



Chemical Safety and Security Officer Training

**Bangkok, Thailand
February 2010**



SAND No. 2009-8395P
Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company,
for the United States Department of Energy's National Nuclear Security Administration
under contract DE-AC04-94AL85000.

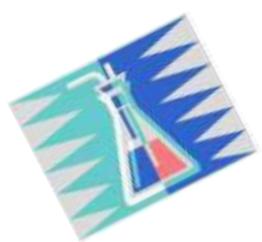




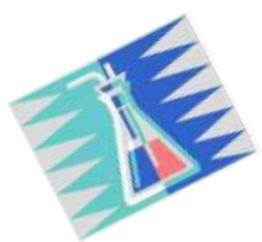
Lab Visit



Lunch



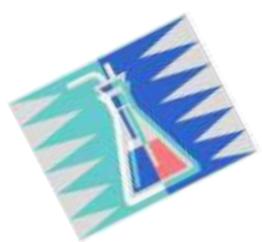
Fire Protection and Prevention in Chemical Laboratories



Fires

- **Preventable**
- **Caused by unsafe practices**
 - **Electrical safety violations**
 - **Uncontrolled use of flammable and combustible materials**
- **Control**
 - **Inspect, inspect, inspect**
Educate, educate, educate!





Home Fires

1 million fires and 8,000 deaths annually in the US



Leading causes:
Cigarettes
Heating/cooling equipment
Electrical
Matches, lighters, candles



Industrial Fires

- **Fifth leading cause of accidental death**
 - Vehicles, falls, poison, drowning, fire
- **Most dangerous industries from fire hazard:**
 - Mines
 - Grain elevators and mills
 - Refineries
 - Chemical plants
- **Leading causes:**
 - Electrical
 - Smoking
 - Friction
 - Overheating
 - Hot surfaces



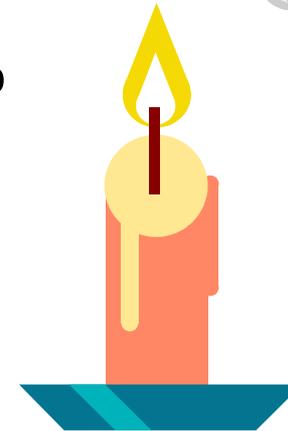


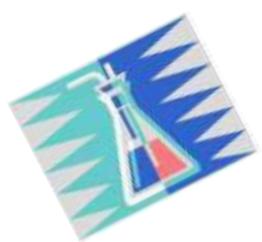
Fire Causes in the US

Factory Mutual

25,000 fires/over 10 yrs:

- Electrical 23%
- Smoking 18%
- Friction 10%
- Abnormal process temp. 8%
- Hot Surfaces 7%
- Improper open flames 7%
- Arson 3%

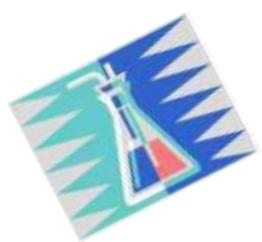




Key Elements of Fire Safety



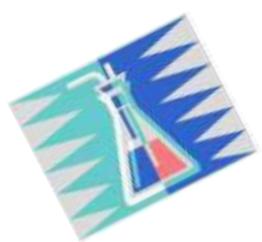
Get occupants out
Minimize property loss and interruption
Fire Containment/Suppression



Common Myths

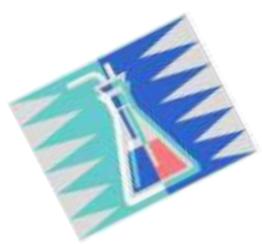
- **Fire will light the way out**
 - Smoke cloud & soot
- **Plenty of time to escape**
 - 1 min from small to inescapable fire
- **People are killed by the flames**
 - #1 killer in fires is CO, not flames
- **Wait to be rescued**
 - No! Act to save self
 - Ladders can reach to about 6th floor
- **Can not prepare for a fire**
 - Preparation can save your life





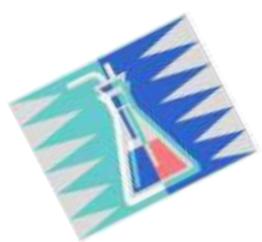
It's the Smoke...





