
Approved Storage of Hazardous Materials

Megan C. Hall, PhD

Director – UC Chemical Safety Management CoE

Deputy Fire Marshal – Hazardous Materials

Email: mchall@berkeley.edu

Cell: 510-295-3580

Approved Storage

- **Introduction**
- **California Fire Code background:**
 - Storage vs. In-Use
 - Approved storage - MAQs
- **Examples**
- **Application of Approved Storage in Chemicals**
- **Questions**



JUSTRITE
FLAMMABLE
KEEP FIRE AWAY
INFLAMABLE
INFLAMABLE

JUSTRITE
Sure-Grip™
FLAMMABLE LIQUID
STORAGE CABINET

Flammables Cabinet 1

JUSTRITE
FLAMMABLE
KEEP FIRE AWAY
INFLAMABLE
INFLAMABLE

JUSTRITE
Sure-Grip™
FLAMMABLE LIQUID
STORAGE CABINET

Flammables Cabinet 2

JUSTRITE
FLAMMABLE
KEEP FIRE AWAY
INFLAMABLE
INFLAMABLE

JUSTRITE
Sure-Grip™
FLAMMABLE LIQUID
STORAGE CABINET

Flammables Cabinet

JUSTRITE

JUSTRITE

JUSTRITE

Introduction

How are hazardous materials regulated?

- **Many agencies regulate (OSHA, EPA, CFC, DOT)**
- **Focus on California Fire Code (CFC) storage regulations**
- **Approved storage**
 - Reduces exposure of chemicals to fires
 - Ensures chemical spills do not negatively impact occupant evacuations
 - Leaking gas cylinders will exhaust directly outside
 - Limits chemical exposure to first responders
 - Avoid dangerous chemical reactions due to incompatibles
- **Increase in MAQs for approved storage**

California Fire Code: Hazardous Materials Regulations

Storage vs. Use

Containers (bottles, tanks, cylinders, dewars, vessels, baths)

Approved Storage

Cabinets or other additional storage where containers are located

California Fire Code: Hazardous Materials Regulations

Storage vs. Use



Storage: closed containers

California Fire Code: Hazardous Materials Regulations

Storage vs. Use



In Use: closed system

California Fire Code: Hazardous Materials Regulations

Storage vs. Use



In Use: open system

California Fire Code: MAQs

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

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)
Flammable gas	Gaseous	H-2	NA	NA	1,000 ^{d, e}	NA	NA	1,000 ^{d, e}	NA	NA
	Liquefied			(150) ^{d, e}	NA		(150) ^{d, e}	NA		
Flammable liquid ^c	IA IB and IC	H-2 or H-3	NA	30 ^{d, e}	NA	NA	30 ^d	NA	NA	10 ^d
				120 ^{d, e}			120 ^d			30 ^d
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ^{d, e, h}	NA	NA	120 ^{d, h}	NA	NA	30 ^{d, h}
Flammable solid	NA	H-3	125 ^{d, e}	NA	NA	125 ^d	NA	NA	25 ^d	NA
Inert gas	Gaseous	NA	NA	NA	NL	NA	NA	NL	NA	NA
	Liquefied	NA	NA	NA	NL	NA	NA	NL	NA	NA
Organic peroxide	UD	H-1	1 ^{e, g}	(1) ^{e, g}	NA	0.25 ^g	(0.25) ^g	NA	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	NA	NL	NL		NL	NL		NL	NL
	V	NA	NL	NL		NL	NL		NL	NL
Oxidizer	4	H-1	1 ^g	(1) ^{e, g}	NA	0.25 ^g	(0.25) ^g	NA	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	NA	4,000 ^{e, f}	(4,000) ^{e, f}		4,000 ^f	(4,000) ^f		1,000 ^f	(1,000) ^f

California Fire Code: Hazardous Materials Regulations

Storage vs. Use

Containers (bottles, tanks, cylinders, dewars, vessels, baths)

Approved Storage

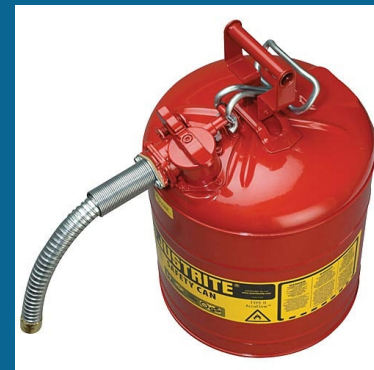
Cabinets or other additional storage where containers are located

California Fire Code: Hazardous Materials Regulations

Approved Storage



UL 1275



UL 30

California Fire Code: Hazardous Materials Regulations

Approved Storage



200 fpm



200 fpm

California Fire Code: Hazardous Materials Regulations

Approved Storage



Day box



Glove box



Flammable storage fridge

Approved Storage: when to apply?

