fire-protection-rated assemblies.
5. Readily accessible manual or automatic remotely activated fail-safe emergency shutoff valves shall be installed on piping and tubing other than waste lines at the following locations:
   5.1. At branch connections into the *fabrication area*.
   5.2. At entries into *corridors*.

Exception: Transverse crossings of the *corridors* by supply piping that is enclosed within a ferrous pipe or tube for the width of the *corridor* need not comply with Items 1 through 5.

[F] 415.11.7.5 Identification.

Piping, tubing and HPM waste lines shall be identified in accordance with ANSI A13.1 to indicate the material being transported.

[F] 415.11.8 Gas detection systems.

A *gas detection system* complying with Section 916 shall be provided for HPM gases where the *physiological warning threshold level* of the gas is at a higher level than the accepted permissible exposure limit (PEL) for the gas and for flammable gases in accordance with Sections 415.11.8.1 through 415.11.8.2.

[F] 415.11.8.1 Where required.

A *gas detection system* shall be provided in the areas identified in Sections 415.11.8.1.1 through 415.11.8.1.4.

[F] 415.11.8.1.1 Fabrication areas.

A *gas detection system* shall be provided in fabrication areas where HPM gas is used in the *fabrication area*.

[F] 415.11.8.1.2 HPM rooms.

A *continuous gas detection system* shall be provided in HPM rooms where HPM gas is used in the room.

[F] 415.11.8.1.3 Gas cabinets, exhausted enclosures and gas rooms.

A *gas detection system* shall be provided in gas cabinets and exhausted enclosures for HPM gas. A *gas detection system* shall be provided in gas rooms where HPM gases are not located in gas cabinets or exhausted enclosures.

[F] 415.11.8.1.4 Corridors.

Where HPM gases are transported in piping placed within the space defined by the walls of a corridor and the floor or roof above the corridor, a *gas detection system* shall be provided where piping is located and in the corridor.

Exception: A *gas detection system* is not required for occasional transverse *crossings* of the corridors by supply piping that is enclosed in a ferrous pipe or tube for the width of the corridor.

[F] 415.11.8.2 Gas detection system operation.

The *gas detection system* shall be capable of monitoring the room, area or equipment in which the HPM gas is located at or below all the following gas concentrations:

1. Immediately *dangerous* to life and health (IDLH) values where the monitoring point is within an *exhausted enclosure*, ventilated enclosure or *gas cabinet*.
2. Permissible exposure limit (PEL) levels where the monitoring point is in an area outside an *exhausted enclosure*, ventilated enclosure or *gas cabinet*.
3. For flammable gases, the monitoring detection threshold level shall be vapor concentrations in excess of 25 percent of the lower flammable limit (LFL) where the monitoring is within or outside an *exhausted enclosure*, ventilated enclosure or *gas cabinet*.
4. Except as noted in this section, monitoring for *highly toxic* and toxic gases shall also comply with Chapter 60 of the *International Fire Code*.

[F] 415.11.8.2.1 Alarms.

The *gas detection system* shall initiate a local alarm and transmit a signal to the *emergency control station* when a short-term hazard condition is detected. The alarm shall be both visual and audible and shall provide warning both inside and outside the area where the gas is detected. The audible alarm shall be distinct from all other alarms.

[F] 415.11.8.2.2 Shutoff of gas supply.

The gas detection system shall automatically close the shutoff valve at the source on gas supply piping and tubing related to the system being monitored for which gas is detected when a short-term hazard condition is detected. Automatic closure of shutoff valves shall comply with the following:

1. Where the gas detection sampling point initiating the gas detection system alarm is within a *gas cabinet* or *exhausted enclosure*, the shutoff valve in the *gas cabinet* or *exhausted enclosure* for the specific gas detected shall automatically close.
2. Where the gas detection sampling point initiating the gas detection system alarm is within a room and compressed gas containers are not in gas cabinets or an *exhausted enclosure*, the shutoff valves on all gas lines for the specific gas detected shall automatically close.
3. Where the gas detection sampling point initiating the gas detection system alarm is within a piping distribution manifold enclosure, the shutoff valve supplying the manifold for the compressed gas container of the specific gas detected shall automatically close.

Exception: Where the gas detection sampling point initiating the gas detection system alarm is at the use location or within a gas valve enclosure of a branch line downstream of a piping distribution manifold, the shutoff valve for the branch line located in the piping distribution manifold enclosure shall automatically close.

