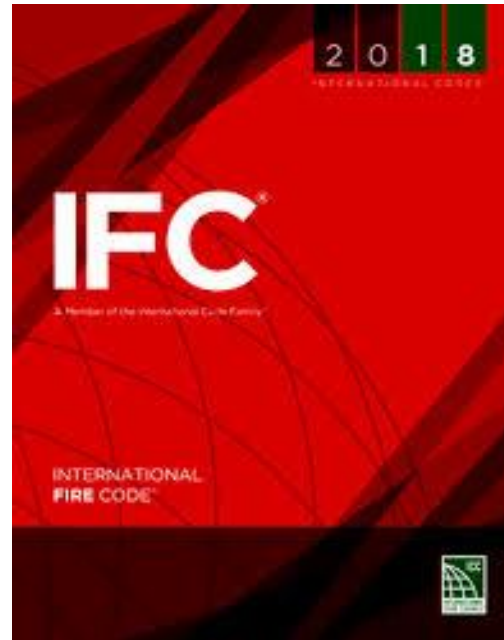


Hazardous Materials and the International Fire Code



Hazardous Materials and the International Fire Code



Who am I?



- John Swanson
- Deputy State Fire Marshal (MN)
- IBC Fire Safety Committee
- NFPA 72 Technical Committee
- Instructor for International Code Council and NFPA 72
- Appointed by MN Gov. Mark Dayton to Board of Architecture & Engineering (2013)



Fire & Life Safety Interests...



- Fire Alarm Systems



Fire & Life Safety Interests...

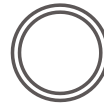


- Fire Alarm Systems



- School Fire Safety

Fire & Life Safety Interests...



- Fire Alarm Systems



- School Fire Safety



- Autism/Fire & Life Safety

Miscellaneous Information

- Restrooms
- Breaks
- Roster
- Informal
- Participate
- Please ask questions

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"You're not allowed to use the sprinkler system to keep your audience awake."

Introductions



- Please introduce yourself:
 - Employer
 - Years of experience in the industry?
 - Years of experience dealing with/reviewing fire alarm systems?



Agenda

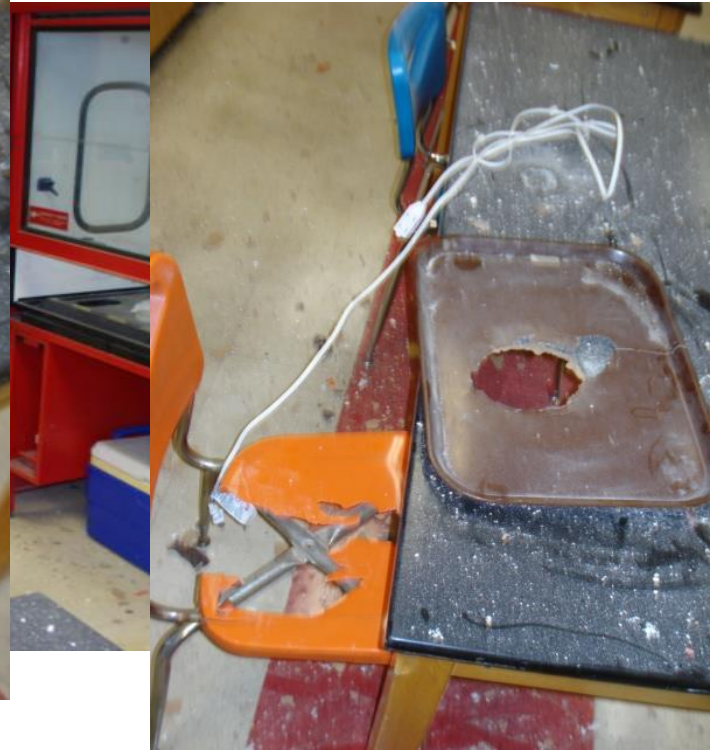


- Different types of hazardous materials
- How the code regulates hazardous materials
- International Fire Code requirements applicable to hazardous materials
 - Storage
 - Use-open systems
 - Use-closed systems

Why is Haz-Mat Important?



Because accidents happen...



Why is Haz-Mat Important?



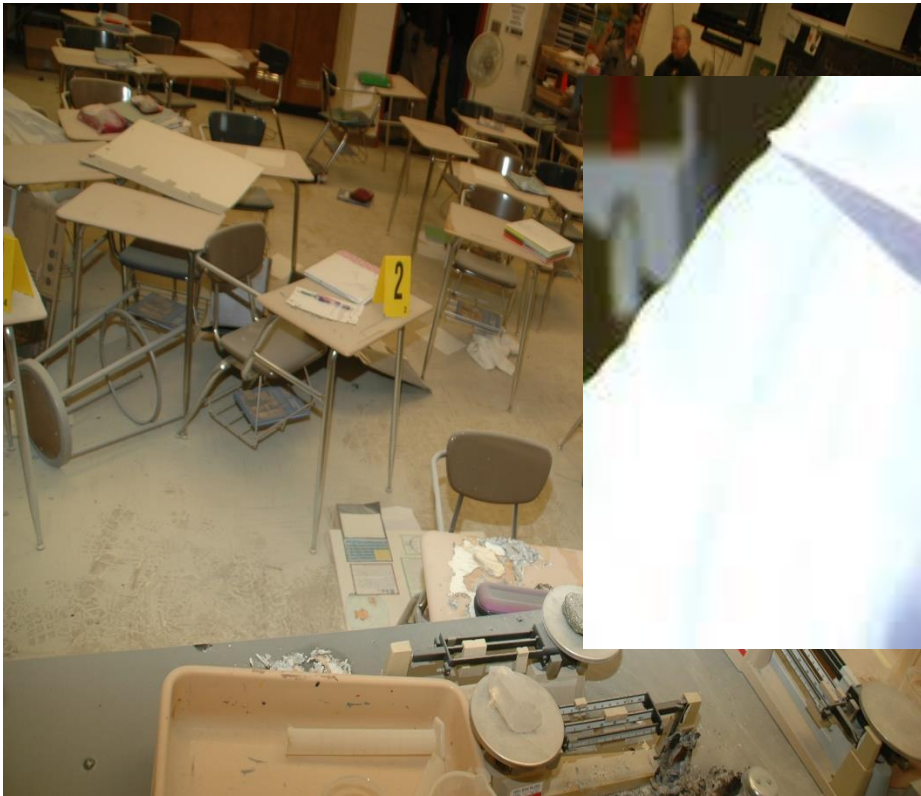
Because accidents happen...



Why is Haz-Mat Important?



Because accidents happen...



Why is Haz-Mat Important?



Because accidents happen...



Why is Haz-Mat Important?



- Bhopal, India
- Dec. 2-3, 1984
- 500,000 people exposed to methyl isocyanate gas (highly toxic) and other chemicals
- Some estimates indicate 8,000 died within 2 weeks of incident
- Another 8,000 have died since
- 558,125 injuries

Identifying the Hazardous Material



- Material Safety data sheets (MSDS)
- IFC Appendix E
- Solid (pounds), Liquid (gallons), or gas (cubic feet)

Operational Provisions – IFC 102.2



- Operational provisions of the IFC apply to:
 - Conditions and operations arising after the adoption of this code.
 - Existing conditions and operations
 - No grandfather clause
 - Follow your state laws/regulations regarding application of the IFC and existing buildings

Conflicts – Codes vs. Standards



- Where a conflict occurs between the IFC and a referenced standard, the provisions of the IFC apply.

Conflicting Provisions – IFC section 102.10



- Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall apply (IFC section 102.10)
 - Ex. Installation of a waste oil storage tank connected to a heating appliance is subject to section 603

Technical Assistance – IFC 104.7.2



- Code officials can require 3rd party verification to review new technologies, processes, products, facilities or materials
 - Cost is assessed to the building owner (not the AHJ)



Permits



- Two types of permits
 - Construction-Allows the applicant to install or modify systems and equipment required under section 105.7
 - Operational-Allows the applicant to conduct an operation or a business for which a permit is required by section 105.6
 - Operational permits can be approved for a prescribed period of time or until revoked or renewed.