TABLE 5003.1.1(2)
MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A HEALTH HAZARD^{a, c, f, h, i}

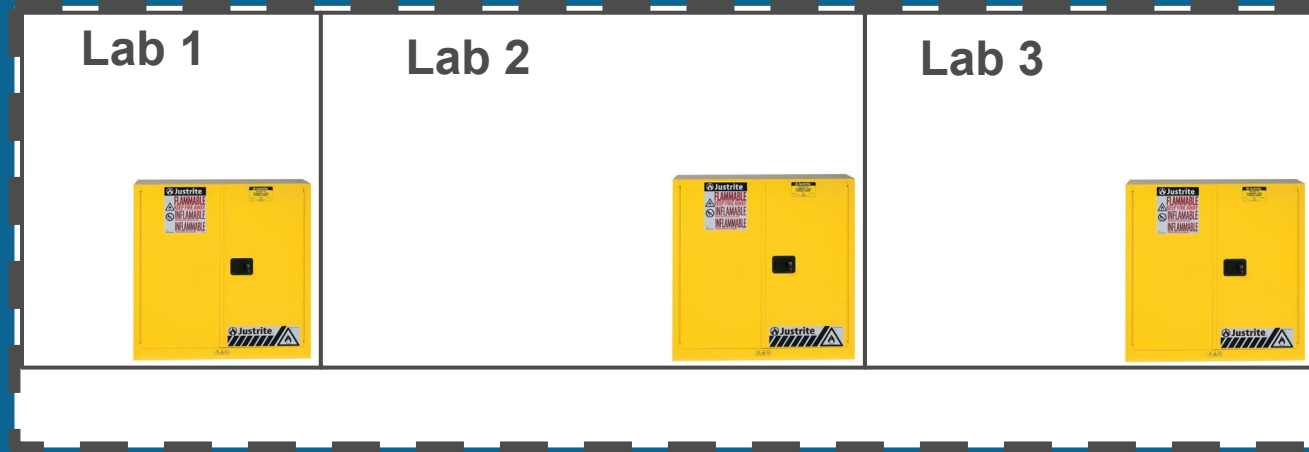
MATERIAL	STORAGE ^b			USE-CLOSED SYSTEMS ^b			USE-OPEN SYSTEMS ^b	
	Solid pounds ^{d, e}	Liquid gallons (pounds) ^{d, e}	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d	Gas cubic feet at NTP (pounds) ^d	Solid pounds ^d	Liquid gallons (pounds) ^d
Corrosives	5,000	500	Gaseous 810 ^e Liquefied (150)	5,000	500	Gaseous 810 ^e 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 ^e Liquefied (150) ^e	500	(500)	Gaseous 810 ^e Liquefied (150) ^e	125	(125)

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

- For use of control areas, see Section 5003.8.3.
- The aggregate quantity in use and storage shall not exceed the quantity listed for storage.
- In retail and wholesale sales occupancies, the quantities of medicines, foodstuff 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.
- [SFM] In other than Group L occupancies, 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. For Group L occupancies, refer to California Building Code Table 453.7.2.1 for approved cabinets.*
- Maximum allowable quantities shall be increased 100 percent where stored in approved storage cabinets, gas cabinets or exhausted enclosures. Where Note d applies, the increase for both notes shall be applied accumulatively.
- 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.
- Allowed only where stored in approved exhausted gas cabinets or exhausted enclosures.
- Quantities in parentheses indicate quantity units in parentheses at the head of each column.
- For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2.

Approved Storage: how to apply?

