

1

**BILL CLAYTON, CBO
COLORADO CODE CONSULTING, LLC**

- Over 33 years in Building Code Enforcement and Administration
- Combination Building Inspector since 1991
- Plans Examiner since 1996
- Recovering CBO, 10 years
- Code consultant, inspector, plans examiner, instructor with CCC & Shums Coda Associates 10+ years & ICC Instructor 7+ years
- IEBC Committee 2009, 2012, 2024
- 2015 IBC General Committee
- Co-Author 2024 ICC resource book on Firestopping, Joint Systems and Dampers

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2

OUTLINE OF CLASS

- IBC Section 307 in detail
- IBC Section 414 and 415
- IFC Chapter 50, and others that apply
- Questions to help evaluate the material
- SDS overview



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3

WHERE ARE HIGH HAZARDS?

- ◉ Places you might think of:
 - Fuel Refineries
 - Cabinet shops
 - Grain silos
 - Fertilizer plants
 - Fireworks
 - Computer Chip processors
 - Distilleries
- ◉ Places you might NOT think of:
 - Swimming Pool equipment rooms
 - Cabella's/Bass Pro
 - Home Depot
 - Laboratories
 - Performance Stages
 - Schools
 - Bulk Storage Liquor Stores

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HELPING THE HAZARDOUS MATERIALS CUSTOMER

- ◉ Work hand in hand with the Fire Dept. if possible
- ◉ Make sure both IFC and IBC code requirements are met
- ◉ Try to use common sense approach to each situation to prevent under/over enforcement



plus



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IFC APPENDIX E103.2 EVALUATION QUESTIONS TO HELP YOU

- ◉ What is the material?
- ◉ Correct identification is important; exact spelling is vital.
- ◉ Checking labels and SDS and asking responsible persons should be among the highest priorities.



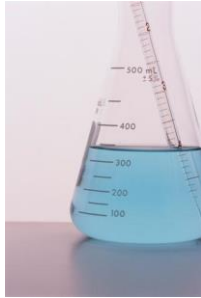
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E 103.2 EVALUATION QUESTIONS

- ⦿ 2. What are the concentration and strength?
 - Some things are stronger at a high concentration
 - Hydrogen Peroxide is hair bleach @ 8%
 - Hydrogen Peroxide can explode in heat at over 90% and is an unstable reactive



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E103.2 EVALUATION QUESTIONS

- ⦿ 3. What is the physical form of the material?
 - ⦿ Liquids, gases and finely divided solids have differing requirements for spill and leak control and containment.



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E103.2 EVALUATION QUESTIONS

- ⦿ How much material is present? Consider in relation to permitted amounts, maximum allowable quantity per control area (from Group H occupancy requirements), amounts which require detached storage and overall magnitude of the hazard.
- ⦿ Is it stored or in use?
- ⦿ Is it closed or open use?



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E103.2 EVALUATION QUESTIONS

- 5. What other materials (including furniture, equipment and building components) are close enough to interact with the material?



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E103.2 EVALUATION QUESTIONS

- 6. What are the likely reactions?
 - Explosions?
 - Fire?
 - People inhaling chemicals?
 - Combustible dust in the area?



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E103.2 EVALUATION QUESTIONS

- 7. What is the activity involving the material?
 - Is it out in the open?
 - Is it enclosed in piping?
 - Is it becoming air laden vapors?



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E103.2 EVALUATION QUESTIONS

- 8. How does the activity impact the hazardous characteristics of the material?
- Consider vapors released or hazards otherwise exposed.



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E103.2 EVALUATION QUESTIONS

- 9. What must the material be protected from?
- Consider other materials, temperature, shock, pressure, water, etc.



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E103.2 EVALUATION QUESTIONS

- 10. What effects of the material must people and the environment be protected from?
- Poisoning
- Skin burns
- Lung irritation
- Eye irritation
- Etc.



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E103.2 EVALUATION QUESTIONS

- 11. How can protection be accomplished?
Consider:
 - 11.1. Proper containers and equipment.
 - 11.2. Separation by distance or construction.
 - 11.3. Enclosure in cabinets or rooms.
 - 11.4. Spill control, drainage and containment.
- 11.5. Control systems-ventilation, special electrical, detection and alarm, extinguishment, explosion venting, limit controls, exhaust scrubbers and excess flow control.
- 11.6. Administrative (operational) controls-signs, ignition source control, security, personnel training, established procedures, storage plans and emergency plans.

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16

307 HIGH-HAZARD GROUP H

- Includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in compliant control areas



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17

WHAT ISN'T A GROUP H OCCUPANCY

GROUP	DESCRIPTION	EXCLUSIONS
GROUP H-1	GROUP H-1: HIGHLY TOXIC MATERIALS & EQUIPMENT	GROUP H-1: HIGHLY TOXIC MATERIALS & EQUIPMENT
GROUP H-2	GROUP H-2: EXTREMELY TOXIC MATERIALS & EQUIPMENT	GROUP H-2: EXTREMELY TOXIC MATERIALS & EQUIPMENT
GROUP H-3	GROUP H-3: HIGHLY TOXIC MATERIALS & EQUIPMENT	GROUP H-3: HIGHLY TOXIC MATERIALS & EQUIPMENT
GROUP H-4	GROUP H-4: EXTREMELY TOXIC MATERIALS & EQUIPMENT	GROUP H-4: EXTREMELY TOXIC MATERIALS & EQUIPMENT
GROUP H-5	GROUP H-5: HIGHLY TOXIC MATERIALS & EQUIPMENT	GROUP H-5: HIGHLY TOXIC MATERIALS & EQUIPMENT
GROUP H-6	GROUP H-6: EXTREMELY TOXIC MATERIALS & EQUIPMENT	GROUP H-6: EXTREMELY TOXIC MATERIALS & EQUIPMENT
GROUP H-7	GROUP H-7: HIGHLY TOXIC MATERIALS & EQUIPMENT	GROUP H-7: HIGHLY TOXIC MATERIALS & EQUIPMENT
GROUP H-8	GROUP H-8: EXTREMELY TOXIC MATERIALS & EQUIPMENT	GROUP H-8: EXTREMELY TOXIC MATERIALS & EQUIPMENT
GROUP H-9	GROUP H-9: HIGHLY TOXIC MATERIALS & EQUIPMENT	GROUP H-9: HIGHLY TOXIC MATERIALS & EQUIPMENT
GROUP H-10	GROUP H-10: EXTREMELY TOXIC MATERIALS & EQUIPMENT	GROUP H-10: EXTREMELY TOXIC MATERIALS & EQUIPMENT

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WHAT ISN'T A GROUP H OCCUPANCY

- Buildings and structures occupied for the application of flammable finishes, provided that such buildings or areas conform to the requirements of Section 416 and the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY

- Wholesale and retail sales and storage of flammable and combustible liquids in mercantile occupancies conforming to the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY

- Closed piping system containing flammable or combustible liquids or gases utilized for the operation of machinery or equipment.