Chapter 50 – Format



- 5001 – General
 - Scope
 - Classifying materials
 - Physical hazards
 - Health hazards
 - Performance requirements
 - Permits (when applicable)
 - Facility closure requirements

Chapter 50 – Format



- 5002 – Definitions

- 2012 edition: All definitions moved from specific chapter to chapter 2
- 5002 still outlines important terms, but must go to chapter 2 for definition

Chapter 50 – Format



- 5003 – General Requirements
 - Requirements in 5003 apply to ALL hazardous materials unless exempt under section 5001.1

Chapter 50 – Format



- 5004 – Storage
 - Section only applies to storage of hazardous materials exceeding the MAQ
 - Retail sales and display of hazardous materials subject to section 5003.11

Chapter 50 – Format



- 5005 – Use, Dispensing and Handling
 - Section only applies to use, dispensing and handling of hazardous materials exceeding the MAQ.

Chapter 50 - Exceptions



(1) Retail sales of medicines, foodstuff or consumer products and cosmetics containing not more 50% by volume of water-miscible liquids with the remainder not flammable shall not be limited in individual containers not exceeding 1.3 gallons

Chapter 50 - Exceptions



(2) Quantities of alcoholic beverages in retail or wholesale occupancies shall not be limited providing the liquids are packaged in containers not exceeding 1.3 gallons

(3) Application and release of pesticides and agricultural products and materials intended for use in weed abatement, erosion control, or similar applications when applied in accordance with manufacturer's instructions

Chapter 50 - Exceptions



- (4) The off-site transportation of hazardous materials where in accordance with Department of Transportation regulations
- (5) Building materials not otherwise regulated by this code
- (6) Refrigeration systems pursuant to section 606
- (7) Stationary storage battery systems (see section 608)

Chapter 50 - Exceptions



(8) The display, storage, sale or use of fireworks and explosives in accordance with chapter 56

(9) Corrosives used in personal and household products in the manufacturer's original packaging in Mercantile occupancies

(10) The storage of distilled spirits and wines in wooden barrels and casks

(11) Alcohol based hand sanitizers classified as Class I or II liquids in accordance with section 5705.5

IFC Hazard Categories



- Physical

- Explosives
- Compressed gases
- Flammable liquids
- Combustible liquids
- Flammable solids
- Combustible dusts & powders
- Combustible fibers
- Oxidizers
- Organic peroxides
- Unstable/Reactive materials
- Water-reactive materials
- Cryogenic fluids

IFC Hazard Categories



- Health
 - Highly toxic materials
 - Toxic
 - Corrosives

Safeguards – IFC 5001.3.3.6

- Safeguards shall be provided to minimize risk of exposing hazardous materials to fire or physical damage where exposure could endanger people or property.

- See 901.4.4



Emergency Plan – IFC 5001.3.3.14



- An emergency plan approved by the fire code official shall be provided and employees must be trained on the plan

Hazardous Materials



- Quantities NOT exceeding the MAQ per control area indicated in tables 5003.1.1(1) through 5003.1.1(4) shall comply with:
 - Section 5001
 - Section 5003

Hazardous Materials



- Quantities exceeding the MAQ per control area indicated in Tables 5003.1.1(1) through 5003.1.1(4) shall comply with Chapter 50:
 - Section 5001 – General (Applicable to all storage)
 - Section 5002 – Definitions
 - Section 5003 – General Requirements (applicable to all storage)
 - Section 5004 – Storage
 - Section 5005 – Use, Dispensing & Handling

Hazardous Materials



- Become familiar with Table 5003.1.1(1)
 - The hazardous materials requirements can be very confusing!
 - Understand the different requirements:
 - Storage
 - Use – Open System
 - Use – Closed System



Hazardous Materials – Chapter 50



- Important terms

- *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.
- *Maximum allowable quantity*-The maximum amount of hazardous materials allowed to be stored or used within a control area. The maximum allowable quantity per control area is based on the material state (solid, liquid or gas) and the material storage or use condition (open or closed)

Hazardous Materials – Chapter 50



- **Important terms**

- *Open System*-The use of a solid or liquid hazardous material involving a vessel or system that is continuously open to the atmosphere during normal operations and where vapors are liberated, or the product is exposed to the atmosphere during normal operations
- *Closed System*-The use of a solid or liquid hazardous material involving a closed vessel or system that remains closed during normal operations where vapors emitted by the product are not liberated outside of the vessel or system and the product is not exposed to the atmosphere during normal operations. Closed systems include the use of all compressed gases.

Hazardous Materials - General



- Section 5003



Storage vs. Use



- Tables 5003.1.1(1) through 5003.1.1(4) provide the maximum allowable quantities for:
 - Physical hazardous
 - Health hazards
 - Indoor control areas
 - Outdoor control areas

TABLE 5003.1.1(1)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING PHYSICAL HAZARD^{a, j, m, n}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
			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)
Combustible dust	Not Applicable	H-2	See Note q	Not Applicable	Not Applicable	See Note q	Not Applicable	Not Applicable	See Note q	Not Applicable
Combustible fiber	Loose Baled ^o	H-3	(100) (1,000)	Not Applicable	Not Applicable	(100) (1,000)	Not Applicable	Not Applicable	(20) (200)	Not Applicable
Combustible liquid ^{c, i}	II IIIA IIIB	H-2 or H-3 H-2 or H-3 Not Applicable	Not Applicable	120 ^{d, e} 330 ^{d, e} 13,200 ^{e, r}	Not Applicable	Not Applicable	120 ^d 330 ^d 13,200 ^f	Not Applicable	Not Applicable	30 ^d 80 ^d 3,300 ^f
Cryogenic Flammable	Not Applicable	H-2	Not Applicable	45 ^d	Not Applicable	Not Applicable	45 ^d	Not Applicable	Not Applicable	10 ^d
Consumer fireworks	1.4G	H-3	125 ^{d, e, i}	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Applicable
Cryogenic Oxidizing	Not Applicable	H-3	Not Applicable	45 ^d	Not Applicable	Not Applicable	45 ^d	Not Applicable	Not Applicable	10 ^d
Explosives	Division 1.1	H-1	1 ^{e, g}	(1) ^{e, g}	Not Applicable	0.25 ^g	(0.25) ^g	Not Applicable	0.25 ^g	(0.25) ^g
	Division 1.2	H-1	1 ^{e, g}	(1) ^{e, g}		0.25 ^g	(0.25) ^g		0.25 ^g	(0.25) ^g
	Division 1.3	H-1 or H-2	5 ^{e, g}	(5) ^{e, g}		1 ^g	(1) ^g		1 ^g	(1) ^g
	Division 1.4	H-3	50 ^{e, g}	(50) ^{e, g}		50 ^g	(50) ^g		Not Applicable	Not Applicable
	Division 1.4G	H-3	125 ^{d, e, i}	Not Applicable		Not Applicable	Not Applicable		Not Applicable	Not Applicable
	Division 1.5	H-1	1 ^{e, g}	(1) ^{e, g}		0.25 ^g	(0.25) ^g		0.25 ^g	(0.25) ^g
	Division 1.6	H-1	1 ^{e, g}	Not Applicable		Not Applicable	Not Applicable		Not Applicable	Not Applicable
Flammable gas	Gaseous Liquefied	H-2	Not Applicable	Not Applicable (150) ^{d, e}	1,000 ^{d, e} Not Applicable	Not Applicable	Not Applicable (150) ^{d, e}	1,000 ^{d, e} Not Applicable	Not Applicable	Not Applicable
Flammable liquid ^c	IA	H-2 or H-3	Not Applicable	30 ^{d, e}	Not Applicable	Not Applicable	30 ^d	Not Applicable	Not Applicable	10 ^d
	IB and IC		Not Applicable	120 ^{d, e}	Not Applicable	Not Applicable	120 ^d	Not Applicable	Not Applicable	30 ^d
Flammable liquid, combination (IA, IB, IC)	Not Applicable	H-2 or H-3	Not Applicable	120 ^{d, e, h}	Not Applicable	Not Applicable	120 ^{d, h}	Not Applicable	Not Applicable	30 ^{d, h}
Flammable solid	Not Applicable	H-3	125 ^{d, e}	Not Applicable	Not Applicable	125 ^d	Not Applicable	Not Applicable	25 ^d	Not Applicable