Flammable liquids (Class I)



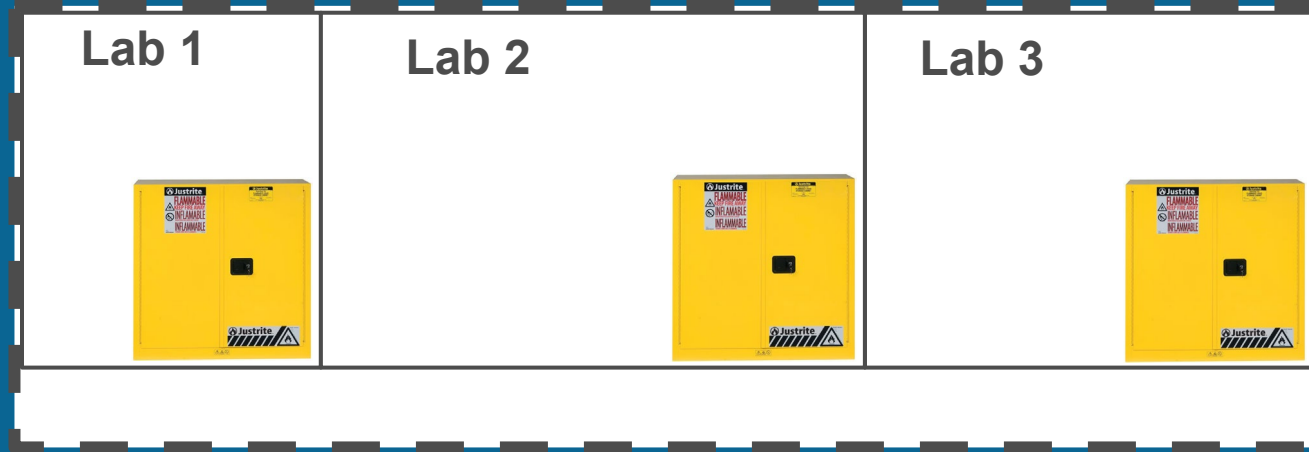
Control area A

First story above grade plane

No automatic fire sprinkler coverage in building

Approved Storage: how to apply?

Flammable liquids (Class I)



MAQ = 120 gal

MAQ (+ storage)
= 240 gal

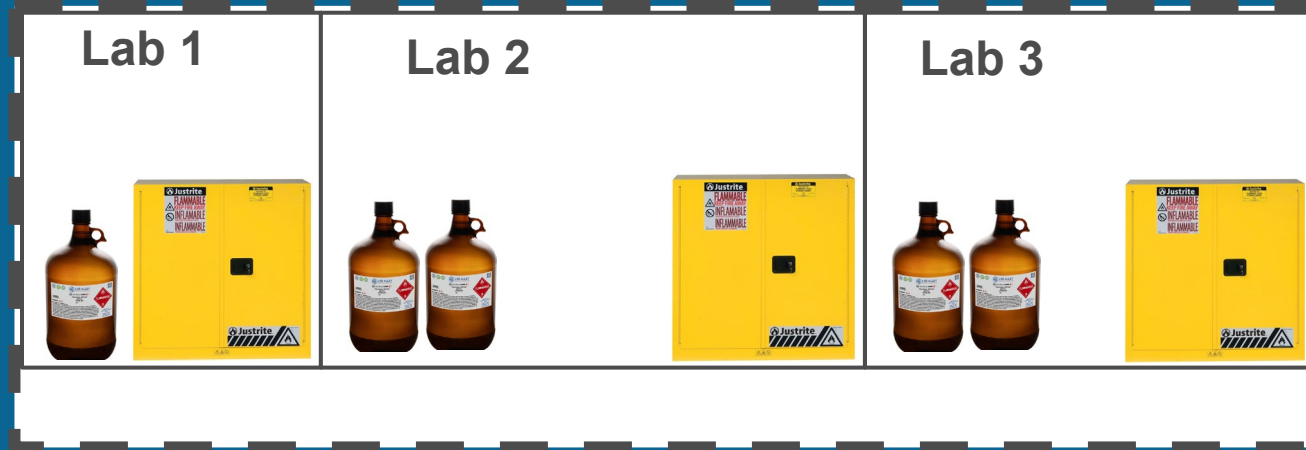
Control area A

First story above grade plane

No automatic fire sprinkler coverage in building

Approved Storage: how to apply?

Flammable liquids (Class I)