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WHAT ISN'T A GROUP H OCCUPANCY



- Cleaning establishments that utilize combustible liquid solvents having a flash point of 140° F or higher in closed systems employing equipment listed by an approved testing agency, provided that this occupancy is separated from all other areas of the building by 1-hour fire barriers constructed in accordance with Section 707 or 1-hour horizontal assemblies constructed in accordance with Section 712, or both.

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WHAT ISN'T A GROUP H OCCUPANCY

- Cleaning establishments that utilize a liquid solvent having a flash point at or above 200° F.



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WHAT ISN'T A GROUP H OCCUPANCY



- Liquor stores and distributors without bulk storage.
- Packaged in containers not exceeding 1.3 Gallons

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WHAT ISN'T A GROUP H OCCUPANCY

- Refrigeration systems.



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WHAT ISN'T A GROUP H OCCUPANCY

- The storage or utilization of materials for agricultural purposes on the premises.



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WHAT ISN'T A GROUP H OCCUPANCY

- Stationary storage battery systems installed in accordance with the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY



- Corrosive personal or household products in their original packaging used in retail display.

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WHAT ISN'T A GROUP H OCCUPANCY



- Commonly used corrosive building materials.

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WHAT ISN'T A GROUP H OCCUPANCY



- Buildings and structures occupied for aerosol product storage, aerosol cooking spray products or plastic aerosol 3 products shall be classified as Group S-1, provided that such buildings conform to the requirements of the International Fire Code.

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WHAT ISN'T A GROUP H OCCUPANCY

- ◉ Display and storage of nonflammable solid and nonflammable or noncombustible liquid hazardous materials in quantities not exceeding the maximum allowable quantity per control area in Group M or S occupancies complying with Section 414.2.5.



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WHAT ISN'T A GROUP H OCCUPANCY

- ◉ The storage of black powder, smokeless propellant and small arms primers in Groups M and R-3 and special industrial explosive devices in Groups B, F, M and S, provided such storage conforms to the quantity limits and requirements prescribed in the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY

- ◉ Stationary fuel cell power systems installed in accordance with the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY



- Capacitor energy storage systems in accordance with the International Fire Code.

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WHAT ISN'T A GROUP H OCCUPANCY

- Group B higher education laboratory occupancies complying with IBC Section 428 and Chapter 38 of the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY

- Distilling or brewing of beverages conforming to the requirements of Chapter 57 of the International Fire Code.



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WHAT ISN'T A GROUP H OCCUPANCY

- The storage of beer, distilled spirits and wines in barrels and casks conforming to the requirements of the chapter 40 of the International Fire Code.



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307 HIGH-HAZARD GROUP H

- Physical Hazards Table 307.1(1) defined in IFC as:
 - 1. Explosives and blasting agents.
 - 2. Combustible liquids.
 - 3. Flammable solids, liquids and gases.
 - 4. Organic peroxide solids or liquids.
 - 5. Oxidizer, solids or liquids.
 - 6. Oxidizing gases.
 - 7. Pyrophoric solids, liquids or gases.
 - 8. Unstable (reactive) solids, liquids or gases.
 - 9. Water-reactive materials solids or liquids.
 - 10. Cryogenic fluids .

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307 HIGH-HAZARD GROUP H

- Health Hazards Table 301.1(2) defined in IFC as:
 - 1. Highly toxic and toxic materials.
 - 2. Corrosive materials.
- A material with a health hazard classification can also pose a physical hazard. (Anhydrous Ammonia-See HMEx)



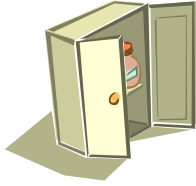
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USE TABLE 307 FOOTNOTES AND PREVENT AN "H" OCCUPANCY LABEL

- Safety & Protection occur when we:
 - Reduce amounts
 - Separate materials into protected areas(control areas)
 - Put it into approved cabinets/day boxes
 - Enclose it instead of making it open to the air
 - Sprinkle the building
- This is more of the compartmentation concept as already exists in the code



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TABLE 307.1(1) FOOTNOTES

- a. For use of control areas, see Section 414.2.
- b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
- c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.5 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.5 gallons.
- d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
- e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
- f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.
- i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 603.3.2 of the *International Fire Code*.
- j. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
- k. A maximum quantity of 220 pounds of solid or 22 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment when the storage containers and the manner of storage are approved.
- l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.
- m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *International Fire Code*.
- n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
- o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
- p. The following shall not be included in determining the maximum allowable quantities:
 1. Liquid or gaseous fuel in fuel tanks on vehicles.
 2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with the *International Fire Code*.
 3. Gaseous fuels in piping systems and fixed appliances regulated by the *International Fuel Gas Code*.
 4. Liquid fuels in piping systems and fixed appliances regulated by the *International Mechanical Code*.
 5. Alcohol-based hand rags classified as Class I or II liquids in dispensers that are installed in accordance with Sections 5705.5 and 5705.5.1 of the *International Fire Code*. The location of the alcohol-based hand rag (ABHR) dispensers shall be provided in the construction documents.
- q. 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 414.1.3.

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FOOTNOTE "A" CONTROL AREAS

- IBC 202 Definition of CONTROL AREA.
- Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See the definition of "Outdoor control area" in the International Fire Code.



