



California Fire Code Chemical Hazard Classification discussion with examples

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Poll #1 Training/Experience



- □ Hazardous Materials Incident Commander
- Hazardous Materials Technician
- Hazardous Materials Instructor
- Haz Mat Technical Reference Specialist
- Haz Mat Specialist
- Haz Mat Assistant Safety Officer
- Chemistry Degree or Industrial Hygienist





Why I Care?

- UC has a major focus on MAQ compliance
- The MAQ concept is new to most people
- The rules are complicated
- In academia, new faculty have very little control over where their rooms are assigned
- The rules seem arbitrary



Poll #2 Familiarity with MAQ



- □ Architect or building design planner
- **G** Fire Marshal
- □ Fire Protection Engineer
- Involved in Construction
- I've heard of it
- U What's MAQ?

History of loss



- 48 BCE Great Library of Alexandria Fire
- 64 CE Great Fire of Rome Nero
- 1871 Great Chicago Fire ~300 deaths



- 1903 Chicago Iroquois Theatre Fire 602 deaths
- 1911 Triangle Shirtwaist Factory fire 147 deaths



The Fire of Rome, 18 July 64 AD' by Hubert Robert, 1733-1808 CE. (Musee des Beaux-Arts Andre Malraux, Le Havre, France)

Rules that result...



- Fire resistive construction
- Active automatic suppression
- Compartmentalization to prevent spread
- Awareness of hazards
- Improved safety of response

Standardizing Codes in US



- Prior to 1994
 - the National Fire Prevention Code
 - the Standard Fire Prevention Code
 - the Uniform Fire Code,
 - National Fire Protection Association (NFPA) 1 Fire Prevention Code
- 1994, International Code Council created IFC





MAQ Limits are Complex

- Prior to 2000, no comprehensive limits
- Starting in 2001 California Fire Codes limits quantities of chemicals
- Limits are by physical state at NTP, hazard type & class, locations in or near a building, type of storage, use and design of the building





Changes in MAQ



- In 2016 CFC MAQ rules changed again
- Now, the number of control areas (or lab suites) allowed on varies by floors.
- A percentage reduction is imposed by floor
- These are all added to the 2001 hazardous hazard class limits.

	Floor level (B Occupancy)	Percentage of the Maximum Allowable Quantity per Control Area	NUMBER OF CONTROL AREAS PER FLOOR
	Higher than 9	5	1
	7 thru 9	5	2
	6	12.5	2
Above grade	5	12.5	2
plane	4	12.5	2
	3	50	2
	2	75	3
	1	100	4
Polow	-1	75	3
Below grade plane	-2	50	2
	Lower than -2	Not Allowed	Not Allowed

IFC is model code in most states



CALIFORNIA

Chemical Hazards in Fire Code MAQ limits

Health Hazards



- Corrosives
- Toxics
- Highly Toxics
- Irritants
- Sensitizer
- Other Health Hazard Material

Physical Hazards ≤ 8

- Combustibles
- Flammable
- Pyrophoric
- Oxidizer
- Explosives
- Organic peroxide
- Unstable (reactive)
- Water reactive