MAQ = 120 gal

MAQ (+ storage) =
240 gal

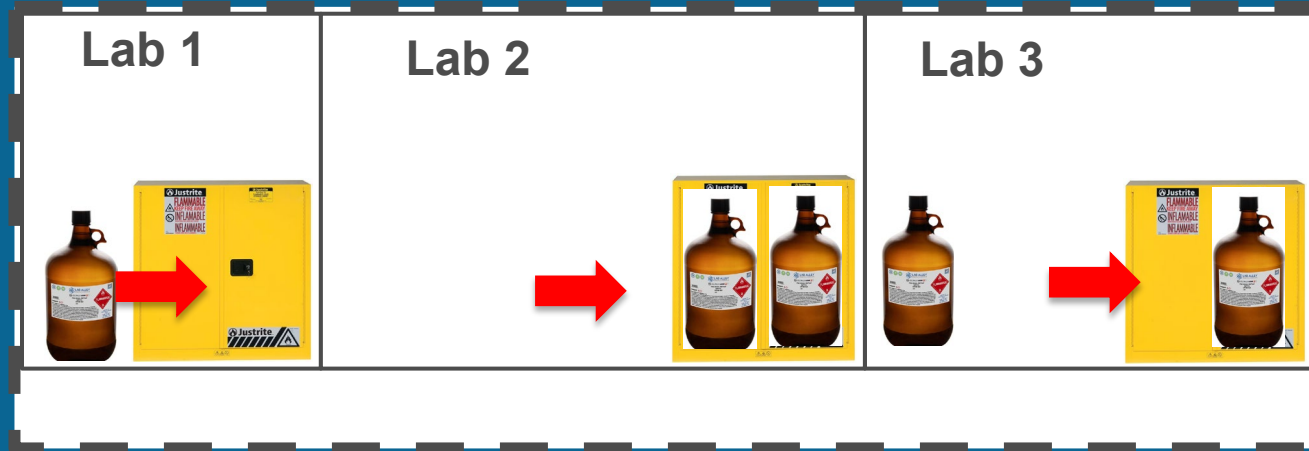
Control area A

First story above grade plane

No automatic fire sprinkler coverage in building

Approved Storage: how to apply?

Flammable liquids (Class I)