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CONTROL AREAS IBC 414.2

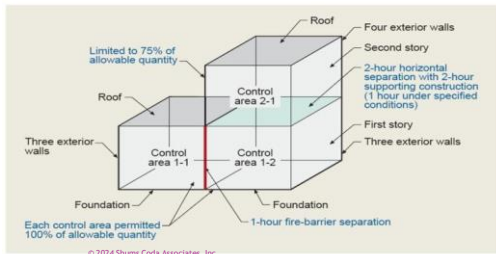
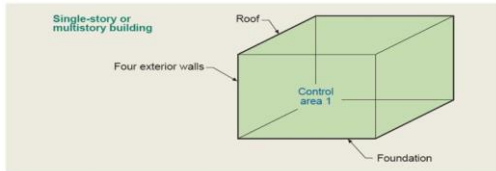
- The control area can be the entire building, the entire floor or the entire room or rooms.
- Separated by fire barriers or horizontal assemblies
- Floors & supporting construction must be 2 hr rated
 - Exceptions for 1 hr in Type IIA, IIIA, VA sprinkled buildings of 3 stories or less



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FOOTNOTE 'D' FIRE SPRINKLERS

- Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- Where Note e also applies, the increase for both notes shall be applied accumulatively.



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FOOTNOTE 'E' APPROVED STORAGE



- Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the International Fire Code.
- Where Note d also applies, the increase for both notes shall be applied accumulatively.

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FOOTNOTE "E"; WHAT MAKES AN APPROVED CABINET OR SAFETY CAN?

- Cabinets are allowed for liquids, solids, gas bottles
- Liquids in cabinets in IFC 5704.3.2 & Solids in cabinets in IFC 5003.8.7
- Gas cylinder in cabinets in IFC 5003.8.6



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FOOTNOTE "E"; WHAT IS A SAFETY CAN?

- Safety Cans: IFC 5003.9.10
- Must be metal and meet UL 30 to increase amounts
- May be non-metallic and meet UL 1313 if not used to increase amounts



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**FOOTNOTE “E”;
WHAT IS A DAY BOX?**

- A portable magazine designed to hold explosive materials constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56 (5604.2) of the IFC and NFPA 495 or 1124.



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**[F] TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD^{a, b, c, d, e, f, g, h, i}**

MATERIAL	STORAGE ^a			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
	Solid pounds ^{a*}	Liquid gallons (pounds) ^{a*}	Gas cubic feet at NTP (pounds) ^{a*}	Solid pounds ^{a*}	Liquid gallons (pounds) ^{a*}	Gas cubic feet at NTP (pounds) ^{a*}	Solid pounds ^{a*}	Liquid gallons (pounds) ^{a*}
Corrosives	5,000	500	Gaseous 810 ^f Liquefied (150)	5,000	500	Gaseous 810 ^f Liquefied (150)	1,000	100
Highly Toxic	10	(10)	Gaseous 20 ^f Liquefied (4) ^f	10	(10)	Gaseous 20 ^f Liquefied (4) ^f	3	(3)
Toxic	500	(500)	Gaseous 810 ^f Liquefied (150) ^f	500	(500)	Gaseous 810 ^f Liquefied (150) ^f	125	(125)

For SI: 1 cubic foot = 0.028 m³; 1 pound = 0.454 kg; 1 gallon = 3.785 L.
 a. For use of control areas, see Section 414.2.
 b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
 c. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
 d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
 e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
 f. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
 g. Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *International Fire Code*.
 h. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
 i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *International Fire Code*.

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**307.2
HAZARDOUS MATERIALS**

- Hazardous materials in any quantity shall conform to the requirements of this code, including Section 414, and the International Fire Code.



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IBC 307.3 H1

- Buildings and structures containing materials that pose a detonation hazard shall be classified as Group H-1. Such materials shall include, but not be limited to, the following:



Type 2 Magazine housing 900 lbs of Division 1.1 mass detonation explosives with bullet resistant CMU wall around. Alt. methods and materials used since no panic hardware and no sprinklers allowed per BATFE which takes precedence over IFC/IBC.

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H1 CONTINUED

- Detonable pyrophoric materials (they ignite spontaneously below room temp, sometimes in water)
- Explosives:
 - Division 1.1
 - Division 1.2
 - Division 1.3
 - Exception: Materials that are used and maintained in a form where either confinement or configuration will not elevate the hazard from a mass fire to mass explosion hazard shall be allowed in H-2 occupancies.
 - Division 1.4
 - Exception: Articles, including articles packaged for shipment, that are not regulated as an explosive under Bureau of Alcohol, Tobacco and Firearms regulations, or unpackaged articles used in process operations that do not propagate a detonation or deflagration between articles shall be allowed in H-3 occupancies.
- Continue H1 on next slide...

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H1 CONTINUED

- Explosives continued;
 - Division 1.5
 - Division 1.6
- Organic peroxides, unclassified detonable
- Oxidizers, Class 4
- Unstable (reactive) materials, Class 3 detonable and Class 4

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EXPLOSIVE DIVISIONS IFC 202

- Division 1.1. Explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.
- Division 1.2. Explosives that have a projection hazard but not a mass explosion hazard.
- Division 1.3. Explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.
- Division 1.4. Explosives that pose a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package.
- Division 1.5. Very insensitive explosives . This division is comprised of substances that have a mass explosion hazard but which are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.
- Division 1.6. Extremely insensitive articles which do not have a mass explosion hazard. This division is comprised of articles that contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

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FIREWORKS IFC 202 DEF.

- FIREWORKS. Any composition or device for the purpose of producing a visible or an audible effect for entertainment purposes by combustion, deflagration or detonation that meets the definition of 1.4G fireworks or 1.3G fireworks as set forth herein.



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FIREWORKS IFC 202 DEF.

- 1.3G (Formerly Class B, Special Fireworks). Large fireworks devices. →
- 1.4G (Formerly known as Class C, Common Fireworks). Small fireworks devices. →



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H1 CONT'D.

- **DETONATION.** An exothermic (process that releases energy in form of heat and light) reaction characterized by the presence of a shock wave in the material which establishes and maintains the reaction.
- The reaction zone progresses through the material at a rate greater than the velocity of sound.
- The principal heating mechanism is one of shock compression.
- Detonations have an explosive effect.