TABLE 5003.1.1(1)—continued

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSSESSING A PHYSICAL HAZARD^{a, j, m, n}

MATERIAL	CLASS	GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
			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)
Inert Gas	Gaseous	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
	Liquefied	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
Cryogenic Inert	Not Applicable	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
	Applicable	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
Organic peroxide	UD	H-1	1 ^{a, g}	(1) ^{a, g}	Not Applicable	0.25 ^g	(0.25) ^g	Not Applicable	0.25 ^g	(0.25) ^g
	I	H-2	5 ^{d, e}	(5) ^{d, e}		1 ^d	(1) ^d		1 ^d	(1) ^d
	II	H-3	50 ^{d, e}	(50) ^{d, e}		50 ^d	(50) ^d		10 ^d	(10) ^d
	III	H-3	125 ^{d, e}	(125) ^{d, e}		125 ^d	(125) ^d		25 ^d	(25) ^d
	IV	Not Applicable	Not Limited	Not Limited		Not Limited	Not Limited		Not Limited	Not Limited
V	Not Applicable	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited		
Oxidizer	4	H-1	1 ^g	(1) ^{a, g}	Not Applicable	0.25 ^g	(0.25) ^g	Not Applicable	0.25 ^g	(0.25) ^g
	3 ^k	H-2 or H-3	10 ^{d, e}	(10) ^{d, e}		2 ^d	(2) ^d		2 ^d	(2) ^d
	2	H-3	250 ^{d, e}	(250) ^{d, e}		250 ^d	(250) ^d		50 ^d	(50) ^d
	1	Not Applicable	4,000 ^{e, f}	(4,000) ^{e, f}		4,000 ^f	(4,000) ^f		1,000 ^f	(1,000) ^f
Oxidizing gas	Gaseous Liquefied	H-3	Not Applicable	Not Applicable (150) ^{d, e}	1,500 ^{d, e} Not Applicable	Not Applicable Not Applicable	Not Applicable (150) ^{d, e}	1,500 ^{d, e} Not Applicable	Not Applicable Applicable	Not Applicable Applicable
Pyrophoric	Not Applicable	H-2	4 ^{a, g}	(4) ^{a, g}	50 ^{a, g}	1 ^g	(1) ^g	10 ^{a, g}	0	0
Unstable (reactive)	4	H-1	1 ^{a, g}	(1) ^{a, g}	10 ^{a, g}	0.25 ^g	(0.25) ^g	2 ^{a, g}	0.25 ^g	(0.25) ^g
	3	H-1 or H-2	5 ^{d, e}	(5) ^{d, e}	50 ^{d, e}	1 ^d	(1) ^d	10 ^{d, e}	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}	250 ^{d, e}	50 ^d	(50) ^d	250 ^{d, e}	10 ^d	(10) ^d
	1	Not Applicable	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited
Water reactive	3	H-2	5 ^{d, e}	(5) ^{d, e}	Not Applicable	5 ^d	(5) ^d	Not Applicable	1 ^d	(1) ^d
	2	H-3	50 ^{d, e}	(50) ^{d, e}		50 ^d	(50) ^d		10 ^d	(10) ^d
	1	Not Applicable	Not Limited	Not Limited		Not Limited	Not Limited		Not Limited	Not Limited

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

a. For use of control areas, see Section 5003.8.3.

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 providing the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial 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 1.3 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.

Footnotes to Table 5003.1.1(1)



- b – aggregate quantity shall not exceed storage
- d – increase 100% for sprinklers
- e – increase 100% for cabinets, day boxes, exhausted enclosures, listed safety cans
- f – not limited in sprinklered buildings
- g – not permitted in unsprinklered buildings
- k – 200 lbs. or 20 gallons of Oxidizer 3 for maintenance or operation of equipment

Footnotes to Table 5003.1.1(1)



- l – fireworks 1.4G based on 25% of gross weight
- m – 1 gallon = 10 lbs.
- n – storage and display in M, storage in S
- p – situations not included
- q – combustible dusts when the concentration and conditions create a fire or explosion hazard

TABLE 5003.1.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIAL PRESENTING A HEALTH HAZARD^{a, b, c, d, e, f, g, h, i}

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

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

- a. For use of control areas, see Section 5003.8.3.
- b. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs, consumer or industrial 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.
- c. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 5003.11, see Table 5003.11.1.
- d. The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
- e. 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 f also applies, the increase for both notes shall be applied accumulatively.
- f. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, gas cabinets or exhausted enclosures. Where Note e also applies, the increase for both notes shall be applied accumulatively.
- g. Allowed only when stored in approved exhausted gas cabinets or exhausted enclosures.
- 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.

TABLE 5003.1.1(3)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSSESSING A PHYSICAL HAZARD IN AN OUTDOOR CONTROL AREA^{a, b}

MATERIAL	CLASS	STORAGE ^b			USE OF SYSTEMS ^b			USE OF SYSTEMS ^b	
		Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds) ^d
Flammable gas	Gaseous Liquefied	Not Applicable	Not Applicable (300)	3,000 Not Applicable	Not Applicable	Not Applicable (150)	1,500 Not Applicable	Not Applicable	Not Applicable
Flammable solid	Not Applicable	500	Not Applicable	Not Applicable	250	Not Applicable	Not Applicable	50	Not Applicable
Inert Gas	Gaseous Liquefied	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
Cryogenic inert	Not Applicable	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable	Not Limited	Not Applicable	Not Applicable
Organic peroxide	Unclassified Detonable	1	(1)	Not Applicable	0.25	(0.25)	Not Applicable	0.25	(0.25)
Organic peroxide	I	20	(20)	Not Applicable	10	(10)	Not Applicable	2	(2)
	II	200	(200)		100	(100)		20	(20)
	III	500	(500)		250	(250)		50	(50)
	IV	1,000	(1,000)		500	(500)		100	(100)
	V	Not Limited	Not Limited		Not Limited	Not Limited		Not Limited	Not Limited
Oxidizer	4	2	(2)	Not Applicable	1	(1)	Not Applicable	0.25	(0.25)
	3	40	(40)		20	(20)		4	(4)
	2	1,000	(1,000)		500	(500)		100	(100)
	1	Not Limited	Not Limited		Not Limited	Not Limited		Not Limited	Not Limited
Oxidizing gas	Gaseous Liquefied	Not Applicable	Not Applicable (600)	6,000 Not Applicable	Not Applicable	Not Applicable (300)	1,500 Not Applicable	Not Applicable	Not Applicable
Pyrophoric materials	Not Applicable	8	(8)	100	4	(4)	10	0	0
Unstable (reactive)	4	2	(2)	20	1	(1)	2	0.25	(0.25)
	3	20	(20)	200	10	(10)	10	1	1
	2	200	(200)	1,000	100	(100)	250	10	10
	1	Not Limited	Not Limited	1,500	Not Limited	Not Limited	Not Limited	Not Limited	Not Limited
Water reactive	3	20	(20)	Not Applicable	10	(10)	Not Applicable	1	(1)
	2	200	(200)		100	(100)		10	(10)
	1	Not Limited	Not Limited		Not Limited	Not Limited		Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³.

a. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.

b. The aggregate quantities in storage and use shall not exceed the quantity listed for storage.

c. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed in outdoor storage per single property under the same ownership or control used for retail or wholesale sales is allowed to exceed the maximum allowable quantity per control area when such storage is in accordance with Section 5003.11.

d. Quantities in parentheses indicate quantity units in parentheses at the head of each column.