MAQ = 120 gal

MAQ (+ storage)
= 240 gal

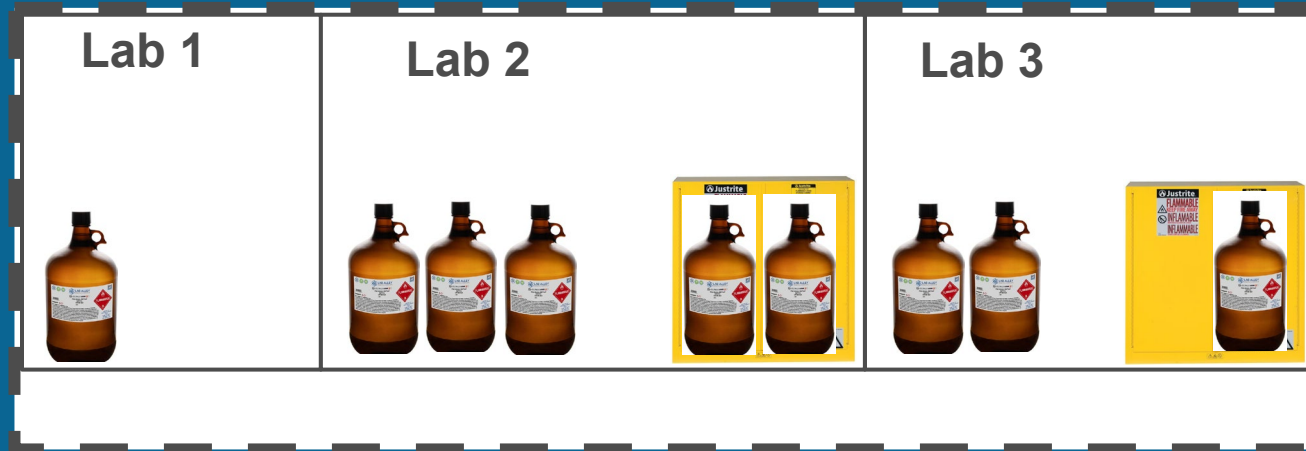
Control area A

First story above grade plane

No automatic fire sprinkler coverage in building

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 1

In approved cabinets: 60 gallons

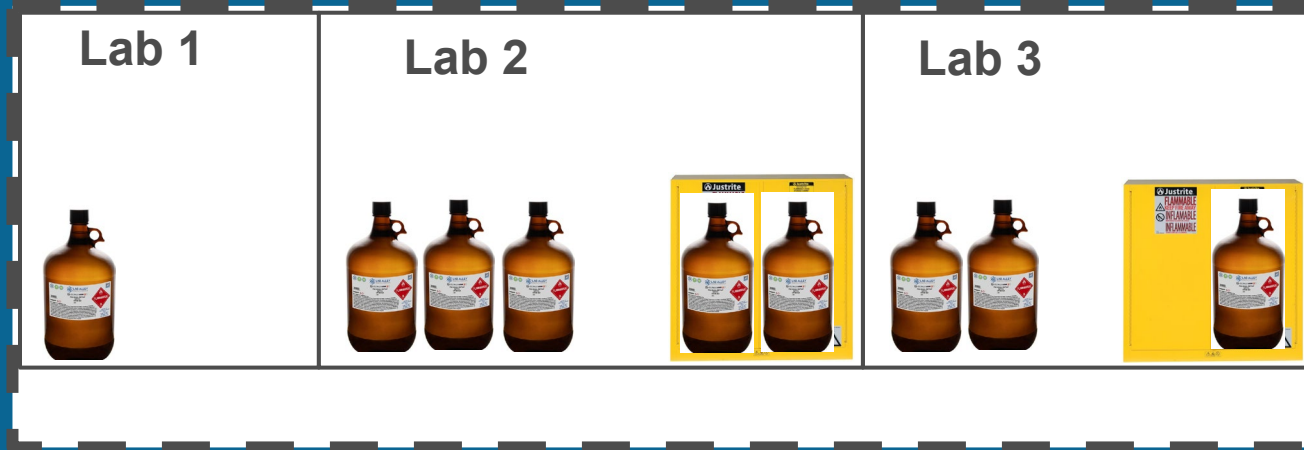
Outside cabinets: 120 gallons

Total Flammable liquids: 180 gallons

Actual FLI	MAQ	MAQ + storage
180 gal	120 gal	240 gal

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 1

In approved cabinets: 60 gallons

Outside cabinets: 120 gallons

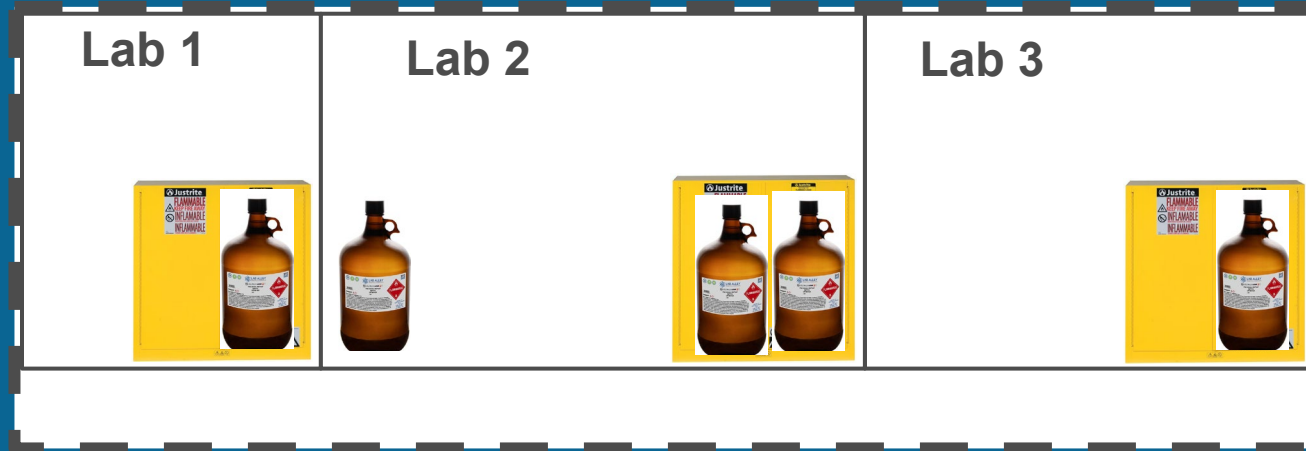
Total Flammable liquids: 180 gallons

Actual FLI	MAQ	MAQ + storage
180 gal	120 gal	240 gal

Approved storage? **Yes**
MAQ Compliant? **Yes**