MAQ CFC Tables 5003.1.1(1-4) **Indoor Control Areas**

Outdoor Control Areas

	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA DO F HAZARDOUS MATERIALS POSING A PHYSICAL HAZARDAL TO									
[GROUP WHEN		STORAGE*		USI	E-CLOBED SYSTEM	46*	USE-OPEN	AVATEMS*
MATERIAL	GLASS	ALLOWABLE QUANTITY IS EXCEEDED	Solid pounds (subic feet)	Liquid gallona (pounds)	(cubic feet at NTP)	Stolid pounds (cubic foot)	galtons (pounds)	(cubic feet at NTP)	Stolid pounds (cubic feet)	galtone (pounds)
Combustible	NA	11-2	See Note q	NA	NA	See Note q	NA	NA	See Note q	NA
Combustible fibers*	Loose Baled*	H 3	(100) (1,000)	NA	NA	(100) (1,000)	NA	NA	(20)	NA
Combustible liquid**		H-2 or H-3 H-2 or H-3 NA	NA	120 ⁴ 330 ⁴ 13,200 ⁻¹	NA	NA	120 ⁴ 330 ⁴ 13,200 ⁷	NA	NA	30° 80° 3,300'
Consumer	1.4G	11-3	125**	NA	NA	NA	NA	NA	NA	NA
Cryogenic Flammable	NA	11-2	NA	4.54	NA	NA	45*	NA	NA	104
Cryogenic Inert	NA	NA	NA	NA	NL	NA	NA	NL	NA	NA
Cryogenic Oxidizing	NA	Н 3	NA	45*	NA	NA	45*	NA	NA	104
Explosives	Division 1.1 Division 1.2 Division 1.3 Division 1.4 Division 1.4 Division 1.5 Division 1.5	H-1 H-1 H-1 or H-2 H 3 H-3 H-1 H-1	10.8 10.8 10.8 50.8 1254.6 1.6 8 1.6 8	(1)** (1)** (10)** (50)** NA (1)** NA	NA	0.25 ⁸ 0.25 ⁸ 1 ⁸ 50 ⁶ NA 0.25 ⁸ NA	(0.25) ^s (0.25) ^s (1) ^s (50) ^s NA (0.25) ^s NA	NA	0.25 ^s 0.25 ^s 1 ^s NA NA 0.25 ^s NA	(0.25)* (0.25)* (1)* NA NA (0.25)* NA
Flammable	Gaseous Liquefied	11-2	NA	(150) ^{4,a}	1,000 ^{L*}	NA	NA (150) ^{6,e}	1.000 ^{±.*}	NA	NA
Flammable liquid*	IA IB and IC	H-2 or H-3	NA	30 ^{±.} * 120 ^{±.*}	NA	NA	30 ² 120 ⁴	NA	NA	10 ² 30 ⁴
Flammable liquid, combination (IA, III, IC)	NA	M 2 or H-3	NA	1204.5.8	NA	NA	1204.8	NA	NA	30 ^{4,8}
Flammable	NA	11-3	1254*	NA	NA	12.54	NA	NA	2.54	NA
				TAD	E 5003 1 1(1)	cottoued				

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARDSHIDS P										
		GHOUP WHEN		STORAGE*		USI	E-CLOSED SYSTE	MIS"	USE-OPEN	SYSTEMS"
MATERIAL	GLASS	ALLOWABLE GUANTITY IS EXCEEDED	Bolld pounds (cubic feel)	Liquid gullons (pounds)	Gras (eubic faul ol NTP)	Bolid pounds (cubic feel)	Liquid guilterns (pounds)	Gas (cubic feel ol NTP)	Bolid pounds (cubic feel)	(pounds)
Inert Gas	Gaseous Liquefied	NA NA	NA	NA NA	NL NL	NA	NA NA	NL	NA NA	NA
Organic peroxide		H-1 H 2 H-3 NA NA	10.8 504.0 1254.0 NL NL	(1)** (5)* (125)* NL NL	NA	0.25 ^s 1 ^d 50 ^d 125 ^d NL NL	(0.25)* (10)* (125)* NL NL	NA	0.25 ⁸ 1 ⁹ 10 ⁶ 25 ⁸ NL NL	0.25 ⁸ (10) ⁴ (25) ⁴ NL NL
Oxidizer	4 3 ⁴ 2 1	H-1 H-2 or H-3 H-3 NA	1# 10 ^k * 250 ^k * 4,000* ^s	(10) ^{4, a} (10) ^{4, a} (250) ^{4, a} (4,000) ^{a, f}	NA	0.25* 25 250* 4,000*	(0,25)* (2) ⁴ (2:50)* (4,000)*	NA	0.25 ⁴ 2 ⁴ 50 ⁴ 1,000 ⁴	(0.25)* (2) ⁴ (50) ⁴ (1,000) ²
Oxidizing gas	Gaseous Liquefied	H-3	NA	NA (150)**	1,500 ^{4,4} NA	NA	(150)***	1,500°.° NA	NA	NA
Pyrophoric	NA	H-2	4	(4) ^{r.s}	50%*	14	CD#	10%.*	0	0
Unstable (reactive)	4 3 2 1	H-1 H-1 or H-2 II-3 NA	1** 50** NL	(1)*** (5)** (50)** NL	10** 50** 750** NL	0.25 ⁴ 1 ⁴ 50 ⁴ NL	(0.25) ^a (1) ^a (50) ^a NL	2** 10** 750** NL	0.25 ⁴ 1 ⁴ 10 ⁴ NL	(0.25) [#] (1) ⁴ (10) ⁴ NL
Water reactive	2	11-2 H-3 NA	50%** NL	(5)4.4 (50)4.4 NL	NA	54 504 NL	(5) ² (50)* NL	NA	10" NL	CD ²