Maximum Allowable Quantities



TABLE 5003.1.1(4)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD IN AN OUTDOOR CONTROL AREA^{a, b, c, f}

MATERIAL	STORAGE			USE-CLOSED SYSTEMS			USE-OPEN SYSTEMS	
	Solid pounds	Liquid gallons (pounds)	Gas cubic feet at NTP (pounds)	Solid pounds	Liquid gallons (pounds)	Gas cubic feet at NTP (pounds)	Solid pounds	Liquid gallons (pounds)
Corrosives	20,000	2,000	Gaseous 1,620 Liquefied (300)	10,000	1,000	Gaseous 810 Liquefied (150)	1,000	100
Highly toxics	20	(20)	Gaseous 40 ^d Liquefied (8) ^d	10	(10)	Gaseous 20 ^d Liquefied (4) ^d	3	(3)
Toxics	1,000	(1,000) ^e	Gaseous 1,620 Liquefied (300)	500	50 ^e	Gaseous 810 Liquefied (150)	125	(125) ^e

For SI: 1 cubic foot = 0.02832 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 pound per square inch absolute = 6.895 kPa, °C = [(°F)-32]/1.8.

- a. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.
- b. The aggregate quantities in storage and use shall not exceed the quantity listed for storage.
- c. The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials allowed in outdoor storage per single property under the same ownership or control used for retail or wholesale sales is allowed to exceed the maximum allowable quantity per control area when such storage is in accordance with Section 5003.11.
- d. Allowed only when used in approved exhausted gas cabinets, exhausted enclosures or under fume hoods.
- e. The maximum allowable quantity per control area for toxic liquids with vapor pressures in excess of 1 psia at 77°F shall be the maximum allowable quantity per control area listed for highly toxic liquids.
- f. Quantities in parentheses indicate quantity units in parentheses at the head of each column.

Maximum Allowable Quantities – 5003.1.1(1)



- Table 5003.1.1(1) modified related to 1.4G explosives (consumer fireworks)
- Removes the 100% increase when sprinkler protection is required where consumer fireworks are stored

**NEW
2018**



Maximum Allowable Quantities – 5003.1.1(1)



**NEW
2015**

- A new #5 added to footnote P in Table 5003.1.1(1)
- Alcohol based hand sanitizers shall not be considered when determining maximum allowable quantity.



Control Areas – 5003.8.3.4



- The fire resistance rating requirement for fire barriers separation control areas modified.

**NEW
2012**

- Floor assembly of the control area is allowed to be 1-hour in buildings of protected (IIA, IIIA, IV and VA) construction.

**NEW
2018**



Hazardous Materials Storage



- IFC outlines several different methods for storage of hazardous materials
 - Cylinders
 - Containers
 - Tanks
 - Atmospheric
 - Portable
 - Stationary
 - Protected Aboveground
 - Vehicles

Cylinders



- *Cylinder – A pressure vessel designed for pressures higher than 40 psia and having a circular cross section. It does not include a portable tank, multi-unit tank, car tank, cargo tank or tank car*
 - Cylinders are vessels containing flammable or non-flammable compressed gases.
 - Fabricated and designed to DOT criteria and generally limited to a capacity equivalent to the volume of 1,000 pounds of water.



Container



- *Container – A vessel of 60 gallons or less in capacity used for transporting or storing hazardous materials. Pipes, piping systems, engines and engine fuel tanks are not considered to be containers.*
 - Establishes a maximum capacity so containers are not confused with stationary tanks.
 - Includes 55 gallon drums or 2 oz. cans

Containers



Tanks



- Tank, Atmospheric – A storage tank designed to operate at pressures from atmospheric through 1.0 pounds per square inch gauge measured at the top of the tank
 - Not designed for internal pressure that exceeds atmospheric pressure.
 - Typically requires an emergency venting system for relief of pressure in fire situations

Tanks - Atmospheric



- *Tank, Atmospheric – A storage tank designed to operate at pressures from atmospheric through 1.0 pounds per square inch gauge measured at the top of the tank*
 - Not designed for internal pressure that exceeds atmospheric pressure.
 - Requires an emergency venting for relief of pressure in fire situations

Tanks - Atmospheric



Tank, Portable



- *Tank, Portable – A packaging of more than 60-gallons capacity and designed primarily to be loaded into or on temporarily attached to a transport vehicle or ship and equipped with skids, mountings or accessories to facilitate handling by mechanical means*
 - By definition, a portable tank must be moveable without having to detach permanently mounted electrical controls for dispensing operations

Tank, Portable



Tank, Protected Aboveground



- Tank, Protected Aboveground – A tank listed in accordance with UL 2085 consisting of a primary tank provided with protection from physical damage and fire resistive protection from a high-intensity liquid pool fire exposure.
 - Subject to a fire test that replicates exposure to a 2 – hour flammable liquid pool fire

Tank, Protected Above Ground (UL 2085)



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Tank, Stationary



- *Tank, Stationary – Packaging designed primarily for stationary installations not intended for loading, unloading or attachment to a transport vehicle as part of its normal operation in the process of use. This definition does not include cylinders having less than a 1,000 pound water capacity*
 - Permanent tank and typically has electrical equipment permanently mounted and attached to a permanent power source

Tank, Stationary

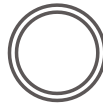


Tank, Vehicle



- *Tank, Vehicle – A vehicle other than a railroad car or boat, with a cargo tank mounted thereon or built as an integral part thereof, used for the transportation of flammable or combustible liquids, LP-gas or hazardous chemicals.*
 - Definition includes self-propelled vehicles and full trailers and semi-trailers, with or without motive power