[F] 415.11.9 Manual fire alarm system.

An *approved* manual *fire alarm* system shall be provided throughout buildings containing Group H-5. Activation of the alarm system shall initiate a local alarm and transmit a signal to the *emergency control station*. The *fire alarm* system shall be designed and installed in accordance with Section 907.

[F] 415.11.10 Emergency control station.

An *emergency control station* shall be provided in accordance with Sections 415.11.10.1 through 415.11.10.3.

[F] 415.11.10.1 Location.

The *emergency control station* shall be located on the premises at an *approved* location outside the *fabrication area*.

[F] 415.11.10.2 Staffing.

Trained personnel shall continuously staff the *emergency control station*.

[F] 415.11.10.3 Signals.

The *emergency control station* shall receive signals from emergency equipment and alarm and detection systems. Such emergency equipment and alarm and detection systems shall include, but not be limited to, the following where such equipment or systems are required to be provided either in this chapter or elsewhere in this code:

1. *Automatic sprinkler system* alarm and monitoring systems.
2. Manual *fire alarm* systems.
3. *Emergency alarm systems*.
4. *Gas detection systems*.
5. Smoke detection systems.
6. Emergency power system.
7. Automatic detection and alarm systems for *pyrophoric* liquids and Class 3 water-reactive liquids required in

Section 2705.2.3.4 of the *International Fire Code*.

8. Exhaust *ventilation* flow alarm devices for *pyrophoric* liquids and Class 3 water-reactive liquids cabinet exhaust *ventilation* systems required in Section 2705.2.3.4 of the *International Fire Code*.

[F] 415.11.11 Emergency power system.

An emergency power system shall be provided in Group H-5 occupancies in accordance with Section 2702. The emergency power system shall supply power automatically to the electrical systems specified in Section 415.11.11.1 when the normal electrical supply system is interrupted.

[F] 415.11.11.1 Required electrical systems.

Emergency power shall be provided for electrically operated equipment and connected control circuits for the following systems:

1. HPM exhaust *ventilation systems*.
2. HPM *gas cabinet ventilation systems*.
3. HPM *exhausted enclosure ventilation systems*.
4. HPM *gas room ventilation systems*.
5. HPM gas detection systems.
6. *Emergency alarm systems*.
7. Manual and automatic *fire alarm systems*.
8. *Automatic sprinkler system* monitoring and alarm systems.
9. Automatic alarm and detection systems for *pyrophoric* liquids and Class 3 water-reactive liquids required in Section 2705.2.3.4 of the *International Fire Code*.
10. Flow alarm switches for *pyrophoric* liquids and Class 3 water-reactive liquids cabinet exhaust *ventilation systems* required in Section 2705.2.3.4 of the *International Fire Code*.
11. Electrically operated systems required elsewhere in this code or in the *International Fire Code* applicable to the use, storage or handling of HPM.

[F] 415.11.11.2 Exhaust ventilation systems.

Exhaust *ventilation* systems are allowed to be designed to operate at not less than one-half the normal fan speed on the emergency power system where it is demonstrated that the level of exhaust will maintain a safe atmosphere.

[F] 415.11.12 Automatic sprinkler system protection in exhaust ducts for HPM.

An *approved automatic sprinkler system* shall be provided in exhaust ducts conveying gases, vapors, fumes, mists or dusts generated from HPM in accordance with Sections 415.11.12.1 through 415.11.12.3 and the *International Mechanical Code*.

[F] 415.11.12.1 Metallic and noncombustible nonmetallic exhaust ducts.

An *approved automatic sprinkler system* shall be provided in metallic and noncombustible nonmetallic exhaust ducts where all of the following conditions apply:

1. Where the largest cross-sectional diameter is equal to or greater than 10 inches (254 mm).
2. The ducts are within the building.
3. The ducts are conveying flammable gases, vapors or fumes.

[F] 415.11.12.2 Combustible nonmetallic exhaust ducts.

Automatic sprinkler system protection shall be provided in combustible nonmetallic exhaust ducts where the largest cross-sectional diameter of the duct is equal to or greater than 10 inches (254 mm).