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 2

In approved cabinets: 80 gallons

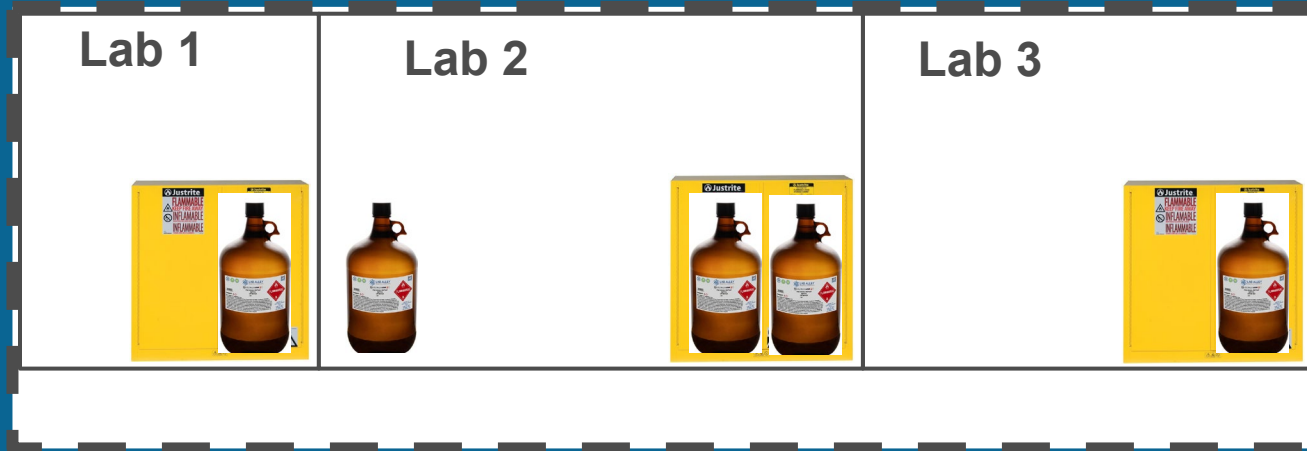
Outside cabinets: 10 gallons

Total Flammable liquids: 90 gallons

Actual FLI	MAQ	MAQ + storage
90 gal	120 gal	240 gal

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 2

In approved cabinets: 80 gallons

Outside cabinets: 10 gallons

Total Flammable liquids: 90 gallons

Actual FLI	MAQ	MAQ + storage
90 gal	120 gal	240 gal

Approved storage? **Yes**
MAQ Compliant? **Yes**

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 3

In approved cabinets: 240 gallons

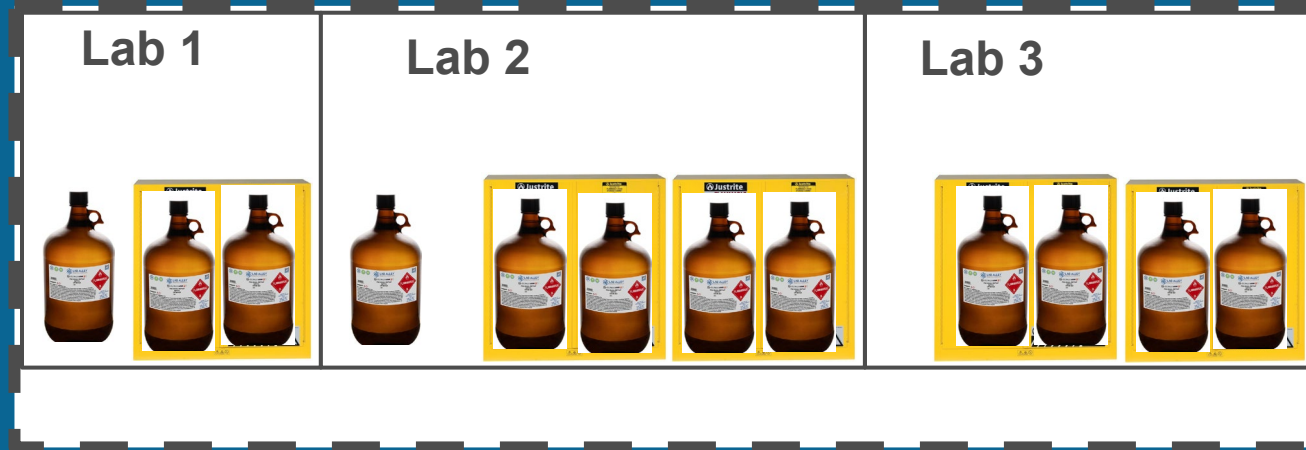
Outside cabinets: 30 gallons

Total Flammable liquids: 270 gallons

Actual FLI	MAQ	MAQ + storage