Tank, Vehicle



Control Areas

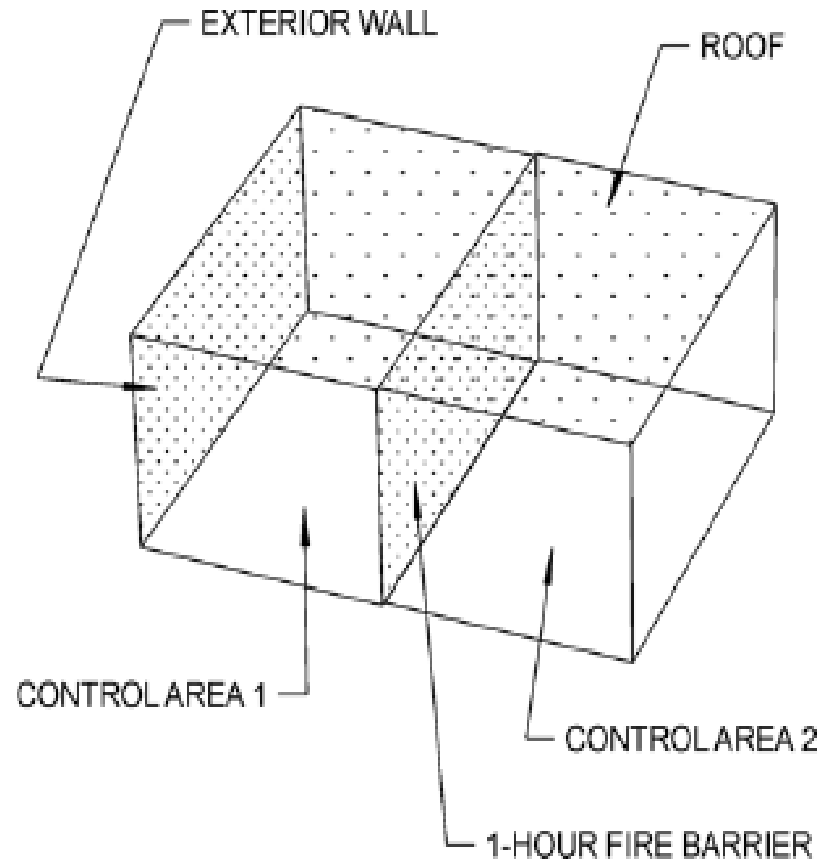
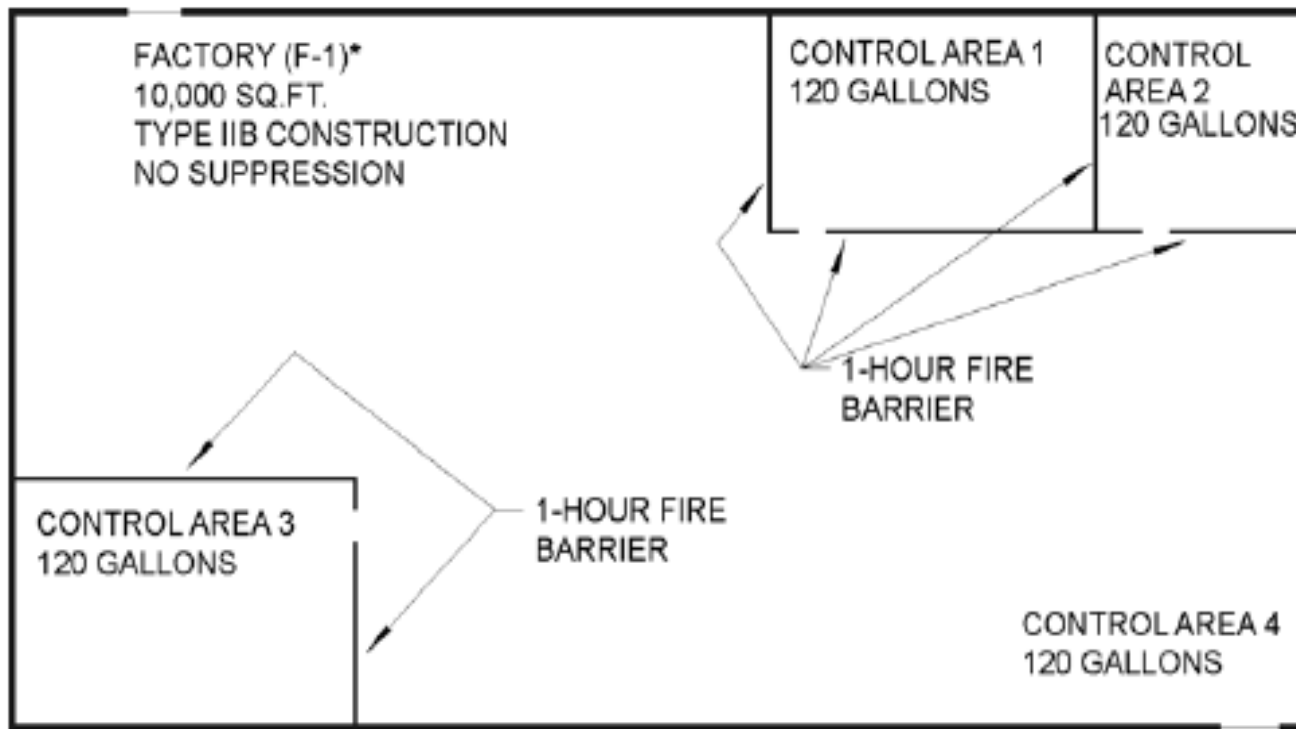


Figure 5003.8.3(1)
CONTROL AREAS

Hazardous Materials – Chapter 50



* ASSUME CLASS IB FLAMMABLE LIQUIDS

For SI: 1 square foot = 0.0929 m², 1 gallon = 3.785 L.

Figure 5003.8.3(2)
CONTROL AREA EXAMPLE

Maximum Allowable Quantities – 5003.1.1(1)



- Footnote Q requires combustibles to be evaluated by a special expert
- Review should include the use of the building, quantity of combustibles produced, number of occupants, importance of business to community, etc.
 - See technical expertise in section 104.7.2
 - Classified if H-2 if warranted

Aboveground tanks – 5003.2.4.2



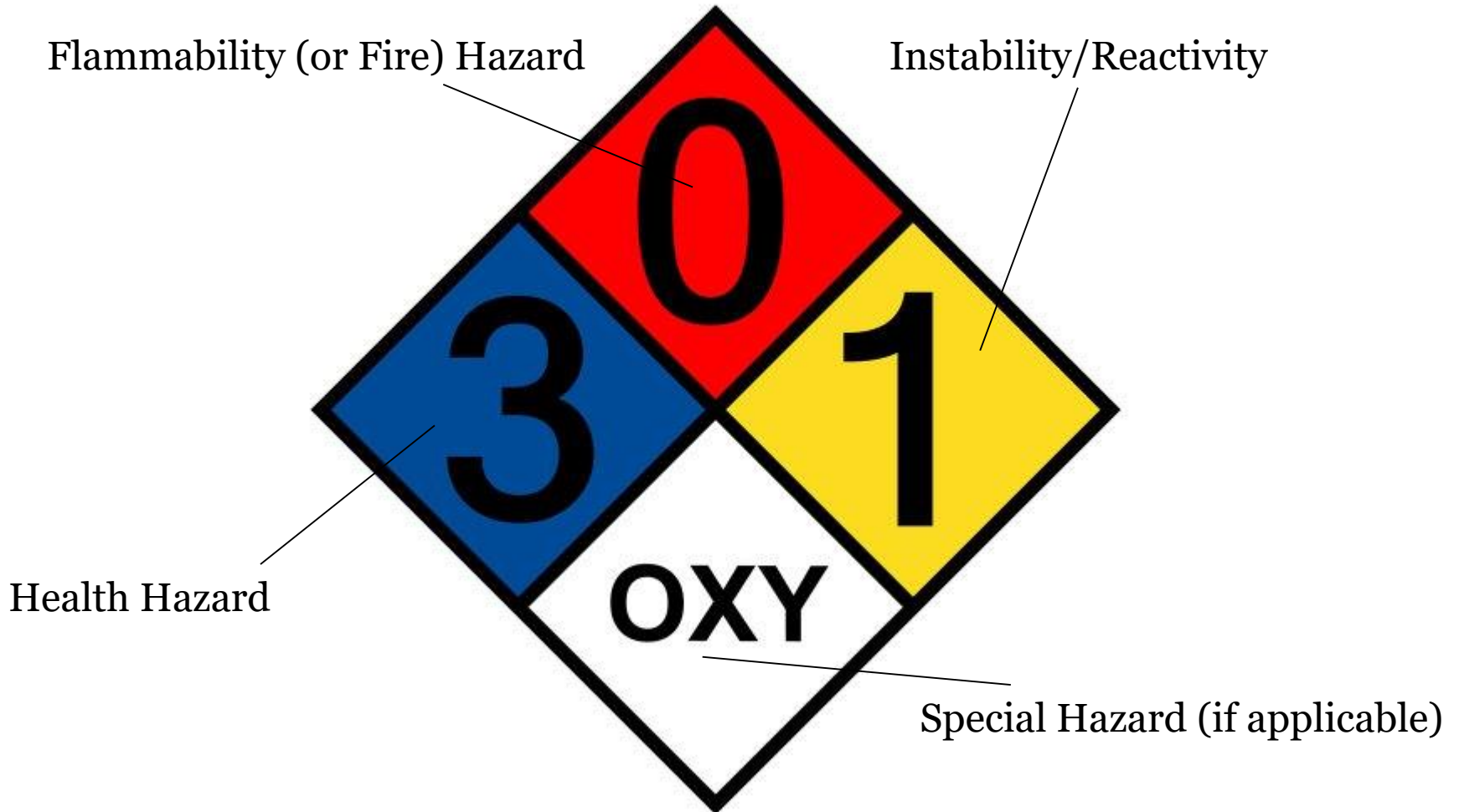
- Aboveground tank installations depend on the hazard being stored.
- Specific tank requirements are found in:
 - Section 2306 – Dispensing into motor vehicles
 - 5404 – Corrosives
 - 5704.2.8 – Flammable/combustible liquids

Tank Marking – 5003.2.4.2.1



- Aboveground stationary storage tanks shall be marked in accordance with section 5003.5:
 - Signs complying with NFPA 704 shall be provided for all stationary storage tanks and containers
 - Specific entrances and locations designated by the fire code official