Exception: Ducts need not be provided with automatic sprinkler protection as follows:

1. Ducts *listed* or *approved* for applications without *automatic sprinkler system* protection.
2. Ducts not more than 12 feet (3658 mm) in length installed below ceiling level.

[F] 415.11.12.3 Automatic sprinkler locations.

Sprinkler systems shall be installed at 12-foot (3658 mm) intervals in horizontal ducts and at changes in direction. In vertical ducts, sprinklers shall be installed at the top and at alternate floor levels.

SECTION 416
SPRAY APPLICATION OF FLAMMABLE FINISHES

[F] 416.1 General.

The provisions of this section shall apply to the construction, installation and use of buildings and structures, or parts thereof, for the spray application of flammable finishes. Operations and equipment shall comply with the *International Fire Code*.

[F] 416.2 Spray rooms.

Spray rooms shall be enclosed with not less than 1-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both. Floors shall be waterproofed and drained in an *approved* manner.

[F] 416.2.1 Construction.

Walls and ceilings of *spray rooms* shall be constructed of noncombustible materials or the interior surface shall be completely covered with noncombustible materials. Aluminum shall not be used.

[F] 416.2.2 Surfaces.

The *interior surfaces* of *spray rooms* shall be smooth and shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning, and shall be so designed to confine residues within the room.

[F] 416.2.3 Ventilation.

Mechanical *ventilation* and interlocks with the spraying operation shall be in accordance with the *International Fire Code* and *International Mechanical Code*.

[F] 416.3 Spraying spaces.

Spraying spaces shall be ventilated with an exhaust system to prevent the accumulation of flammable mist or vapors in accordance with the *International Mechanical Code*. Where such spaces are not separately enclosed, noncombustible spray curtains shall be provided to restrict the spread of flammable vapors.

[F] 416.3.1 Surfaces.

The *interior surfaces* of spraying spaces shall be smooth; shall be so constructed to permit the free passage of exhaust air from all parts of the interior and to facilitate washing and cleaning; and shall be so designed to confine residues within the spraying space. Aluminum shall not be used.

[F] 416.4 Spray booths.

Spray booths shall be designed, constructed and operated in accordance with the *International Fire Code*.

[F] 416.5 Fire protection.

An *automatic sprinkler system* or *fire-extinguishing system* shall be provided in all spray rooms and spray booths, and shall be installed in accordance with Chapter 9.

SECTION 417
DRYING ROOMS

[F] 417.1 General.

A drying room or dry kiln installed within a building shall be constructed entirely of *approved* noncombustible materials or assemblies of such materials regulated by the *approved* rules or as required in the general and specific sections of this chapter for special occupancies and where applicable to the general requirements of the *International Mechanical Code*.

[F] 417.2 Piping clearance.

Overhead heating pipes shall have a clearance of not less than 2 inches (51 mm) from combustible contents in the dryer.

[F] 417.3 Insulation.

Where the operating temperature of the dryer is 175°F (79°C) or more, metal enclosures shall be insulated from adjacent combustible materials by not less than 12 inches (305 mm) of airspace, or the metal walls shall be lined with $^1/_4$-inch (6.4 mm) insulating mill board or other approved equivalent insulation.

[F] 417.4 Fire protection.

Drying rooms designed for high-hazard materials and processes, including special occupancies as provided for in Chapter 4, shall be protected by an *approved automatic fire-extinguishing system* complying with the provisions of Chapter 9.

SECTION 418
ORGANIC COATINGS

[F] 418.1 Building features.

Manufacturing of organic coatings shall be done only in buildings that do not have pits or *basements.*

[F] 418.2 Location.

Organic coating manufacturing operations and operations incidental to or connected therewith shall not be located in buildings having other occupancies.

[F] 418.3 Process mills.

Mills operating with close clearances and that process flammable and heat-sensitive materials, such as nitrocellulose, shall be located in a *detached building* or noncombustible structure.

[F] 418.4 Tank storage.

Storage areas for *flammable and combustible liquid* tanks inside of structures shall be located at or above grade and shall be separated from the processing area by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 418.5 Nitrocellulose storage.

Nitrocellulose storage shall be located on a detached pad or in a separate structure or a room enclosed with not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

[F] 418.6 Finished products.

Storage rooms for finished products that are *flammable or combustible liquids* shall be separated from the processing area by not less than 2-hour *fire barriers* constructed in accordance with Section 707 or *horizontal assemblies* constructed in accordance with Section 711, or both.