	· · ·		
Free City 1 models: Court -	0.03033.ml 1.mm	4 - 0 464 hrs. 1	11

- In a second per and storage quantities in Group 8 comparison with the packing requirements of BO 8115 shall not be refinited in the method. The method is a storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the storage of the storage of the storage of the infinite on second storage of the s

IFORNI

- ous fuel in fuel tanks on motorized equipment operated in accord

TABLE 6003.1.1(3) MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD IN AN OUTDOOR CONTROL AREA ^{4,5,4}									
			STORAGE ^b		U	SE-CLOSED SYST	EWS	USE-OPEN	SYSTEMS
MATERIAL	CLASS	Solid pounds (cubic feet)	Liquid gallons (pounds) ^d	Gas cubic feet at NTP	Solid pounds (cubic feet)	Liquid gallons (pounds) ^c	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 Cryogenic inert	Gaseous Liquefied Not Applicable	Not Applicable Not Applicable Not Applicable	Not Applicable Not Applicable Not Applicable	Not Limited Not Limited Not Limited	Not Applicable Not Applicable Not Applicable	Not Applicable Not Applicable Not Applicable	Not Limited Not Limited Not Limited	Not Applicable Not Applicable Not Applicable	Not Applicable 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 II IV V	20 200 500 1,000 Not Limited	(20) (200) (500) (1,000) Not Limited	Not Applicable	10 100 250 500 Not Limited	(10) (100) (250) (500) Not Limited	Not Applicable	2 20 50 100 Not Limited	(2) (20) (50) (100) Not Limited
Oxidizer	4 3 2 1	2 40 1,000 Not Limited	(2) (40) (1,000) Not Limited	Not Applicable	1 20 500 Not Limited	(1) (20) (500) Not Limited	Not Applicable	0.25 4 100 Not Limited	(0.25) (4) (100) 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 3 2	2 20 200 Not Limited	(2) (20) (200) Not Limited	20 200 1,000 1,500	1 10 100 Not Limited	(1) (10) (100) Not Limited	2 10 250 Not Limited	0.25 1 10 Not Limited	(0.25) (1) (10) Not Limited

100

Not Limited

(100)

Not Limite

Applicable

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

Water reactive

200 Not Limited 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 where such storage is in accordance with Section 5003.11

Not

Applicable

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

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

	STORAGE			USE-CLOSED SYSTEMS			USE-OPEN SYSTEMS	
MATERIAL	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)°	Gaseous 1,620 Liquefied (300)	500	50°	Gaseous 810 Liquefied (150)	125	(125)°

For S1: 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].

(200)

Not Limited

a. For vallons 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 where such storage is in accordance with Section 5003.11. d. Allowed only where 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

26th California Unified Program **Annual Training Conference** February 26-29, 2024

10

Not Limited

(10)

Not Limited

Compliance Challenges

- Flammable liquid IA MAQ
- 1st floor 30 gallons
- 2nd floor 22.5 gallons
- 3rd floor 15 gallons
- 4th thru 6th floors 3.75 gallons
- 7th floor and higher 1.5 gallons
- If there are 4 lab groups in one control area, it is possible that each would get 1/3rd of a gallon for all IA flammable liquids

26th California Unified Program Annual Training Conference February 26-29, 2024

RISK & SAFETY







- Only allowed with sprinklers
 - Most explosives except commercial fireworks
 - Organic Peroxides (UD), Oxidizer 4, Pyrophoric, Unstable (reactive) 4
- Only allowed in approved exhausted gas cabinets or exhausted enclosures.
 - Highly Toxic Gas and Liquefied gas