NFPA 704 Placard



NFPA 704



NFPA Rating Explanation Guide



HEALTH HAZARD

- 4 = Can be lethal
- 3 = Can cause serious or permanent injury
- 2 = Can cause temporary incapacitation or residual injury
- 1 = Can cause significant irritation
- 0 = No hazard

FLAMMABILITY HAZARD

- 4 = Will vaporize and readily burn at normal temperatures
- 3 = Can be ignited under almost all ambient temperatures
- 2 = Must be heated or high ambient temperature to burn
- 1 = Must be preheated before ignition can occur
- 0 = Will not burn

OX = Oxidizing

SA = Simple asphyxiants

W = Reacts violently or explosively with water

SPECIAL HAZARD

- 4 = May explode at normal temperatures and pressures
- 3 = May explode at high temperature or shock
- 2 = Violent chemical change at high temperatures or pressures
- 1 = Normally stable. High temperatures make unstable
- 0 = Stable

INSTABILITY HAZARD

This chart for reference only - For complete specifications consult the NFPA 704 Standard

Tanks Out of Service – 5003.2.6.1



- Tanks out of service for > 90 days:
 - Shall be safeguarded or removed in an approved manner
 - The following shall be secured against tampering:
 - Fill line
 - Gauge opening
 - Pump connection
 - Vent lines maintained



Defective Containers or Tanks – 5003.2.6.2

- Defective containers or tanks shall be:
 - Removed from service
 - Repaired in accordance with approved standards
 - Disposed of in an approved manner



SDS – 5003.4



- Safety data sheets (SDS) shall be readily available on the premises for hazardous materials regulated by chapter 50.
- Does an SDS in electronic format meet this requirement?



Outdoor Control Area



- *Outdoor control area – An outdoor area that contains hazardous materials in amounts not exceeding the maximum allowable quantities of Table 5001.1.1(3) or Table 5003.1.1.(4)*

Control Area Construction 5003.8.3.1



- Control areas shall be separated from each other in accordance with the following:
 - Fire barriers complying with section 707 of the IBC; and/or,
 - Horizontal assemblies constructed in accordance with section 711 of the IBC.

Number of Control Areas – 5003.8.3.2

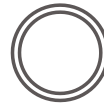


TABLE 5003.8.3.2
DESIGN AND NUMBER OF CONTROL AREAS

FLOOR LEVEL		PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER FLOOR	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	1	2
	7-9	5	2	2
	6	12.5	2	2
	5	12.5	2	2
	4	12.5	2	2
	3	50	2	1
	2	75	3	1
	1	100	4	1
Below grade plane	1	75	3	1
	2	50	2	1
	Lower than 2	Not Allowed	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 5003.1.1(1) and 5003.1.1(2), with all increases allowed in the footnotes to those tables.

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

Gas Rooms – 5003.8.4



- Gas room may be used to increase the MAQ or may be necessary to comply with chapter 60 (Toxic and Highly Toxic Materials)
 - Sprinkler protected
 - Separated in accordance with IBC
 - 1-hour fire barrier/horizontal assembly (IBC 415.9.2)
 - Ventilation in accordance with Mechanical Code

Exhausted Enclosures – 5003.8.5



- Exhausted enclosures may be used to increase the MAQ or required by chapter 60 (Toxic and Highly Toxic Materials):
 - Non-combustible construction
 - Ventilation in accordance with Mechanical Code
 - Extinguishing System
 - When flammable materials are used

Exhausted Enclosures – 5003.8.5



Gas Cabinets – 5003.8.6



- Gas cabinets may also be used to increase the MAQ or may be necessary to comply with chapter 60.
 - Not less than 12 gage steel
 - Self-closing limited access ports or non-combustible windows
 - Self-closing doors
 - Treated, coated or constructed of approved materials for the hazardous materials stored

Gas Cabinets – 5003.8.6



- Gas cabinets shall be provided with approved ventilation in accordance with Mechanical Code
- Negative pressure in relation to surrounding area
- Toxic and highly toxic gases shall be subject to chapter 60
- Maximum number of cylinders shall not exceed 3 in a single gas cabinet

Gas Cabinets – 5003.8.6

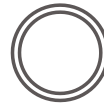


Hazardous Materials Cabinet – 5003.8.7



- Can be used to increase MAQ
- Construction requirements:
 - 18 gage steel (0.0478 inch)
 - Double-walled with 1 ½ inch airspace between walls
 - Joints riveted or welded that are tight-fitting
 - Self-closing doors that self-latch
 - Markings: “HAZARDOUS – KEEP FIRE AWAY”

Hazardous Materials Cabinet – 5003.8.7



General Safety Precautions – 5003.9



- Personnel training and written procedures
 - 5003.9.1
- Fire Department liaison
 - 5003.9.1.1
- Security
 - 5003.9.2



Vehicle Impact Protection – 5003.9.3



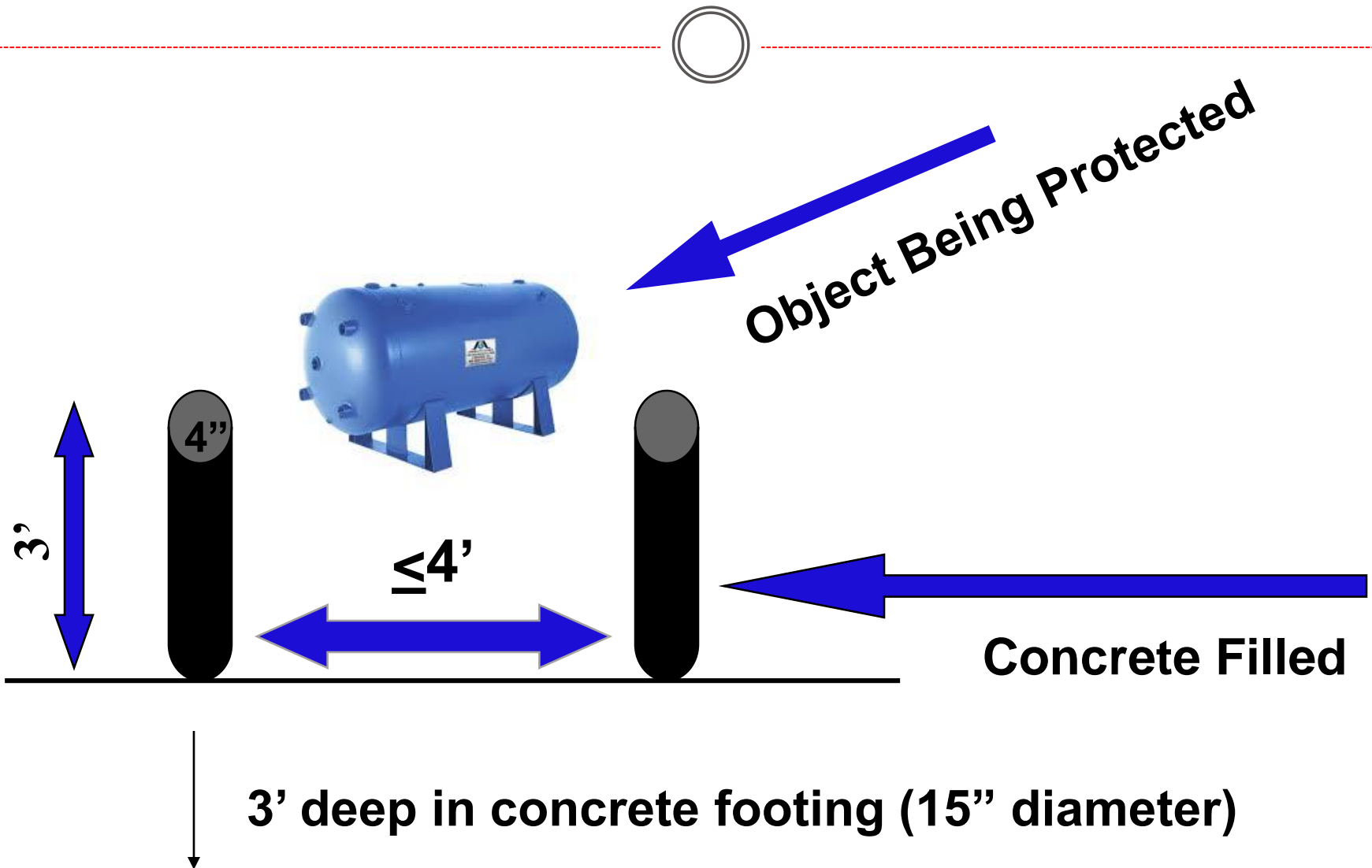
- Vehicle impact protection
 - Guard posts or other approved means shall be provided to protect storage tanks and connected piping, valves and fittings; dispensing areas and use areas subject to vehicular damage in accordance with IFC section 312.