Facial Burns

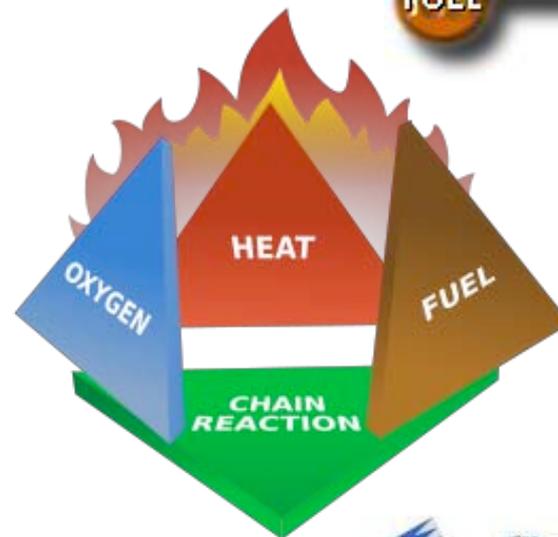


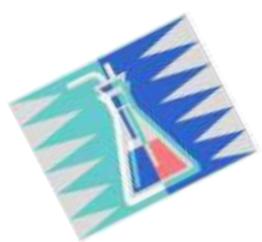


Fire

• A fire must have four things to ignite and maintain combustion:

- Fuel
- Heat
- Oxygen
- Chain reaction





Flash Point

- **Flash point:**

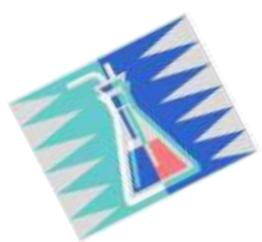
- The minimum temperature at which a liquid gives off enough vapor to form an ignitable mixture.
- In general, **the lower the flash point, the greater the hazard.**

- **Flammable liquids:**

- have flash points below 38°C
- are more dangerous than combustible liquids
- may be ignited at room temperature

- **Combustible liquids:**

- have flash points at or above 38°C
- Can pose serious fire and/or explosion hazards when heated



Flammability/Explosive Limits

Above UFL/UEL, mixture is too rich to burn

Upper Flammability/Explosive Limit (UFL/UEL)