Classes Not Limited



- Regardless of sprinklers
 - Cryogenic Inert, Inert Gas both Gaseous & Liquefied gas, Organic Peroxide classes IV and V, Unstable (reactive) class 1, Water reactive class 1
 - Combustible Dust limited to:
 - Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard (reviewed by a PE)







Resources

- Definitions from California Fire Code about Hazard Classes (https://codes.iccsafe.org/content/CAFC2022P2/california-code-of-regulations-title-24)
- GHS Pictogram Guide to CFC Hazard Classes
- GHS Pictograms & Hazard Statement to IFC Hazard Class (https://codes.iccsafe.org/s/IFC2024P1/part-vii-appendices/IFC2024P1-Pt07-AppxE-SecE104.2)
- GHS Classification Summary PubChem

(https://pubchem.ncbi.nlm.nih.gov/ghs/)



Resources in pdf



- Definitions from California Fire Code about Hazard Classes.pdf
- GHS Pictogram Guide to CFC Hazard Classes .pdf
- GHS Pictograms & Hazard Statement to IFC Hazard Class.pdf
- GHS Classification Summary PubChem.pdf
- ToxicFlammable Notes.pdf



SDS Resources



Dibenzylamine MilliporeSigma SDS 2023.06.06.pdf DIBENZYLAMINE-ThermoFisher SDS 2021.12.24.pdf ethyl alcohol Millipore Sigma SDS 2023.08.23.pdf tert-butyllithium 1.7 M in pentane Millipore Sigma SDS.pdf Acetone MilliporeSigma SDS 2023.07.25.pdf



BREAK TIME!





- Flammable & combustive Liquids
- Pyrophorics
- Toxic & Highly Toxic



Flammable & Combustible Liquids



Classification Comparison

Fire Code

Flammable Liquid, FP < 38 C

- Class IA, FP < 22.8 C, BP < 37.8 C ≈
- Class IB, FP < 22.8 C, BP ≥ 37.8 C
- Class IC, FP ≥ 22.8 C < 37.8 C⁻

Combustible Liquids, FP ≥ 37.8 C

- Class II, FP ≥ 37.8 C & < 60 C
- Class IIIA, FP ≥ 60 C & 93.3 C
- Class IIIB, $FP \ge 93.3 C$

OSHA

Liquid, Flammable, $FP \le 93 C$

- Category 1, FP < 23 C, BP \leq 35 C
- Category 2, FP < 23 C, BP > 35 C
- Category 3, $FP \ge 23 C \& \le 60 C$
- Category 4, FP > $60C \& \le 93C$



Flammable Liquids

CALIFORNIA



Pictogram	Signal word	Hazard Statement	Hazard Code	Hazard Class
•	Danger	Extremely flammable liquid and vapor	H224, Category 1	IA
	Danger	Highly Flammable liquid and vapor	H225, Category 2	IB
	Warning	Flammable liquid and vapor	H226, Category 3	IC

https://codes.iccsafe.org/content/IFC2024P1/appendix-e-hazard-categories



A material, other than an explosive, which in the pure state or as commercially produced, will vigorously polymerize, decompose, condense or become self-reactive and undergo other violent chemical changes, including explosion, when exposed to heat, friction or shock, or in the absence of an inhibitor, or in the presence of contaminants, or in contact with incompatible materials.

Unstable (reactive) materials are subdivided as follows:

• Class 4; Class 3; Class 2; Class 1





Class 4. Materials that in themselves are **readily capable of detonation** or explosive decomposition or explosive reaction at normal temperatures and pressures. This class includes materials that are sensitive to mechanical or localized thermal shock at normal temperatures and pressures.

MAQ 1st floor, B occupancy, <u>only allowed with sprinklers</u>: 1 pounds for solid & liquids, 10 cubic feet for gas





Class 3. Materials that in themselves are **capable of detonation** or of explosive decomposition or explosive reaction but which require a strong initiating source or which must be heated under confinement before initiation. This class includes materials that are sensitive to thermal or mechanical shock at elevated temperatures and pressures.