Vehicle Impact Protection – 312



- Protection criteria for posts:
 - Minimum 4” steel pipe – concrete filled,
 - Spaced not more than 4 ft. apart,
 - At least 3 ft. deep in 15” diameter concrete,
 - Top of posts at least 3 ft. high,
 - At least 3 ft. from protected object.

Vehicle Impact Protection – 312



Vehicle Impact Protection

- A performance option is also provided
 - Barriers other than posts designed to resist, deflect, or visually deter vehicular impact are permitted when approved
 - New language in the 2015 IFC



Vehicle Impact Protection Necessary?



Incompatible Materials – 5003.9.8



- Incompatible materials in storage and in use shall be separated when capacity > 5 pounds or 0.5 gallon.
- Incompatible materials, depending on the product, will be outlined in the product's Material Safety Data Sheet (MSDS)

Cyclohexane MSDS



Stability and Reactivity

Chemical Stability: Stable at room temperature in closed containers under normal storage and handling conditions. Explosive peroxides may form on concentration. Peroxides can be detonated by friction, impact, or heating. Peroxide formation may occur in containers that have been opened and remain in storage. Normally stable; however, on long term storage, materials containing similar functional groups form peroxides of unknown stability.

Conditions to Avoid: Incompatible materials, ignition sources, excess heat, oxidizers.

Incompatibilities with Other Materials: Strong oxidizing agents, nitrogen dioxide.

Hazardous Decomposition Products: Carbon monoxide, irritating and toxic fumes and gases, carbon dioxide.

Incompatible Materials – 5003.9.8



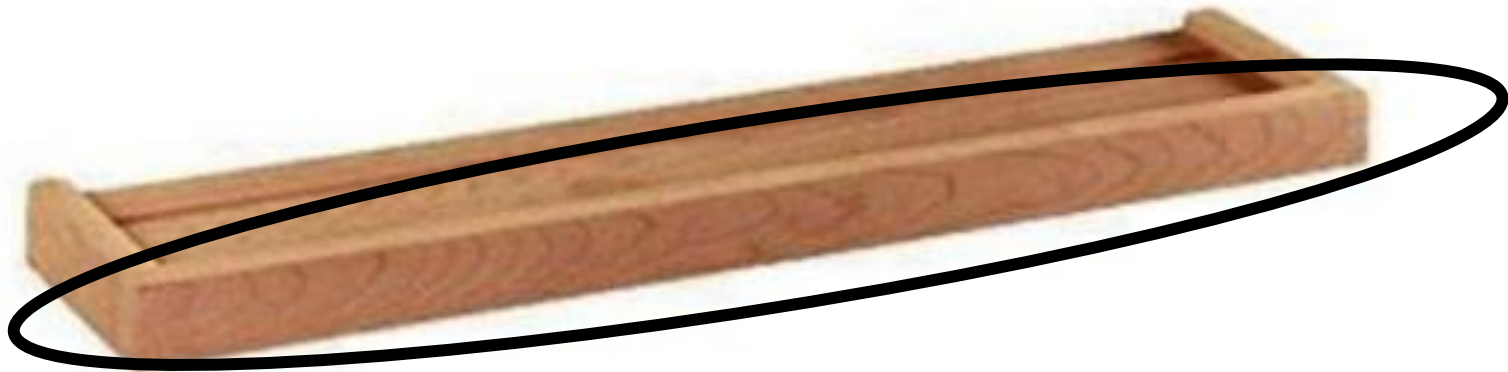
- Separation shall be accomplished by:
 - Distance not less than 20 feet;
 - Non-combustible partition extending a minimum of 18” above and to the sides of the stored material
 - Stored in hazardous materials cabinets
 - Compressed gases in cabinets or exhausted enclosures
 - Materials that are incompatible shall not be stored in the same cabinet or exhausted enclosure

Shelf Storage – 5003.9.9



- Shelving shall be substantial construction
- Compatible with the hazardous materials being stored
- Provided with a lip or guard when used for storage of individual containers
 - Exceptions:
 - Storage in cabinets or laboratory furniture designed for such use
 - Storage not requiring a permit
- Storage shall be maintained orderly

Lip or Guard Protection



Retail/Wholesale Storage and Display



- Retail and wholesale storage and display of non-flammable solids and non-flammable or non-combustible liquids in Group M and Group S occupancies are subject to section 5003.11.
 - Group M and S are not subject to Tables 5003.1.1(2) or 5003.1.1(2).

TABLE 5003.11.1

**MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M
AND S OCCUPANCIES NONFLAMMABLE SOLIDS, NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS ^{d,e,f}**

CONDITION		MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
Material ^g	Class	Solids pounds	Liquids gallons
A. HEALTH-HAZARD MATERIALS—NONFLAMMABLE AND NONCOMBUSTIBLE SOLIDS AND LIQUIDS			
1. Corrosives ^{h,c}	Not Applicable	9,750	975
2. Highly Toxics	Not Applicable	20 ^{b,c}	2 ^{b,c}
3. Toxics ^{h,c}	Not Applicable	1,000	100
B. PHYSICAL-HAZARD MATERIALS—NONFLAMMABLE AND NONCOMBUSTIBLE SOLIDS AND LIQUIDS			
1. Oxidizers ^{h,c}	4	Not Allowed	Not Allowed
	3	1,150 ^g	115
	2	2,250 ^h	225
	1	18,000 ^{i,j}	1,800 ^{i,j}
2. Unstable (Reactives) ^{h,c}	4	Not Allowed	Not Allowed
	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water Reactives	3 ^{h,c}	550	55
	2 ^{h,c}	1,150	115
	1	Not Limited	Not Limited

For SI: 1 pound = 0.454 kg, 1 gallon = 3.785 L, 1 cubic foot = 0.02832 m³.

Footnotes to Table 5003.11.1



- a. Hazard categories are as specified in section 5001.2.2
- b. Maximum allowable quantities shall be increased 100% in buildings equipped throughout with an NFPA 13 system
- c. Maximum allowable quantities shall be increased 100% when stored in approved storage cabinets

Footnotes to Table 5003.11.1



- d. See Table 5003.8.3.2 for design and number of control areas.
- e. Maximum allowable quantities for other hazardous material categories shall be in accordance with section 5003.1
- f. Maximum allowable quantities shall be increased 100% in outdoor control areas

Footnotes to Table 5003.11.1



g. MAQ is permitted to be increased to 2,250 lbs. when individual packages are in original sealed containers from manufacturer and do not exceed 10 lbs. each

h. MAQ is permitted to be increased to 4,500 lbs. when individual packages are in the original manufacturer containers and do not exceed 10 lbs.

Footnotes to Table 5003.11.1



- i. Quantities are unlimited where protected by an automatic sprinkler system
- j. Quantities are unlimited in an outdoor control area.