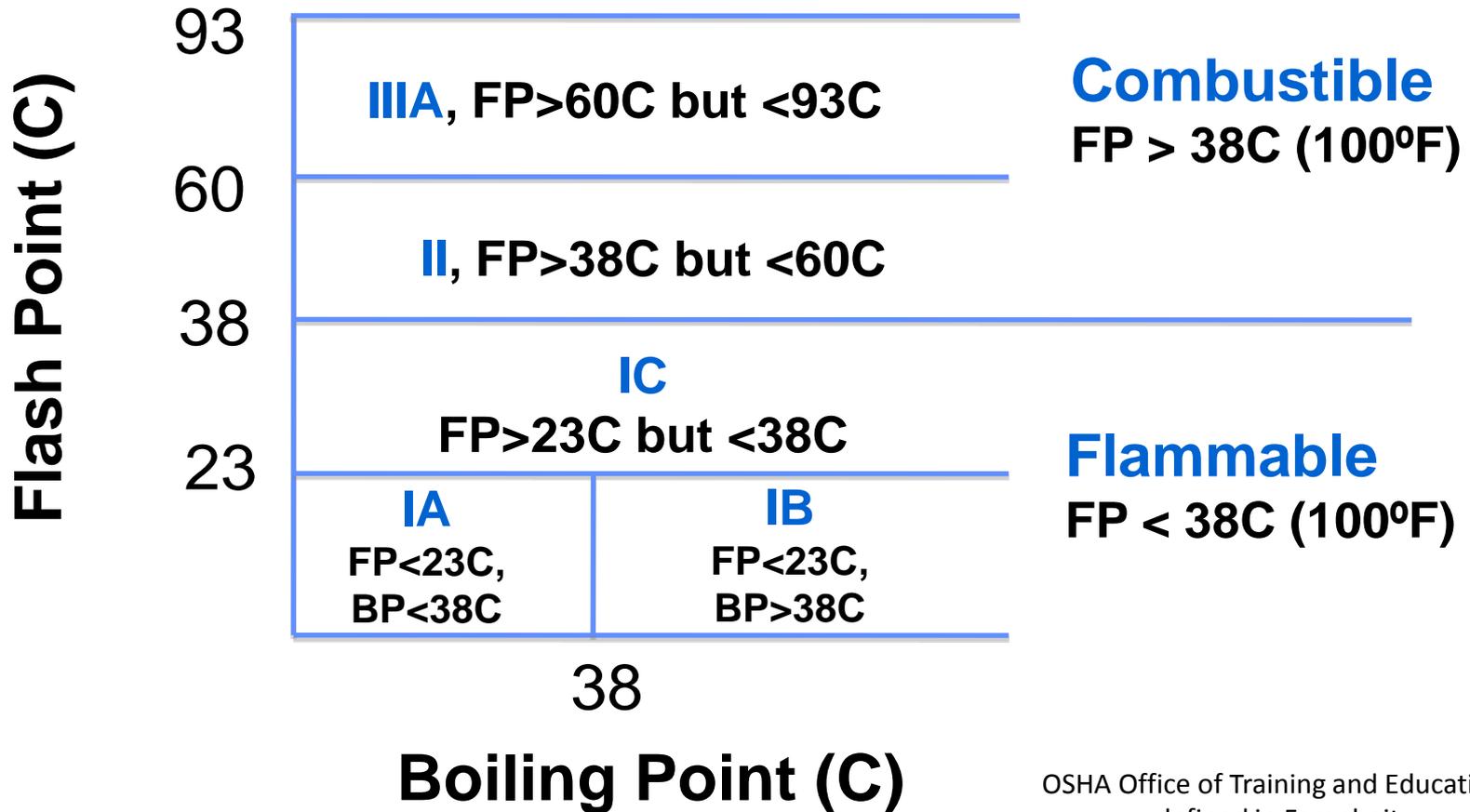
Flammability/Explosive Range

Lower Flammability/ Explosive Limit (LFL/LEL)

Below LFL/LEL, mixture is too lean to burn



Classes of Flammable and Combustible Liquids



OSHA Office of Training and Education,
defined in Fahrenheit



Classes of Some Flammable Liquids

	<u>Common Name</u>	<u>Flash Point (C)</u>
CLASS IA	Ethyl Ether	- 45
CLASS IB	Gasoline	- 43
	Methyl Ethyl Ketone	- 6
	Toluene	4
CLASS IC	Xylene	27 - 46
	Turpentine	35