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PEPCON DISASTER

- Pacific Engineering and Production Company of Nevada (PEPCON)
- Henderson, Nevada
- May 4, 1988
- Two fatalities, 372 injuries
- An estimated \$100 million of damage



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DETONATION



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HIGH-HAZARD GROUP H-2

- Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2.
- Such materials shall include, but not be limited to, the following:
 - Class I, II or IIIA flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge.
 - 1A flammable gasses
 - 1B flammable gasses having a burning velocity >3.9 inches /second
 - Combustible dusts
 - Cryogenic fluids, flammable

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H-2 CONTINUED

- Organic peroxides, Class I
- Oxidizers, Class 3, that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge
- Pyrophoric liquids, solids and gases, nondetonable
- Unstable (reactive) materials, Class 3, nondetonable
- Water-reactive materials, Class 3



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65

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UNDERSTANDING KEY “H” TERMS

- Deflagration: rapid exothermic reaction, burns at less than the speed of sound
- Detonation: rapid exothermic reaction, burns at more than the speed of sound
- H1 detonates
- H2 deflagrates
- Exothermic: an extreme chemical reaction of oxidation releasing energy in the form of heat (exo=outside, thermic=heating)

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Detonation vs Deflagration

<ul style="list-style-type: none">▪ Faster than the speed of sound▪ Shockwave effect▪ Shattering▪ Instant Chemical Reaction proceeding forward through the compound▪ Requires a Detonator	<ul style="list-style-type: none">▪ Slower than the speed of sound▪ Confinement and compression▪ Particle to particle burn rate▪ No Detonator Required
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67

DEFLAGRATION



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68

UNDERSTANDING KEY "H" TERMS

- Cryogenic-
 - Very cold liquid/gas (-60° to -270° F)
- Flammable
 - A liquid having a closed cup flash point below 100° F
- Combustible
 - A liquid having a closed cup flash point at or above 100° F



Closed cup flashpoint tester

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HIGH HAZARD GROUP H-3

- Buildings and structures containing materials that readily support combustion (it burns) or that pose a physical hazard shall be classified as Group H-3.
- Such materials shall include, but not be limited to, the following:



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HIGH HAZARD GROUP H-3

- Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge (103.4 kPa) or less
- Combustible fibers, other than densely packed baled cotton, 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 414.1.3.
- Consumer fireworks, 1.4G (Class C, Common)
- Category 1B flammable gasses having a burning velocity of 3.9 inches/second or less
- Cryogenic fluids, oxidizing
- Flammable solids



Old cotton mill

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71

71

COMBUSTIBLE FIBERS



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72

72

SAMPLE HAZARD: MARIJUANA EXTRACTION

- The extraction process includes the act of extraction of the oils and fats by use of a solvent, desolventizing of the raw material, production of the miscella, distillation of the solvent from the miscella and solvent recovery.
- Is it an “H”?
- Also see IFC chapter 39



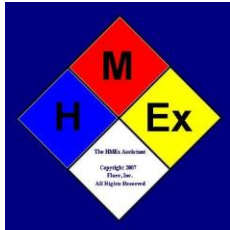
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SAMPLE HAZARD: MARIJUANA EXTRACTION

- Propane is a liquified flammable gas



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SAMPLE HAZARD: MARIJUANA EXTRACTION

TABLE 307.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{1, 2, 3, 4}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ⁵		USE-CLOSED SYSTEMS ⁶		USE-OPEN SYSTEMS ⁷			
			Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds)
Flammable gas	Gaseous Liquified	H-2	NA	NA	1,000 ⁸ NA	NA	NA	1,000 ⁸ NA	NA	NA
Flammable liquid ⁹	IA IB and IC	H-2 or H-3	NA	30 ¹⁰ 120 ¹¹	NA	NA	30 ¹⁰ 120 ¹¹	NA	NA	10 ¹² 30 ¹³
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ^{10, 11}	NA	NA	120 ¹¹	NA	NA	30 ¹³

(continued)

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75

SAMPLE HAZARD CONTINUED APPLYING TABLE 307.1(1)

- Flammable Gas in excess of MAQ is a Group H-2.
- Quantities permitted to be increased 100% in each control area if the building is provided with fire sprinklers



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307.6 HIGH-HAZARD GROUP H-4.

- Buildings and structures which containing materials that are health hazards shall be classified as Group H-4.
- Such materials shall include, but not be limited to, the following:
 - Corrosives
 - Highly toxic materials
 - Toxic materials
 - See definitions for when it is toxic or highly toxic



150 lb cyl. Chlorine gas

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TABLE 307.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD^{a-c,d,e,f}

MATERIAL	STORAGE ^g			USE-CLOSED SYSTEMS ^h			USE-OPEN SYSTEMS ^h	
	Solid pounds ^g	Liquid gallons (pounds) ^g	Gas cubic feet at NTP (pounds) ^g	Solid pounds ^g	Liquid gallons (pounds) ^g	Gas cubic feet at NTP (pounds) ^g	Solid pounds ^g	Liquid gallons (pounds) ^g
Corrosives	5,000	500	Gaseous 810 ^g Liquefied (150)	5,000	500	Gaseous 810 ^g Liquefied (150)	1,000	100
Highly Toxic	10	(10)	Gaseous 20 ^g Liquefied (4) ^g	10	(10)	Gaseous 20 ^g Liquefied (4) ^g	3	(3)
Toxic	500	(500)	Gaseous 810 ^g Liquefied (150) ^g	500	(500)	Gaseous 810 ^g Liquefied (150) ^g	125	(125)

For SI: 1 cubic foot = 0.028 m³; 1 pound = 0.454 kg; 1 gallon = 3.785 L.
 a. For use of control areas, see Section 414.2.
 b. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
 c. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water miscible liquids and with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
 d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an approved automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
 e. Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, gas cabinets or exhausted enclosures as specified in the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
 f. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
 g. Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures as specified in the *International Fire Code*.
 h. Quantities in parentheses indicate quantity units in parentheses at the head of each column.
 i. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the *International Fire Code*.

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HIGH HAZARD GROUP H-4

- Corrosive: DEF. A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact.



