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.