Relocated

SECTION 419
ARTIFICIAL DECORATIVE VEGETATION

[F] 419.1 Artificial decorative vegetation.

Artificial decorative vegetation exceeding 6 feet (1830 mm) in height and permanently installed outdoors within 5 feet (1524 mm) of a building, or on the roof of a building, shall comply with Section 321.1 of the *International Fire Code*.

Exception: Artificial decorative vegetation located more than 30 feet (9144 mm) from the exterior wall of a building.

SECTION 420
GROUPS I-1, R-1, R-2, R-3 AND R-4

420.1 General.

Occupancies in Groups I-1, R-1, R-2, R-3 and R-4 shall comply with the provisions of Sections 420.1 through 420.11 and other applicable provisions of this code.

420.2 Separation walls.

Walls separating *dwelling units* in the same building, walls separating *sleeping units* in the same building and walls separating *dwelling* or *sleeping units* from other occupancies contiguous to them in the same building shall be constructed as *fire partitions* in accordance with Section 708.

420.3 Horizontal separation.

Floor assemblies separating *dwelling units* in the same buildings, floor assemblies separating *sleeping units* in the same building and floor assemblies separating dwelling or *sleeping units* from other occupancies contiguous to them in the same building shall be constructed as *horizontal assemblies* in accordance with Section 711.

[F] 420.4 Automatic sprinkler system.

Group R occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.8. Group I-1 occupancies shall be equipped throughout with an *automatic sprinkler system* in accordance with Section 903.2.6. Quick-response or residential *automatic* sprinklers shall be installed in accordance with Section 903.3.2.

[F] 420.5 Fire alarm systems and smoke alarms.

Fire alarm systems and smoke alarms shall be provided in Group I-1, R-1 and R-2 occupancies in accordance with Sections 907.2.6, 907.2.8 and 907.2.9, respectively. Single- or multiple-station smoke alarms shall be provided in Groups I-1, R-2, R-3 and R-4 in accordance with Section 907.2.11.

420.6 Smoke barriers in Group I-1, Condition 2.

Smoke barriers shall be provided in Group I-1, Condition 2 to subdivide every *story* used by persons receiving care, treatment or sleeping and to provide other *stories* with an *occupant load* of 50 or more persons, into not fewer than two *smoke compartments*. Such *stories* shall be divided into *smoke compartments* with an area of not more than 22,500 square feet (2092 m^2) and the distance of travel from any point in a *smoke compartment* to a *smoke barrier* door shall not exceed 200 feet (60 960 mm). The *smoke barrier* shall be in accordance with Section 709.

420.6.1 Refuge area.

Refuge areas shall be provided within each *smoke compartment*. The size of the refuge area shall accommodate the occupants and care recipients from the adjoining *smoke compartment.* Where a *smoke compartment* is adjoined by two or more *smoke compartments*, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments. The size of the refuge area shall provide the following:

1. Not less than 15 net square feet (1.4 m^2) for each care recipient.
2. Not less than 6 net square feet (0.56 m^2) for other occupants.

Areas or spaces permitted to be included in the calculation of the refuge area are corridors, lounge or dining areas and other low-hazard areas.

420.7 Group I-1 assisted living housing units.

In Group I-1 occupancies, where a *fire-resistance corridor* is provided in areas where assisted living residents are housed, shared living spaces, group meeting or multipurpose therapeutic spaces open to the *corridor* shall be in accordance with all of the following criteria:

1. The walls and ceilings of the space are constructed as required for *corridors*.
2. The spaces are not occupied as resident sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
3. The open space is protected by an *automatic* fire detection system installed in accordance with Section 907.
4. In Group I-1, Condition 1, the *corridors* onto which the spaces open are protected by an *automatic* fire detection system installed in accordance with Section 907, or the spaces are equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
5. In Group I-1, Condition 2, the *corridors* onto which the spaces open, in the same *smoke compartment*, are protected by an *automatic* fire detection system installed in accordance with Section 907, or the *smoke compartment* in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.