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79

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307.7 HIGH-HAZARD GROUP H-5

- Semiconductor fabrication facilities and comparable research and development areas in which hazardous production materials (HPM) are used and the aggregate quantity of materials is in excess of those listed in Tables 307.1(1) and 307.1(2) shall be classified as Group H-5. Such facilities and areas shall be designed and constructed in accordance with Section 415.8.
- Houston, Austin, Kalispell, and other areas have experienced billions of dollars in growth based on the microchip industry since covid 2020



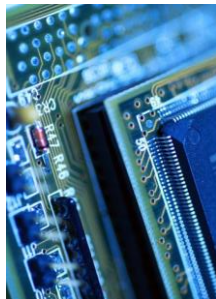
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80

HAZARDOUS PRODUCTION MATERIAL (HPM). IFC 202

- A solid, liquid or gas associated with semiconductor manufacturing that has a degree-of-hazard rating in health, flammability or instability of Class 3 or 4 as ranked by NFPA 704 and which is used directly in research, laboratory or production processes which have, as their end product, materials that are not hazardous.



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81

81

307.8 MULTIPLE HAZARDS

- Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.
- Example: Anhydrous Ammonia
 - Liquefied Flammable gas; H-2 if over exempt amounts
 - Corrosive so also H-4
- Requirements of both occupancies must be followed

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IBC 414 HAZARDOUS MATERIALS

- “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.”
- Explanation:
 - This basic provisions section applies whether the use qualifies for an “H” occupancy label or whether it is exempt.
 - Any hazardous material in any amount is controlled by this section.

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HAZARDOUS MATERIALS 414.1.1 OTHER PROVISIONS

- “Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 415 and the International Fire Code.”
- Section 415 goes through each H occupancy in detail, and shows what to do when a material is in excess of the exempt amounts.
- IFC provides further information

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84



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HAZARDOUS MATERIALS 414.1.2 MATERIALS

- The safe design of hazardous material occupancies is material dependent. Individual material requirements are also found in Sections 307 and 415, and in the International Mechanical Code and the International Fire Code.
- Explanation: the bldg. design depends on the material!
- Every type of material poses a different hazard, so it requires different precautions.
- i.e. /You do different things where things blow up than you do where a liquid could burn you.

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85



HAZARDOUS MATERIALS 414.1.2.1

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



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86

86



HAZARDOUS MATERIALS 414.1.3 INFORMATION REQUIRED

- A report SHALL be submitted to CBO that identifies:
 - Maximum expected amounts
 - Identify if it's stored, use-open or use-closed
 - Identify classification categories
 - Methods of protection to be used
- Must be a report prepared by an approved person or agency



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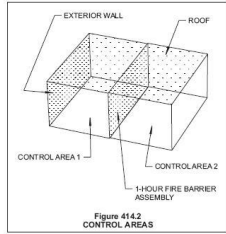
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HAZARDOUS MATERIALS 414.2 CONTROL AREAS

- The control area can be the whole building, the whole floor or the whole room or rooms.
- Separated by fire barriers and/or horizontal Assemblies
- Floors & supporting construction must be 2 hr rated
 - Exceptions for 1 hr in Type IIA, IIIA, VA sprinkled buildings of 3 stories or less

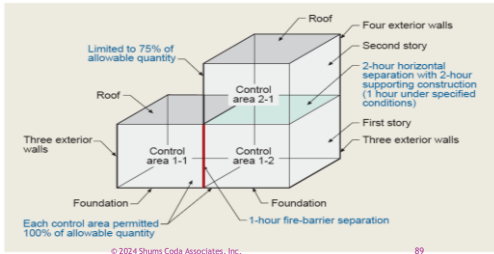
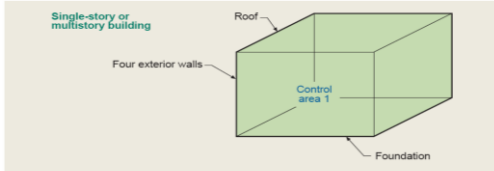


IBC Commentary 4-73

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88

88



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89

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HAZARDOUS MATERIALS 414.2.1 CONST. REQUIREMENTS

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



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90

414.2.4 CONTROL AREAS FIRE RESISTANCE RATINGS

- ⦿ 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; and
 - 2. The building is three stories or less above grade plane .

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94

94

414.2.5 HAZ. MAT. 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 414.2.5.4.



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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 is 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 (5003.11) and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).

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96

96

414.2.5.3 AEROSOL PRODUCTS

- The maximum quantity of aerosol products, aerosol cooking spray products or plastic aerosol 3 products in 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 5003.11.



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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.



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HAZARDOUS EXHAUST IMC 509.2

- A hazardous exhaust system shall be required wherever operations involving the handling or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create one of the following conditions:
 1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25 percent of the lower flammability limit of the substance for the expected room temperature.
 2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration.
 3. A vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2 or 3 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

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HAZARDOUS EXHAUST



- Lower Flammable Limit:
- The minimum concentration of vapor in air at which propagation of flame will occur in the presence of an ignition source.

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414.3 "H" VENTILATION CONT'D.

- 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 509.5.2.



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104



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.



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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 414.5.4 of this code and the International Fire Code.



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106

414.5.1 (INSIDE STORAGE, DISPENSING & USE) EXPLOSION CONTROL.

- Must be provided per the IFC if Table 414.5.1 requires
 - Where quantities of hazmat exceeds MAQ in Table 307.1(1) or;
 - Where structure, room or space is occupied for purposes involving explosion hazards as required by section 415



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107

414.5.1 (INSIDE STORAGE, DISPENSING & USE) EXPLOSION CONTROL CONT'D.