270 gal	120 gal	240 gal

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 3

In approved cabinets: 240 gallons

Outside cabinets: 30 gallons

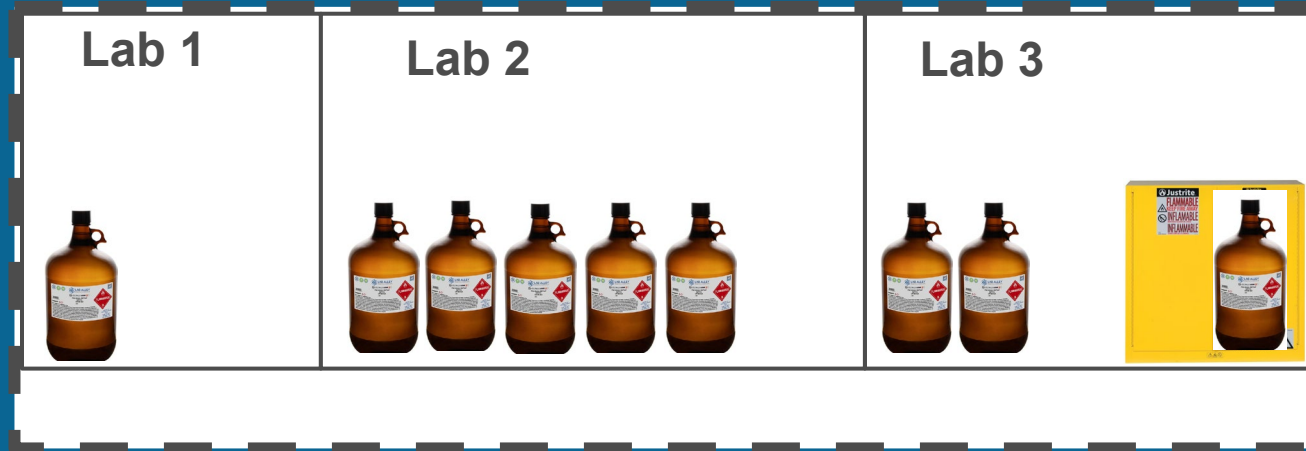
Total Flammable liquids: 270 gallons

Actual FLI	MAQ	MAQ + storage
270 gal	120 gal	240 gal

Approved storage? **Yes**
MAQ Compliant? **No**

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 4

In approved cabinets: 20 gallons

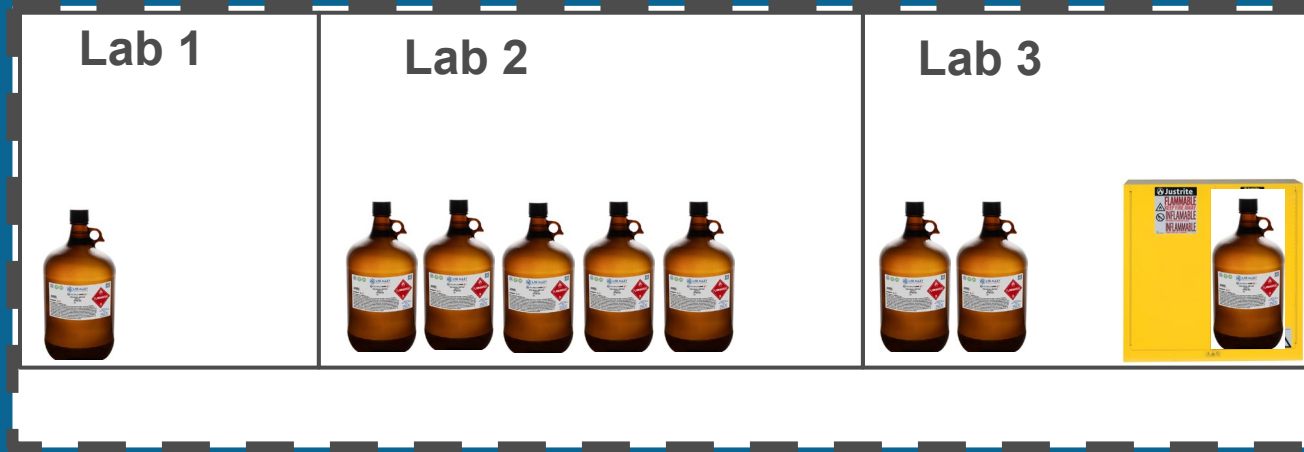
Outside cabinets: 160 gallons

Total Flammable liquids: 180 gallons

Actual FLI	MAQ	MAQ + storage
180 gal	120 gal	240 gal

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 4

In approved cabinets: 20 gallons

Outside cabinets: 160 gallons

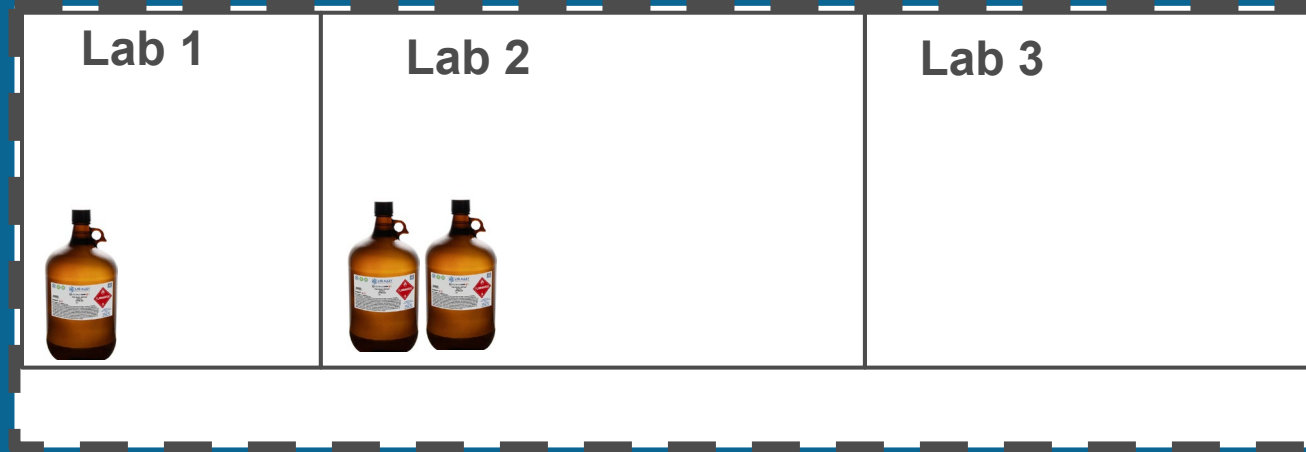