Storage/Display in Group M and S

- Display height shall not exceed 6 feet above the floor in display areas of Group M
- Storage height shall not exceed 8 feet above the floor in storage areas of Group M and S



Storage/Display in Group M and S



- Maximum container size shall be:
 - 100 pounds for solids
 - 10 gallons for liquids in storage and display areas



Outdoor Control Areas – 5003.12



Outdoor Control Areas – 5003.12



- Section regulates outdoor storage of hazardous materials NOT exceeding the MAQ.
- Outdoor control areas shall be kept free from weeds, debris, and combustibles not necessary to the storage
- Not closer than 20 feet from a lot line that can be built upon, public street, public alley or public way.
 - Some exceptions

Storage - 5004



- Applies to storage of hazardous materials exceeding the MAQ



Spill Control & Secondary Containment



- Rooms, buildings or (outdoor) areas used for storage of liquid or solid hazardous materials shall be provided with spill control and secondary containment
- Section 5004.2



Spill Control & Secondary Containment



- Spill Control for hazardous materials liquids
 - Individual capacity > 55 gallons
 - Aggregate capacity > 1,000 gallons

Spill Control & Secondary Containment



- Shall be accomplished by one of the following:
 - Liquid-tight sloped or recessed floors
 - Liquid-tight floors provided with raised or recessed sills or dikes
 - Sumps and collection systems
 - Other approved engineering systems

Fire Protection – 5004.5



- Indoor storage areas and storage buildings shall be equipped throughout with an approved automatic sprinkler system complying with NFPA 13.
 - Design not less than OH Group 2 with a minimum design area of 3,000 sq. ft.
 - If design determines a higher hazard is necessary, the higher protection shall be provided

Explosion Control – 5004.5



- Indoor storage rooms, areas and buildings shall be provided with explosion control
 - See IFC section 911
- Where mechanical ventilation, treatment systems, temperature control, alarm, detection, or other electrically operated systems are required, such systems shall be provided with emergency or standby power
 - See IFC section 604
 - See exemptions in section 5004.7.1

Emergency Alarm – 5004.9



- An approved emergency alarm shall be provided in buildings, rooms or areas used for storage of hazardous materials
 - Provided at each interior exit or exit access door
 - Activation of the emergency alarm shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials

Use, Dispensing and Handling



- Section 5005



Use, Dispensing and Handling - 5005



- Separation of incompatible materials
 - Section 5005.1.1
- Non-combustible floor
 - Section 5005.1.2
- Spill control and secondary containment
 - 5005.1.3

Fire Extinguishing System – 5005.1.8



- Indoor rooms or areas where hazardous materials are used, dispensed or handled shall be protected by an automatic fire extinguishing system complying with chapter 9
 - OH Group 2
 - Minimum design of 3,000 sq. ft.
 - Higher level of protection may be required depending on material stored



Handling – 5005.4



- *Handling – The deliberate transport by any means to a point of storage or use.*
 - *Handling is primarily concerned with transporting of hazardous materials within a building's egress system*
 - *Hazardous materials not in storage or use, are being “handled”.*

Handling of Hazardous Materials



- Quantities exceeding the MAQ per control area:
 - Subject to sections 5001, 5003, 5005.1 and 5005.4
- Quantities not exceeding the MAQ per control area:
 - Subject to sections 5001 and 5003.

Location – 5005.4.3



- Outdoor handling of hazardous materials shall be located as required for outdoor storage in accordance with section 5004.

Dispensing, Use and Handling – 5005.4.4

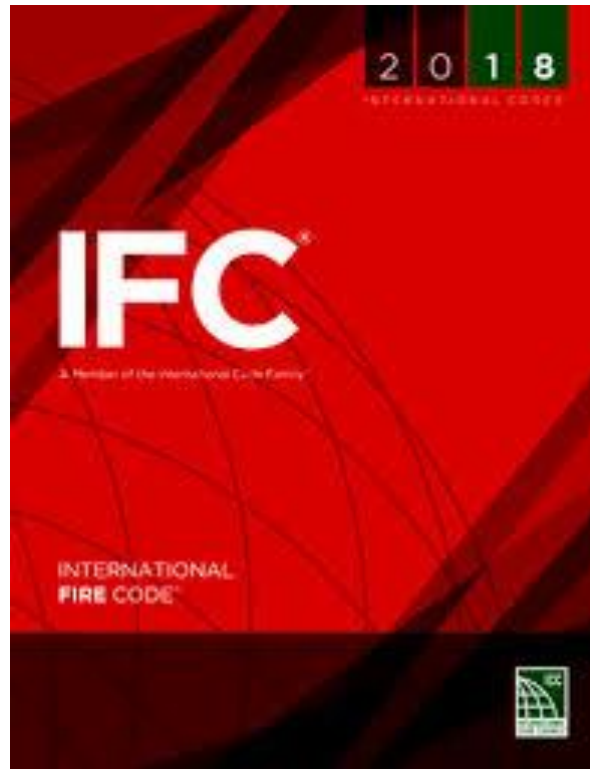


- For materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 that are transported through
 - Corridors
 - Interior exit stairways
 - Ramps, or
 - Exit passageways
- A means shall be provided to communicate an alarm signal every 150 feet
 - Signal shall be transmitted to a supervising station or to a constantly attended onsite location

Chapter 53



- Chapter 53 – Compressed Gases



CO₂ Beverage Dispensing Systems



**NEW
2015**

- New section 5307 added to address carbon dioxide CO₂ systems used in beverage dispensing applications
- Several fatalities and poisonings related to CO₂ systems in buildings



CO₂ Beverage Dispensing Systems



**NEW
2015**

- Equipment in compliance with chapter 53 and NFPA 55
- Protection from damage
- Required protection:
 - Mechanical ventilation per International Mechanical Code
 - Emergency Alarm System



CO₂ Beverage Dispensing Systems



**NEW
2018**

- Section 5307 regulating CO₂ dispensing operations was modified again in the 2018 IFC
- The term “emergency alarm system” from the 2015 IFC was replaced with “gas detection system”
 - Done to correlate with chapter 9 requirements



CO₂ Enrichment Systems – 5307.4



**NEW
2018**

- Carbon dioxide enrichment systems are now regulated in the IFC
- Often used in cultivation facilities for the production of marijuana
- Creates an asphyxiation hazard as the gas is introduced indoors to increase plant growth



CO₂ Enrichment Systems – 5307.4



**NEW
2018**

- Documentation requirements
 - Aggregate quantity of CO₂ on hand
 - Location
- Equipment criteria
 - Must comply with chapter 53 and NFPA 55
- Gas detection system
 - Comply with section 916

CO₂ Enrichment Systems – 5307.4



**NEW
2018**

- System activation requirements
- Pressurization and ventilation
- Signage:

CAUTION – CARBON DIOXIDE GAS
VENTILATE AREA BEFORE ENTERING.

A HIGH CARBON DIOXIDE (CO₂) GAS CONCENTRATION
IN THIS AREA CAN CAUSE ASPHYXIATION

- Seismic and structural design requirements
- Container refilling

Mobile Fueling Operations - 5707



**NEW
2018**

- 2018 IFC now regulates mobile fueling operations
 - Sometimes referred to as “on-demand” mobile fueling
 - These operations are occurring in many locations around the United States
 - Business will deliver and pump fuel to the location of the vehicle (as opposed to the vehicle driving to the service station)

Mobile Fueling Operations - 5707



**NEW
2018**



Mobile Fueling Operations - 5707



**NEW
2018**



Mobile Fueling Operations - 5707



**NEW
2018**

- Operation must occur from a “mobile fueling vehicle” as defined in the IFC
 - Chassis mounted tank not exceeding 1,200 gallons
 - A vehicle carrying a maximum of 60 gallons in metal safety cans complying with UL 30
 - Each container cannot exceed 5 gallon capacity
 - Containers must be secured

Mobile Fueling Operations - 5707



**NEW
2018**

- Safety and emergency response plan
- Training plan
- Prohibitions on where mobile fueling operations take place
- Setback requirements
- Dispensing hoses and nozzle criteria
- Fuel limits
- Fire extinguisher
- Spill reporting



Summary



- Determine the hazard(s) you're dealing with.
- Determine how the hazard(s) will be used
 - Storage
 - Use – Open System
 - Use – Closed System
- Apply the appropriate Tables in chapter 50 to determine the MAQ

Contact Information



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**THANK
YOU!**