(F) TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS¹

HAZARD CATEGORY	MATERIAL CLASS	EXPLOSION CONTROL METHODS	
		Barriade construction	Explosion (detonation) venting or explosion (deflagration) protection systems ²
Compressed gases ³	—	Not Required	Required
Corrosive liquids	—	Not Required	Required
	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
Explosives	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
	Division 1.7	Required	Not Required
Flammable gas	Division 2.1	Not Required	Required
	Liquid ⁴	Not Required	Required
Flammable liquid	2.2	Not Required	Required
	2.3	Not Required	Required
Organic peroxide	3.1	Required	Not Permitted
	3.2	Required	Not Permitted
Oxidizer liquids and solids	4.1	Required	Not Permitted
	4.2	Required	Not Permitted
Poisonous gas	—	Not Required	Required
	—	Not Required	Required
Unstable (reactive)	5.1 Detonable	Required	Not Permitted
	5.2 Non-detonable	Not Required	Required
Water-reactive liquids and solids	6.1	Not Required	Required
	6.2	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Other processing	—	Not Required	Required
Liquidified petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist ⁵	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

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108

414.5.1 (INSIDE STORAGE, DISPENSING & USE) EXPLOSION CONTROL CONT'D.

- Barricade Const.
 - Per NFPA 495
 - A structure made to withstand explosion and that is shielded by dirt mounds or natural hills or thick forests
 - See IFC 3302.1 for details



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109

414.5.2 STANDBY OR EMERGENCY 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.



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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 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.



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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.

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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 Chapter 50.



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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 5005.3.



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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 when the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.



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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 does not exceed 25 percent of the structure's perimeter.



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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 not be less than the distance required for an outside hazardous material storage or use area without weather protection. (See IFC 5003.12)



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117

414.6.1.3
NONCOMBUSTIBLE CONSTRUCTION.

- The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet.
 - Exception: The increases permitted by Section 506 apply.



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118

118

SAMPLE PROPOSAL: CBD
EXTRACTION

- Given: a customer wants to start a CBD Extraction Business
- They will be using Ethyl Alcohol for the process
- Is there anything hazardous with this? Physical or health hazard? Is it an "H" occupancy?



Photo & Interp. courtesy of ICC staff Scott Stoolkey

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119

119

COMBUSTIBLE FIBERS

- Readily ignitable and free-burning materials in a fibrous or shredded form, such as cocoa fiber, cloth, cotton, excelsior, hay, hemp, henequen, istle, jute, kapok, oakum, rags, sisal, Spanish moss, straw, tow, wastepaper, certain synthetic fibers or other like materials.
- This definition does not include densely packed baled cotton.



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EXTRACTION

- Solvents include
 - Alcohol
 - Naphtha
 - Ether
 - Butane
- All flammable liquids or gases
- Owner wants to store 2,000 gallons of Ethyl Alcohol in building.



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124

EXTRACTION

HMMS Chemicals

CAS No. Concentration State RTECS
 64-17-5 100% Liquid 802030000

Boiling Point: 78 °C
 Melting Point: -130 °C
 Flash Point: 48 °C
 Autoignition: 363.0 °C

LD 50 (700GR) LC 50 (RD) LFL/LEL UFL/UEL

Molecular Weight: 46.07
 Specific Gravity or Density: 0.79
 Vapor Density: 1.59
 Vapor Pressure: 40.00 mmHg

ethanol
 ethyl alcohol
 alcohol, ethyl

h-h rat LC50: 20,000 ppm/10H
 Upper Flammable Limit at 80 degrees Centigrade
 Vapor Pressure at 15 degrees Centigrade

EC 2008 DOT 49 CFR SARA Competibility Classifier Info

Physical Hazards: Aerosol Level, Combustible Dust/Fiber, Combustible Liquid, Cryogenic, Explosive, Compressed Gas

Health Hazards: Flammable Gas, Flammable Liquid Class IB, Flammable Solid, Organic Peroxide, Unstabilized Detonable, Unstable Reactive, Water Reactive

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125

125

TABLE 307.1(1)

TABLE 307.1(1)
 MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{1, 2, 3, 4, 5}

MATERIAL	CLASS	GROUP (WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED)	STORAGE ¹			USE-CLOSED SYSTEMS ²			USE-OPEN SYSTEMS ³		
			Solid pounds (metric tons)	Liquid gallons (metric tons)	Gas cubic feet (m ³)	Solid pounds (metric tons)	Gas cubic feet (m ³)	Gas cubic feet (m ³)	Solid pounds (metric tons)	Liquid gallons (metric tons)	Gas cubic feet (m ³)
Flammable gas	Severely Liquefied	H2	NA	NA	1,000 ⁴	NA	NA	1,000 ⁴	NA	NA	NA
Flammable liquid	IA	H2	600 ⁴	600 ⁴	NA	NA	NA	NA	NA	NA	10 ⁵
	IB and IC	H2 or H3	NA	200 ⁴	NA	NA	NA	NA	NA	NA	10 ⁵
Flammable liquid, noncombustion (IA, IB, IC)	NA	H2 or H3	NA	120 ^{4, 5}	NA	NA	NA	120 ^{4, 5}	NA	NA	30 ^{4, 5}

Ethyl Alcohol = Class IB Flammable Liquid

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126

126

MAXIMUM ALLOWABLE QUANTITIES MAQ

- Ethyl Alcohol
 - 120 gallons storage
 - 120 gallons closed use
 - 30 gallons open use
- Sprinklered Building
 - 240 gallons storage
 - 240 gallons closed use
 - 60 gallons open use



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127

IS IT A GROUP H OCCUPANCY?

- Yes, 2,000 gallons exceeds MAQ
- Section 414 and 415 apply
- IFC Requirements apply



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128

128

HIGH-HAZARD GROUP H-2

- Buildings and structures containing materials that pose a deflagration hazard or a hazard from accelerated burning shall be classified as Group H-2.
- Such materials shall include, but not be limited to, the following:
 - Class I, II or IIIA flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems pressurized at more than 15 pounds per square inch gauge.
 - Combustible dusts
 - Flammable gases

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HIGH HAZARD GROUP H-3

- Buildings and structures containing materials that readily support combustion (it burns) or that pose a physical hazard shall be classified as Group H-3.
- Such materials shall include, but not be limited to, the following:



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HIGH HAZARD GROUP H-3

- Class I, II or IIIA flammable or combustible liquids that are used or stored in normally closed containers or systems pressurized at 15 pounds per square inch gauge or less



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131

131

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

- 415.1 SCOPE:
- The provisions of Sections 415.1 through 415.8 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.
- Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 414 and the International Fire Code.