Total Flammable liquids: 180 gallons

Actual FLI	MAQ	MAQ + storage
180 gal	120 gal	240 gal

Approved storage? **NO**
MAQ Compliant? **NO**

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 5

In approved cabinets: 0 gallons

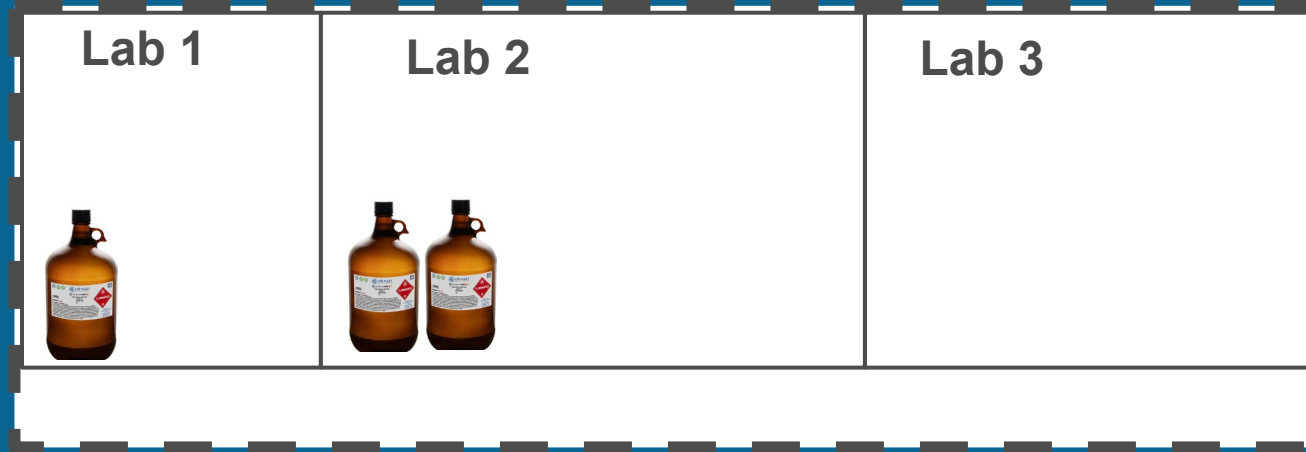
Outside cabinets: 60 gallons

Total Flammable liquids: 60 gallons

Actual FLI	MAQ	MAQ + storage
60 gal	120 gal	240 gal

Approved Storage: how to apply?

Flammable liquids (Class I)



Example 5

In approved cabinets: 0 gallons

Outside cabinets: 60 gallons

Total Flammable liquids: 60 gallons

Actual FLI	MAQ	MAQ + storage
60 gal	120 gal	240 gal

Approved storage? **NO**

MAQ Compliant? **Yes**

Questions?

RSS Chemicals: How to apply approved storage

Questions?