MAQ 1st floor, B occupancy, no sprinklers: 5 pounds for solid & liquids, 50 cubic feet for gas



Class 2. Materials that in themselves are normally unstable and readily undergo violent chemical change but **do not detonate**. This class includes materials that can undergo chemical change with rapid release of energy at normal temperatures and pressures, and that can undergo violent chemical change at elevated temperatures and pressures.

MAQ 1st floor, B occupancy, no sprinklers: 50 pounds for solid & liquids, 750 cubic feet for gas



Class 1. Materials that in themselves are normally stable but which can become unstable at elevated temperatures and pressure.

MAQ 1st floor, B occupancy, no sprinklers: No limit



Unstable (reactive) w/ GHS



Pictogram	Signal word	Hazard Statement	Hazard Code	Hazard Class
	Danger	Heating may cause an explosion	H240, Type A	4
	Danger	Heating may cause a fire or explosion	H241, Type B	3
	Danger	Heating may cause a fire	H242, Type C ^{or} H242, Type D	2
	Warning	Heating may cause a fire	H242, Type E ^{or} H242, Type F	1







dibenzylamine



• ethyl alcohol



- tert-butyllithium
- acetone





Short () Break Time!



Dibenzylamine

- <u>https://commonchemistry.cas.org/</u>
- CAS: 103-49-1
- Boiling Point 270 °C
- Melting Point -26 °C





Dibenzylamine (continued)

• <u>https://pubchem.ncbi.nlm.nih.gov/</u>

» https://pubchem.ncbi.nlm.nih.gov/compound/7656

H410 (39.41%): Very toxic to aquatic life with long lasting effects [Warning Hazardous to the aquatic environment, long-term hazard]

H412 (20.34%): Harmful to aquatic life with long lasting effects [Hazardous to the aquatic environment, long-term hazard]

GHS Hazard Statements

H302 (99.58%): Harmful if swallowed [Warning Acute toxicity, oral]

H314 (73.31%): Causes severe skin burns and eye damage [Danger Skin corrosion/irritation]

H315 (26.69%): Causes skin irritation [Warning Skin corrosion/irritation]

H318 (36.86%): Causes serious eye damage [Danger Serious eye damage/eye irritation]

H319 (26.69%): Causes serious eye irritation [Warning Serious eye damage/eye irritation]





Dibenzylamine (continued)

• <u>https://pubchem.ncbi.nlm.nih.gov/</u>

» https://pubchem.ncbi.nlm.nih.gov/compound/7656

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H315 (26.69%): Causes skin irritation [Warning Skin corrosion/irritation]

H318 (36.86%): Causes serious eye damage [Danger Serious eye damage/eye irritation]

H319 (26.69%): Causes serious eye irritation [Warning Serious eye damage/eye irritation]





Dibenzylamine (continued 2)

- Search for SDS "Dibenzylamine SDS"
- Millipore Sigma

https://www.sigmaaldrich.com/US/en/sds/aldrich/d34108

• ThermoFisher

https://www.fishersci.com/store/msds?partNumber=AC112612500&product Description=DIBENZYLAMINE%2C+98%25+250MLDIBEN&vendorId=VN000321 19&countryCode=US&language=en

Extracted data



Sigma-Aldrich (6/6/2023)

Danger

Harmful if swallowed.

Causes severe skin burns and eye damage.

Toxic to aquatic life.

Very toxic to aquatic life with long lasting effects.

Flash point 143 C (289 F)

Autoignition Temp 395 C (743 F)

Fisher Scientific (12/24/2021)

Danger



Harmful if swallowed

Causes severe skin burns and eye damage May cause respiratory irritation

Flash point 138 C (280 F) Autoignition Temp 425 C (797 F) NFPA 704



GHS Pictogram Guide to CFC Hazard Classes

Corrosion

Pictogram	Signal Words	Hazard Statement	Code	Fire Code Material
	Danger	Causes severe skin burns and eye damage	H314, Category 1 (1A, 1B, 1C)	Corrosive

Sigma-Aldrich



Danger

Harmful if swallowed.

Causes severe skin burns and eye damage. Toxic to aquatic life.

Very toxic to aquatic life with long lasting effects.