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132

DEFINITIONS

- **GAS CABINET.** A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.



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133

DEFINITIONS.

- **EXHAUSTED ENCLOSURE.** An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released. Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.



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DEFINITIONS

- **STORAGE, HAZARDOUS MATERIALS.**
- 1. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders or similar vessels, or
- 2. Vessels supplying operations through closed connections to the vessel.



Sodium Hypochlorite: a corrosive. MAQ 500 gallons

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135

AUTOMATIC FIRE DETECTION AND SPRINKLER SYSTEM

- 415.3 Automatic fire detection systems.
 - Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.
- 415.4 Automatic sprinkler system.
 - Group H occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.



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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.



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137

137



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.

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138

138



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 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.



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139

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.



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415.5.4 EMERGENCY ALARM SYSTEM

- 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.



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141

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.



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142

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 need not be located on the outer perimeter of the building where they are in accordance with the International Fire Code and NFPA 30.



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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 need not be located on the outer perimeter where they are in accordance with the International Fire Code and NFPA 30.



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415.6.3 SPRAY PAINT BOOTHS

- Spray paint booths that comply with the International Fire Code Chapter 24 need not be located on the outer perimeter.



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145

415.6.4 GROUP H OCCUPANCY MINIMUM FIRE SEP. 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.



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146

415.6.4 GROUP H OCCUPANCY MINIMUM FIRE SEP. DISTANCE

- 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 when separation is provided in accordance with the quantity distance tables specified for explosive materials in the International Fire Code.



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147

415.6.4.1 GROUP H-1

- Group H-1 occupancies shall be set back not less than 75 feet and not less than required by the International Fire Code.

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

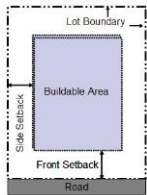


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148

415.6.4.2 GROUP H-2



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

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149

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 where a detached building is required
- (see Table 415.5.2).



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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.

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154

154



415.7.1 FLOORS IN H1 STORAGE ROOMS.

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



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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 (Detached Building Required) shall be in detached buildings used for manufacturing, processing, dispensing, use or storage of hazardous materials.



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156



415.8 SPECIAL PROVISIONS FOR GROUP H-2 AND H-3 OCCUPANCIES.

- 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).



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415.8.1 MULTIPLE HAZARDS



- Group H-2 or H-3 occupancies containing materials which 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.

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158

415.8.2 SEPARATION OF INCOMPATIBLE MATERIALS

- Hazardous materials other than those listed 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 5003.9.8



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159

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.

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160



415.8.4 FLOORS IN H2, H3 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.



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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 fire sprinkler systems shall not be within such rooms or areas.



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415.9 GROUP H-2.

- Occupancies in Group H-2 shall be constructed in accordance with Sections 415.9.1 through 415.9.3 and the International Fire Code. The IFC simply refers back to the IBC.



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415.9.1 (H2) 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. IFC 2902, 2201,5706,5703 etc.



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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. (707 Fire barriers and 711 Horizontal assemblies)



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415.9.1.1.1 STORAGE TANK 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.



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166

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 tank(s) shall be permitted as the method of protection from physical damage.



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415.9.1.3 TANKS.

- Storage tanks shall be approved tanks conforming to the requirements of the International Fire Code .
- IFC 5004.2 covers tank storage provisions for flammable and combustible liquids



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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. 5706, 4003, 5104, 5705, 5704, 5005, 2107 etc.



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415.9.1.4 LEAKAGE CONTAINMENT.

- 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.



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170

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
- Sign must indicate the potential hazard of the interior room or,
- the sign shall state: **WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS.**
- The leakage alarm shall have a monitored signal

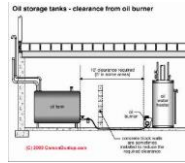
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415.9.1.6 TANK VENT.

- Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the International Fire Code.607,5806,
- 2306, 5704



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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 (403) and the International Fire Code .



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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.
- IFC 5004.6 Explosion control.



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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.



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175

175



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 Mechanical Code, the International Fuel Gas Code and NFPA 58.



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176

176



415.9.3 DRY CLEANING PLANTS.

- The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, and
 - 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 chapter 21.



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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.



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178

178



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. (the same as it was for H2).



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415.10.2 GAS ROOMS.

- When gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour fire barriers or horizontal assemblies, or both. Also see IBC tbl 509.



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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.



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181

415.10.4 SEPARATION-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 or horizontal, or both.



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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.



Bromine (toxic) is often used in circuit boards

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183

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415.11.1.2 SEPARATION.

- Fabrication areas, whose sizes are limited by the quantity of hazardous materials allowed by Table 415.11.2.1.1, 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 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 at least 3/4 hour in accordance with Section 716.

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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



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188

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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 also Section 415.11.1.5).
 - Floors forming a part of an occupancy separation shall be liquid tight.

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189

189



415.11.1.5 SHAFTS AND OPENINGS THROUGH FLOORS.

- Elevator shafts, vent shafts and other openings shall be enclosed when required by Section 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 a single conditioned environment.

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190



415.11.1.6 VENTILATION.

- Mechanical exhaust ventilation at the rate of not less than 1 cubic foot per minute per square foot 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.



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415.11.1.6 VENTILATION.

- 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 occupancy separations 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. Ducts penetrating fire barriers shall be contained in shafts

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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
 - 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 .



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193

415.11.1.8.1 (ELECTRICAL) GENERAL

- 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 at least 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 re-circulated air shall be permitted.



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415.11.1.8.2 WORKSTATIONS

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



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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 (Hazardous Production Materials) and shall not be used for transporting such materials except through closed piping systems as provided in Section 415.11.7.4.



Exceptions!

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415.11.3.1 SERVICE CORRIDORS

- 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 .



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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.



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415.11.3.3 (SERVICE CORRIDORS) MEANS OF EGRESS.

- The maximum travel distance from any point in a service corridor to an exit, exit access corridor or door into a fabrication area shall not exceed 75 feet
- **Dead ends shall not exceed 4 feet in length!!**
- There shall be not less than two exits
- 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. (regardless of occupant load served)

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415.11.3.4 (SERVICE CORRIDORS) MINIMUM WIDTH.