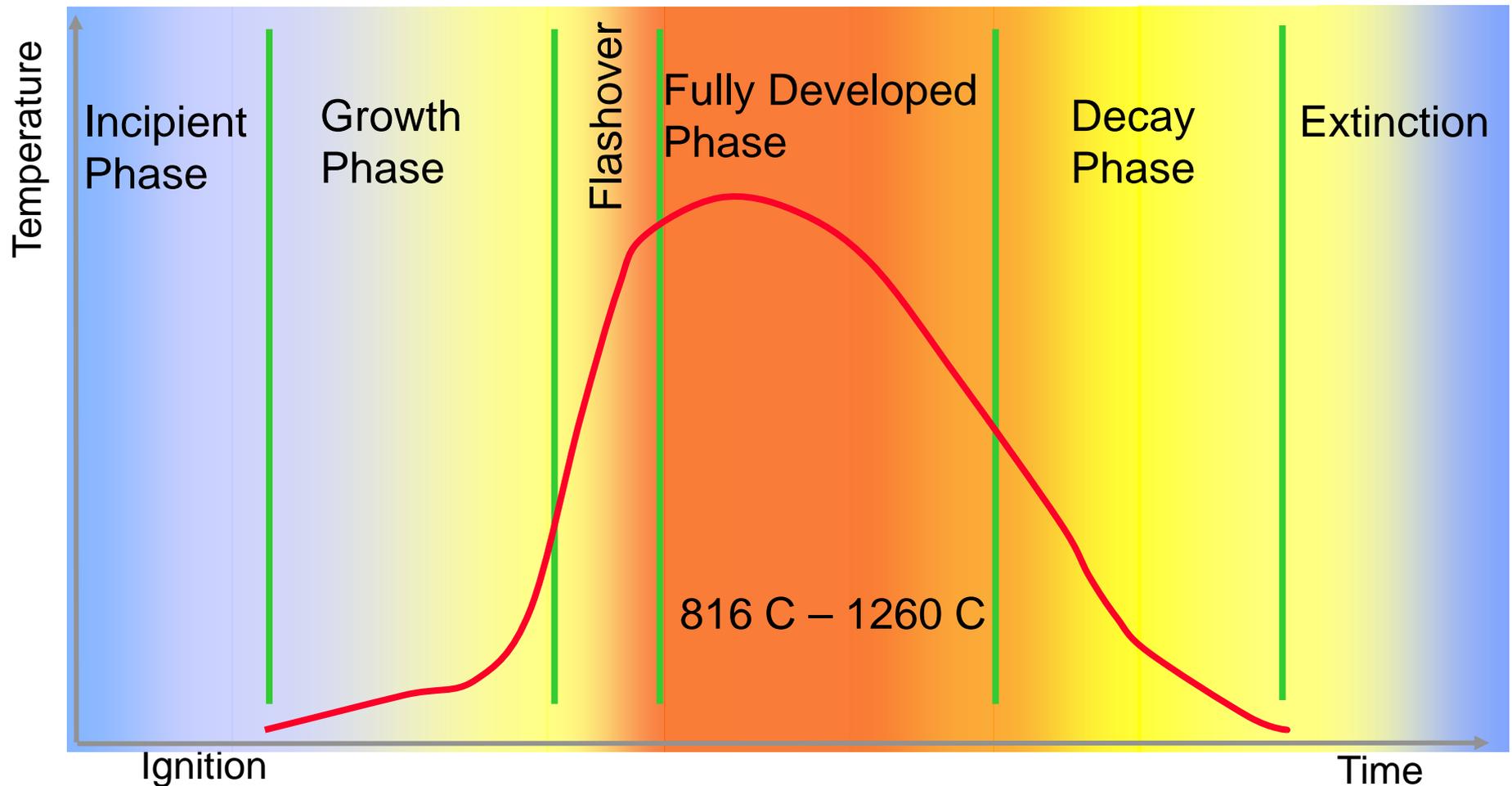
Fire Safety Program Components

A good plan for safe use of flammable and combustible liquids contains at least these components:

- **Control of ignition sources**
- **Proper storage**
- **Fire control**
- **Safe handling**



Fire Behavior

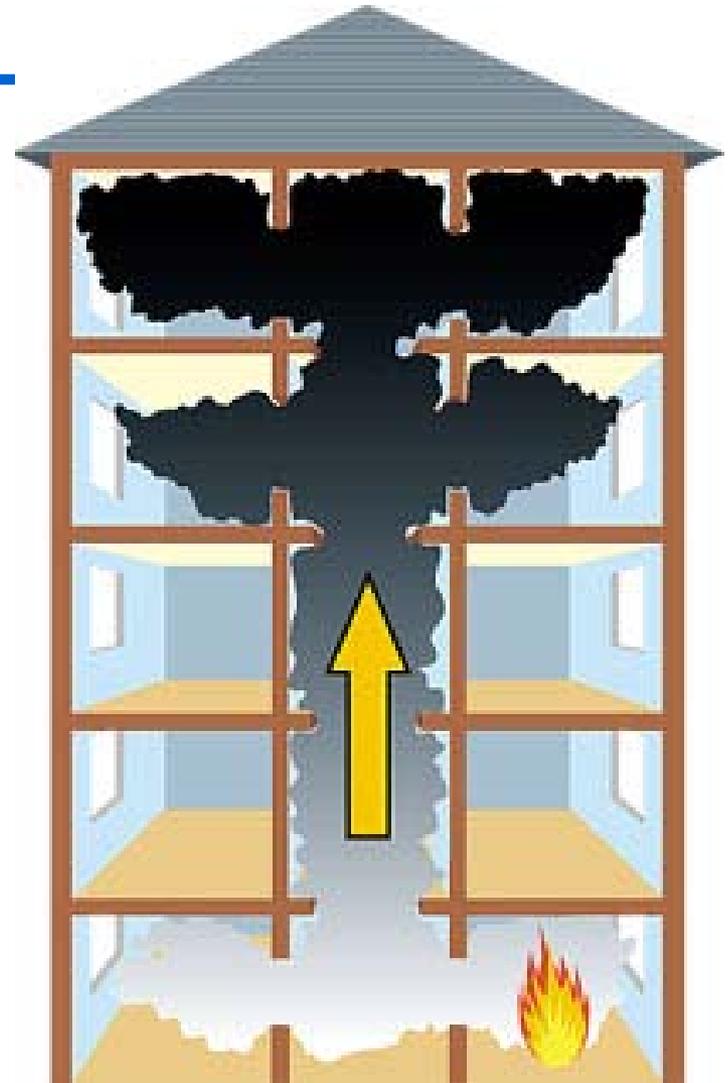


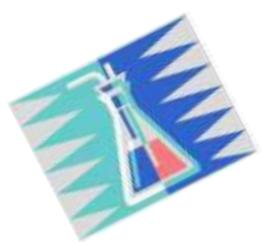


Fire Behavior

- **Hot expanding gases move vertically**
 - Tightness of construction
 - External winds
 - Internal/external temperature
 - Vertical openings
 - Stairways
 - Elevator shafts
 - Ventilation shafts