6. The space is arranged so as not to obstruct access to the required *exits*.

420.8 Group I-1 cooking facilities.

In Group I-1 occupancies, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted to be open to the *corridor* where all of the following criteria are met:

1. In Group I-1, Condition 1 occupancies, the number of care recipients served by one cooking facility shall not be greater than 30.
2. In Group I-1, Condition 2 occupancies, the number of care recipients served by one cooking facility and within the same *smoke compartment* shall not be greater than 30.
3. The space containing the cooking facilities shall be arranged so as not to obstruct access to the required *exit*.
4. The cooking appliances shall comply with Section 420.9.

420.9 Domestic cooking appliances.

In Group I-1 occupancies, installation of cooking appliance used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the *International Mechanical Code* shall be provided over cooktops or ranges.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

Exceptions:

1. Cooking facilities provided within care recipients' individual dwelling units are not required to comply with this section.
2. Cooktops and ranges used for care-recipient training or nutritional counseling are not required to comply with Item 3 of this section

420.10 Group R cooking facilities.

In Group R occupancies, cooking appliances used for domestic cooking operations shall be in accordance with Section 917.2 of the *International Mechanical Code*.

420.11 Group R-2 dormitory cooking facilities.

Domestic cooking appliances for use by residents of Group R-2 college *dormitories* shall be in accordance with Sections 420.11.1 and 420.11.2.

420.11.1 Cooking appliances.

Where located in Group R-2 college *dormitories*, domestic cooking appliances for use by residents shall be in compliance with all of the following:

1. The types of domestic cooking appliances shall be limited to ovens, cooktops, ranges, warmers, coffee makers and microwaves.
2. Domestic cooking appliances shall be limited to approved locations.
3. Cooktops and ranges shall be protected in accordance with Section 904.14.
4. Cooktops and ranges shall be provided with a domestic cooking hood installed and constructed in accordance with Section 505 of the *International Mechanical Code*.

420.11.2 Cooking appliances in sleeping rooms.

Cooktops, ranges and ovens shall not be installed or used in sleeping rooms.

SECTION 421
HYDROGEN FUEL GAS ROOMS

[F] 421.1 General.

Where required by the *International Fire Code*, *hydrogen fuel gas rooms* shall be designed and constructed in accordance with Sections 421.1 through 421.7.

[F] 421.2 Location.

Hydrogen fuel gas rooms shall not be located below grade.

[F] 421.3 Design and construction.

Hydrogen fuel gas rooms not classified as Group H shall be separated from other areas of the building in accordance with Section 509.1.

[F] 421.3.1 Pressure control.

Hydrogen fuel gas rooms shall be provided with a ventilation system designed to maintain the room at a negative pressure in relation to surrounding rooms and spaces.

[F] 421.3.2 Windows.

Operable windows in interior walls shall not be permitted. Fixed windows shall be permitted where in accordance with Section 716.

[F] 421.4 Exhaust ventilation.

Hydrogen fuel gas rooms shall be provided with mechanical exhaust *ventilation* in accordance with the applicable provisions of Section 502.16.1 of the *International Mechanical Code*.

[F] 421.5 Gas detection system.

Hydrogen fuel gas rooms shall be provided with a *gas detection system* that complies with Sections 421.5.1, 421.5.2, and 916.

[F] 421.5.1 System activation.

Activation of a gas detection alarm shall result in both of the following:

1. Initiation of distinct audible and visible alarm signals both inside and outside of the *hydrogen fuel gas room*.
2. *Automatic* activation of the mechanical exhaust ventilation system.

[F] 421.5.2 Failure of the gas detection system.

Failure of the *gas detection system* shall automatically activate the mechanical exhaust *ventilation* system, stop hydrogen generation, and cause a trouble signal to sound at an *approved* location.

[F] 421.6 Explosion control.

Explosion control shall be provided where required by Section 414.5.1.

[F] 421.7 Standby power.

Mechanical *ventilation* and *gas detection systems* shall be provided with a *standby power system* in accordance with Section 2702.

SECTION 422
AMBULATORY CARE FACIILITIES

422.1 General.

Occupancies classified as *ambulatory care facilities* shall comply with the provisions of Sections 422.1 through 422.7 and other applicable provisions of this code.

422.2 Separation.

Ambulatory care facilities where the potential for four or more care recipients are to be *incapable of self-preservation* at any time shall be separated from adjacent spaces, *corridors* or tenants with a *fire partition* installed in accordance with Section 708.