Fisher Scientific



Danger

Harmful if swallowed

Causes severe skin burns and eye damage May cause respiratory irritation



Extracted Toxicity Data



MilliporeSigma-Aldrich

Acute toxicity

LD50 Oral - Rat - female - 632 mg/kg

Inhalation: No data available

LD50 Dermal - Rat - > 2,000 mg/kg

Skin corrosion/irritation

Skin – Rabbit: Corrosive, category 1C

ThermoFisher Scientific

Acute toxicity

LD50 Oral 632 mg/kg (Rat)

LC50 Inhalation Not listed

LD50 Dermal>2000 mg/kg (Rat)

CFC Definitions



NTP state = Liquid (boiling point > 20 C, melting point < 20 C) @ 1atm

Toxic

- LD50 is greater than 50 mg/kg and less than 500 mg/kg in rat, oral
- <u>LC50</u> is greater than or equal to 200 <u>ppmv</u> and less than 2000 <u>ppmv</u> OR <u>LC50</u> is greater than 2 <u>mg/L</u> and less than 20 <u>mg/L</u> in <u>rat</u>, <u>inhalation</u>, 1 <u>hr or less</u>
- LD50 is greater than 200 mg/kg and less than 1000 mg/kg, rabbit, dermal

Corrosive

...visible destruction of, or irreversible alterations in, living tissue by chemical action at the point of contact. ... intact skin of albino rabbits...following an exposure period of 4 hours. This term does not refer to action on inanimate surfaces.









A liquid having a closed cup flash point at or above 100°F (38°C). Combustible liquids shall be subdivided as follows:

Class II. Liquids having a closed cup flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having a closed cup flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having closed cup flash points at or above 200°F (93°C).





RSS Dibenzylamine Classifications at UC

Fire Code Hazard Class

- Combustible Liquid : IIIB
- Irritant (CFC2001)
- Corrosive Liquid

MAQ 1st floor B, No Sprinklers

- 13,200 gal
- No Limit (2001 CFC)
- 500 gal





✓ dibenzylamine



OH

• ethyl alcohol



- tert-butyllithium
- acetone

Ethyl alcohol





- Sigma-Aldrich (8/23/2023) CAS [64-17-5]
- Danger
- Highly flammable liquid and vapor.
- Causes serious eye irritation.
- Flammable liquids (Category 2)H225
- Eye irritation (Category 2A), H319

BP: 78 C (172 F) FP: 13 C (55 F) AIT: 363-425 C (685-797 F) UEL: 27.7 % LEL: 3.1 %

LD50 Oral – Rat: 10,470 mg/kg LC50 Inhalation – Rat, 4h: 124.7 mg/L

Skin - Rabbit: No skin irritation

Ethyl alcohol compare to resources

From SDS	GHS guide	CFC Definition
Danger; Highly flammable liquid and vapor."	Flammable Liquid IB	
FP: 13 C (55 F); BP: 78 C (172 F)"		Flammable Liquids Class IB. Liquids flash point < 73°F (23°C) and boiling point ≥ 100°F (38°C).
Flammable liquids (Category 2), H225	Flammable Liquid IB	
Eye irritation (Category 2A), H319	Irritant (CFC2001)	eye irritant 16 C.F.R. 1500.42 or other approved techniques.
CALIFORNIA		26th California Unified Program Annual Training Conference February 26-29, 2024



RSS Ethanol Classifications at UC

Fire Code Hazard Class	MAQ 1st floor B, No Sprinklers
Flammable Liquid : IB, IC	120 gal
Flammable Liquid : IA, IB, IC	120 gal
Irritant (CFC2001)	No Limit (2001 CFC)









tert-butyllithium 1.7 M in pentane

Sigma-Aldrich
 Image: Sigma-Aldrich



tert-Butyllithium solution

ĭ.	Synonym(s): Lithium-2-methyl-2-propanide, t-BuLi Linear Formula: (CH ₃) ₃ CLi				
LI					
l ₃	CAS No.:	594-19-4	Molecular Weight: 64		
	Beilstein No.:	3587204			

- H225 Highly flammable liquid and vapor.
- H250 Catches fire spontaneously if exposed to air.
- H260 In contact with water releases flammable gases which may ignite spontaneously.
- H304 May be fatal if swallowed and enters airways.
- H314 Causes severe skin burns and eye damage.
- H336 May cause drowsiness or dizziness.