- The minimum clear width of a service corridor shall be 5 feet, or 33 inches wider than the widest cart or truck used in the corridor, whichever is greater.



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415.11.4 SERVICE CORRIDORS

- An emergency alarm system shall be provided in service corridors, with at least one alarm device in each service corridor.
- 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.

This Section requires an emergency alarm system in all areas where HPM is transported or stored. The applicability of either Section 415.5.1 or 415.5.2 depends on whether the HPM material is in a storage or use condition. This Section also clarifies that the requirement for an emergency alarm system in a Group H-5 facility in the locations identified in Sections 415.11.4.1 through 415.11.4.5 is not dependent on whether the maximum allowable quantities per control area of Tables 307.1(1) or 307.1(2) are exceeded.

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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.



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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. (the general emergency alarm provision for H occupancies)



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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.



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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.



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415.11.5 STORAGE OF HAZARDOUS PRODUCTION MATERIALS.

- Storage of 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 listed in Section 5003.1 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 .

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415.11.6.1 CONSTRUCTION OF HPM ROOMS AND GAS ROOMS.

- HPM rooms and gas rooms shall be separated from other areas by
 - fire barriers constructed or horizontal assemblies, or
 - both.
- The minimum fire-resistance rating shall be 2 hours where the area is 300 square feet or more and 1 hour where the area is less than 300 square feet.



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415.11.6.2 CONSTRUCTION OF LIQUID STORAGE ROOMS.

- Liquid storage rooms shall be constructed in accordance with the following requirements:
 1. Rooms in excess of 500 square feet shall have at least one exterior door approved for fire department access.
 2. Rooms shall be separated from other areas by fire barriers or horizontal Assemblies, or both.
 3. The fire-resistance rating shall be not less than 1 hour for rooms up to 150 square feet in area and not less than 2 hours where the room is more than 150 square feet in area.
 4. Shelving, racks and wainscoting in such areas shall be of noncombustible construction or wood of not less than 1-inch nominal thickness.
 5. Rooms used for the storage of Class I flammable liquids shall not be located in a basement.

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415.11.6.3 CONSTRUCTION OF 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.



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415.11.6.4 LOCATION.

- Where HPM rooms, liquid storage rooms and gas rooms are provided, they shall have at least one exterior wall and such wall shall be not less than 30 feet from lot lines, including lot lines adjacent to public ways. **This is different than FSD**



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415.11.6.5 EXPLOSION CONTROL

- Explosion control shall be provided where required by Section 414.5.1. (recall the explosion control table with barricades and venting depending on material)



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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.



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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.
- Outswing and;
- Panic bars are required



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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 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.



Liquid storage room with ethanol.

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214

214

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.

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415.11.7 PIPING AND TUBING.

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



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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.
- Special inspection per 1705.11 is recommended



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415.11.7.2 LOCATION IN SERVICE CORRIDOR

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



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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), 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.



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415.11.7.4 PIPING 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:



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415.11.7.4 PIPING INSTALLATIONS IN CORRIDORS AND ABOVE OTHER OCCUPANCIES

- 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.

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221

221

415.11.7.4 PIPING INSTALLATIONS IN CORRIDORS AND ABOVE OTHER OCCUPANCIES.

- 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.

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222

222

415.11.6.5
IDENTIFICATION.

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



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223

223

415.11.7
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 415.11.8.4.



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224

224

415.11.8.1
WHERE REQUIRED

- In fabrication areas when gas is used
- In HPM rooms when gas is used
- In gas cabinets
- In exhausted enclosures
- In gas rooms
 - When gasses are not in gas cabinets or exhausted enclosures
- In corridors and in the space between the corridors and the floor or roof above-(see exc).
- Exception: A continuous 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 .

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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 when the monitoring point is within an exhausted enclosure, ventilated enclosure or gas cabinet.
 - 2. Permissible exposure limit (PEL) levels when 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) when 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 37 of the International Fire Code .

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226



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.



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227



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.



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228



415.11.8.2.2
SHUTOFF OF GAS SUPPLY.

- 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.

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229

229



415.11.8.2.2
SHUTOFF OF GAS SUPPLY.

- 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.

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230

230



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 IBC Section 907.



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231

231



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.
 - At an approved location on the premises outside the fabrication area
 - trained personnel shall continuously staff the station



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232

232



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. Continuous 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 .



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233

233



415.11.10.3 SIGNALS.

- 1. Automatic sprinkler system alarm and monitoring systems.
- 2. Manual fire alarm systems.
- 3. Emergency alarm systems.
- 4. Continuous 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 .

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234

234



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.



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235

235



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 fire alarm systems.
 8. Automatic sprinkler system monitoring and alarm systems.

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236

236



415.11.11.1 (H5 EMERGENCY POWER)
REQUIRED ELECTRICAL 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.

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237

237



**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.



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238

238

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.



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239

239

415.11.12.1 - METALLIC AND NON-COMBUSTIBLE NONMETALLIC EXHAUST DUCTS.

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

- Where the largest cross-sectional diameter is equal to or greater than 10 inches.
- The ducts are within the building.
- The ducts are conveying flammable gases, vapors or fumes.



Fire resistant non-combustible duct

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240

240

415.11.12.2 SPRINKLERS IN 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.



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241

241

415.11.12.2 SPRINKLERS IN COMBUSTIBLE NONMETALLIC EXHAUST DUCTS.

- Exceptions:
 - 1. Ducts listed or approved for applications without automatic fire sprinkler system protection.
 - 2. Ducts not more than 12 feet in length installed below ceiling level.



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242

242

415.11.12.3 AUTOMATIC SPRINKLER LOCATIONS.

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



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243

243

IBC TABLE 1604.5 OCCUPANCY CATEGORY IV BUILDINGS

- Containing highly toxic materials over the Maximum Allowable Quantities.
- Are sufficient to pose a threat to the public if released



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244

244



IBC 1705.1.1 SPECIAL INSPECTIONS

- IBC allows the Building Division to require a special inspector for unusual materials, systems and designs that are not normally encountered.
- This could include Hazardous Materials
- Feel free to use this option to require a specialist



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245

245



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246

246



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247

247

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248

248