422.3 Smoke compartments.

Where the aggregate area of one or more *ambulatory care facilities* is greater than 10,000 square feet (929 m^2) on one *story*, the *story* shall be provided with a *smoke barrier* to subdivide the *story* into not fewer than two *smoke compartments*. The area of any one such *smoke compartment* shall be not greater than 22,500 square feet (2092 m^2). The distance of travel from any point in a *smoke compartment* to a *smoke barrier* door shall be not greater than 200 feet (60 960 mm). The *smoke barrier* shall be installed in accordance with Section 709 with the exception that *smoke barriers* shall be continuous from outside wall to an outside wall, a floor to a floor, or from a *smoke barrier* to a *smoke barrier* or a combination thereof.

422.3.1 Means of egress.

Where *ambulatory care facilities* require smoke compartmentation in accordance with Section 422.3, the fire safety evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support a *defend-in-place* emergency response in accordance with Sections 403 and 404 of the *International Fire Code*.

422.3.2 Refuge area.

Not less than 30 net square feet (2.8 m^2) for each nonambulatory care recipient shall be provided within the aggregate area of *corridors*, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each *smoke compartment*. Each occupant of an *ambulatory care facility* shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

422.3.3 Independent egress.

A *means of egress* shall be provided from each *smoke compartment* created by *smoke barriers* without having to return through the *smoke compartment* from which *means of egress* originated.

[F] 422.4 Automatic sprinkler systems.

Automatic sprinkler systems shall be provided for *ambulatory care facilities* in accordance with Section 903.2.2.

[F] 422.5 Fire alarm systems.

A *fire alarm* system shall be provided for *ambulatory care facilities* in accordance with Section 907.2.2.

[F] 422.6 Electrical systems.

In *ambulatory care facilities*, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.

422.7 Domestic cooking.

Installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:

1. The types of cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the *International Mechanical Code* shall be provided over cooktops or ranges.
3. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
4. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
5. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

SECTION 423
STORM SHELTERS

423.1 General.

This section applies to the construction of storm shelters constructed as separate detached buildings or constructed as rooms or spaces within buildings for the purpose of providing protection from storms that produce high winds, such as tornadoes and hurricanes, during the storm. This section specifies where *storm shelters* are required and provides requirements for the design and construction of *storm shelters*. Design of facilities for use as emergency shelters after the storm are outside the scope of ICC 500 and shall comply with Table 1604.5 as a *Risk Category* IV Structure.

423.2 Construction.

Storm shelters shall be constructed in accordance with this code and ICC 500 and shall be designated as hurricane shelters, tornado shelters, or combined hurricane and tornado shelters. Buildings or structures that are also designated as emergency shelters shall also comply with Table 1604.5 as *Risk Category* IV structures.

Any *storm shelter* not required by this section shall be permitted to be constructed, provided that such structures meet the requirements of this code and ICC 500.

423.3 Occupancy classification.

The occupancy classification for a *storm shelter* shall be determined in accordance with this section.

423.3.1 Dedicated storm shelters.

A facility designed to be occupied solely as a *storm shelter* shall be classified as Group A-3 for the determination of requirements other than those covered in ICC 500.

Exceptions:

1. The occupancy category for dedicated storm shelters with an occupant load of fewer than 50 persons as determined in accordance with ICC 500 shall be in accordance with Section 303.
2. The occupancy category for a dedicated residential storm shelter shall be the Group R occupancy served.

423.3.2 Storm shelters within host buildings.

Where designated *storm shelters* are constructed as a room or space within a host building that will normally be occupied for other purposes, the requirements of this code for the occupancy of the building, or the individual rooms or spaces thereof, shall apply unless otherwise required by ICC 500.

423.4 Critical emergency operations.

In areas where the shelter design wind speed for tornados in accordance with Figure 304.2(1) of ICC 500 is 250 mph, 911 call stations, emergency operation centers and fire, rescue, ambulance and police stations shall comply with Table 1604.5 as a *Risk Category* IV structure and shall be provided with a *storm shelter* constructed in accordance with ICC 500.

423.5 Group E occupancies.

In areas where the shelter design wind speed for tornados is 250 mph in accordance with Figure 304.2(1) of ICC 500, all Group E occupancies with an *occupant load* of 50 or more shall have a storm shelter constructed in accordance with ICC 500.

Exceptions:

1. Group E day care facilities.
2. Group E occupancies accessory to *places of religious worship*.
3. Buildings meeting the requirements for shelter design in ICC 500.