Autoignition Temperature (AIT) = No data available Flash Point= -49 C (-56 F) Boiling Point = No data Acute toxicity estimate Inhalation - 4 h - 30.1 mg/l - vapor

.06



t-butyllithium 1.7 M in pentane

Pictogram	Hazard Statements (Signal Word - Danger)	GHS Classification	CFC Hazard Class
٨	Highly flammable liquid and vapor.	Flammable liquids (Cat 2), H225	Flammable Liquid IB
٨	Catches fire spontaneously if exposed to air.	Pyrophoric liquids (Cat 1), H250	Pyrophoric
۲	In contact with water releases flammable gases which may ignite spontaneously.	Chemicals which, in contact with water, emit flammable gases (Cat 1), H260	Water Reactive 3
الله الله الم	May be fatal if swallowed and enters airways.	Aspiration hazard (Cat 1), H304	Other Health Hazard Material
()	May cause drowsiness or dizziness.	Specific target organ toxicity - single exposure (Cat 3), Central nervous system, H336	Other Health Hazard Material
	Causes severe skin burns and eye damage.	Skin corrosion (Cat 1B), H314 Serious eye damage (Cat 1), H318	Corrosive

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RSS *t*-butyllithium 1.7 M in pentane Classifications at UC

Fire Code Hazard Class	MAQ 1st floor B, No Sprinklers
Flammable Liquid : IB, IC	120 gal
Flammable Liquid : IA, IB, IC	120 gal
Irritant (CFC2001)	No Limit (2001 CFC)
Other Health Hazard Material	No Limit (2001 CFC)







✓ ethyl alcohol



✓ tert-butyllithium

acetone



Acetone



- Sigma-Aldrich
- Highly flammable liquid and vapor. - Flammable liquids (Cat 2), H225
- Causes serious eye irritation. - Eye irritation (Cat 2A), H319
- May cause drowsiness or dizziness.
 - Specific target organ toxicity single exposure (Cat 3), Central nervous system, H336





RSS Acetone Classifications at UC

Fire Code Hazard Class	MAQ 1st floor B, No Sprinklers
Flammable Liquid : IB, IC	120 gal
Flammable Liquid : IA, IB, IC	120 gal
Irritant (CFC2001)	No Limit (2001 CFC)
Other Health Hazard Material	Not Included







OH

✓ ethyl alcohol

✓ acetone

✓ tert-butyllithium





Common Chemicals Extra Credit



Solid

Sodium hydroxide Aluminum oxide Sodium bicarbonate Calcium carbonate

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Liquid Sulfuric acid Benzene Ethanol Ethylene glycol Acetic acid Acetone Hydrochloric acid Formaldehyde (aq) Ammonia (aq) Sodium hydroxide (aq) Gas Ethylene Ammonia Propylene Chlorine Nitrogen Formaldehyde

Summary



- No need to have a chemistry degree
- Seemingly arbitrary and complicated regulations can be the basis for employment
- Making reasonable approximations of hazard classes can be fun ^(C)

Additional Resources



• <u>NIST</u>

- <u>https://webbook.nist.gov/chemistry/</u>
- <u>https://www.nist.gov/pml/productsservices/physical-reference-data</u>
- UNECE GHS
 - <u>https://unece.org/transport/dangerous-goods/ghs-rev10-2023</u>
- <u>CFC 2022</u>
 - <u>https://codes.iccsafe.org/content/CAFC2022P2/california-code-of-regulations-title-24</u>
- <u>NIH NLM PubChem</u>
 - <u>https://pubchem.ncbi.nlm.nih.gov/ghs/</u>
- All suppliers who sell to people who are required to provide SDS to the people who obtain use the hazardous material* in their work

*as defined by OSHA, excludes 'articles', additives and alcoholic beverages, cosmetics, drugs and pharmaceuticals, hazardous wastes & remediation, tobacco & tobacco products, wood & lumber, consumer products, non-hazardous nuisance particulates & dust, ionizing & non-ionizing radiation, biological hazards, office & school supplies







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Any Questions?

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