423.5.1 Required occupant capacity.

The required occupant capacity of the *storm shelter* shall include all of the buildings on the site and shall be the greater of the following:

1. The total *occupant load* of the classrooms, vocational rooms and offices in the Group E occupancy.
2. The *occupant load* of the largest indoor assembly space that is associated with the Group E occupancy.

Exceptions:

1. Where a new building is being added on an existing Group E site, and where the new building is not of sufficient size to accommodate the required occupant capacity of the *storm shelter* for all of the buildings on the site, the storm shelter shall at a minimum accommodate the required occupant capacity for the new building.

2. Where approved by the *building official,* the required occupant capacity of the shelter shall be permitted to be reduced by the occupant capacity of any existing *storm shelters* on the site.

423.5.2 Location.

Storm shelters shall be located within the buildings they serve or shall be located where the maximum distance of travel from not fewer than one exterior door of each building to a door of the shelter serving that building does not exceed 1,000 feet (305 m).

SECTION 424
PLAY STRUCTURES

424.1 General.

Play structures installed inside all occupancies covered by this code that exceed 10 feet (3048 mm) in height or 150 square feet (14 m^2) in area shall comply with Sections 424.2 through 424.5.

424.2 Materials.

Play structures shall be constructed of noncombustible materials or of combustible materials that comply with the following:

1. *Fire-retardant-treated* wood complying with Section 2303.2.
2. Light-transmitting plastics complying with Section 2606.
3. Foam plastics (including the pipe foam used in *soft-contained play equipment structures*) having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source.
4. Aluminum composite material (ACM) meeting the requirements of Class A *interior finish* in accordance with Chapter 8 when tested as an assembly in the maximum thickness intended for use.
5. Textiles and films complying with the fire propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
6. Plastic materials used to construct rigid components of *soft-contained play equipment structures* (such as tubes, windows, panels, junction boxes, pipes, slides and decks) exhibiting a peak rate of heat release not exceeding 400 kW/ m^2 when tested in accordance with ASTM E1354 at an incident heat flux of 50 kW/m^2 in the horizontal orientation at a thickness of 6 mm.
7. Ball pool balls, used in *soft-contained play equipment structures*, having a maximum heat-release rate not greater than 100 kilowatts when tested in accordance with UL 1975 or when tested in accordance with NFPA 289, using the 20 kW ignition source. The minimum specimen test size shall be 36 inches by 36 inches (914 mm by 914 mm) by an average of 21 inches (533 mm) deep, and the balls shall be held in a box constructed of galvanized steel poultry netting wire mesh.
8. Foam plastics shall be covered by a fabric, coating or film meeting the fire propagation performance criteria contained in Test Method 1 or Test Method 2, as appropriate, of NFPA 701.
9. The floor covering placed under the *play structure* shall exhibit a Class I *interior floor finish* classification, as described in Section 804, when tested in accordance with ASTM E648 or NFPA 253.
10. Interior finishes for structures exceeding 600 square feet (56 m^2) in area or 10 feet (3048 mm) in height shall have a flame spread index not greater than that specified in Table 803.13 for the occupancy group and location designated. Interior wall and ceiling finish materials tested in accordance with NFPA 286 and meeting the acceptance criteria of Section 803.1.1.1, shall be permitted to be used where a Class A classification in accordance with ASTM E84 or UL 723 is required.

[F] 424.3 Fire protection.

Play structures shall be provided with the same level of *approved* fire suppression and detection devices required for other structures in the same occupancy.

424.4 Separation.

Play structures shall have a horizontal separation from building walls, partitions and from elements of the *means of egress* of not less than 5 feet (1524 mm). Play structures shall have a horizontal separation from other *play structures* of not less than 20 feet (6090 mm).

424.5 Area limits.

Play structures shall be not greater than 600 square feet (56 m^2) in area, unless a special investigation, acceptable to the *building official*, has demonstrated adequate fire safety.

424.5.1 Design.

Play structures exceeding 600 square feet (56 m^2) in area or 10 feet (3048 mm) in height shall be designed in accordance with Chapter 16.

SECTION 425
HYPERBARIC FACILITIES

425.1 Hyperbaric facilities.

Hyperbaric facilities shall meet the requirements contained in Chapter 14 of NFPA 99.