Stack Effect





Vapor Volume

Volume of gas formed when a liquid substance evaporates

Computed from specific gravity and vapor density

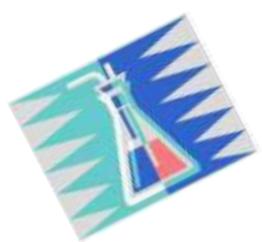
$$\text{Vapor Volume (m}^3\text{/liter)} = \frac{0.829 (\text{SpG})}{\text{Vapor density}}$$

Example: What is the vapor volume of a liter of acetone?

[SpG = 0.9, relative to water; Vapor density = 2, relative to air]

$$\text{Vapor Volume (m}^3\text{/l)} = \frac{0.829 (0.9)}{2} = 0.373 \text{ m}^3\text{/L}$$





Vapor Volume

**What is the probability of forming a combustible mixture if a 4 liter container of acetone is used in a room 3 x 4 x 2.5 m?
[LEL = 2.5%; assume incomplete mixing factor 5]**

Volume of the space = 30 m³

Vapor volume = 0.373 m³/L

**Vapor volume necessary to form a
Combustible mixture:**

$$30 \text{ m}^3 \times 0.025 = 0.75 \text{ m}^3$$

$$\frac{0.75 \text{ m}^3}{0.373 \text{ m}^3/\text{L}} = 2.01 \text{ L}$$

Applying the mixing factor of 5:

$$2.01 \text{ L} / 5 = 0.40 \text{ L}$$

[About = 1 coffee mug]

Since it doesn't take much more than "1 coffee mug" of acetone to form a combustible mixture, the probability appears to be high!



Housekeeping...





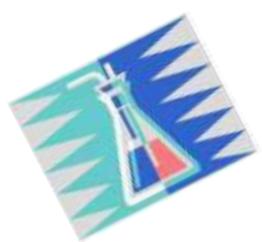
Flammable Liquid Containers





Tool Cleaning (Acetone)





Fire Hazards

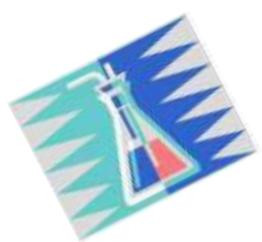
- **Sources of fuel**
 - Flammable liquids
 - Flammable gases
 - Wood, paper, cardboard
 - Oil soaked rags
- **Sources of heat (ignition)**
 - Electrical circuits:
 - Shorts, sparks
 - Arcs (switches)
 - Heat build-up
 - Hot surfaces
 - Space heaters
 - Hotplates, coffee pots, coffee makers
 - Welding
 - Smoking
 - Open flames
 - Static electricity

Train employees to notice & report fire hazards

Periodic inspections

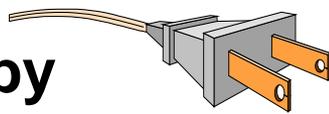
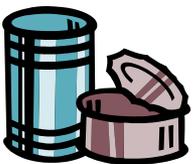
Drills

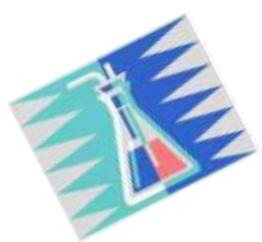




Classification of Fires

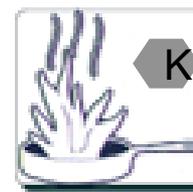
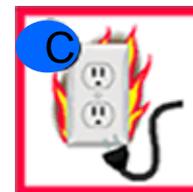
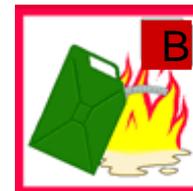
With recommended extinguisher distances

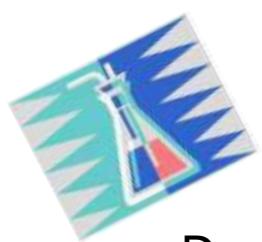
- **A** Ordinary combustibles – cloth, paper, wood, coal ~23 m 
- **B** Flammable/combustible liquids, gases, greases and oils - gasoline, diesel fuel ~15 m 
- **C** Energized Electrical equipment cables, motors nearby 
- **D** Combustible metals - sodium, magnesium, titanium ~23 m 
- **K** Restaurant grease fires associated with cooking nearby 



Classification of Fires

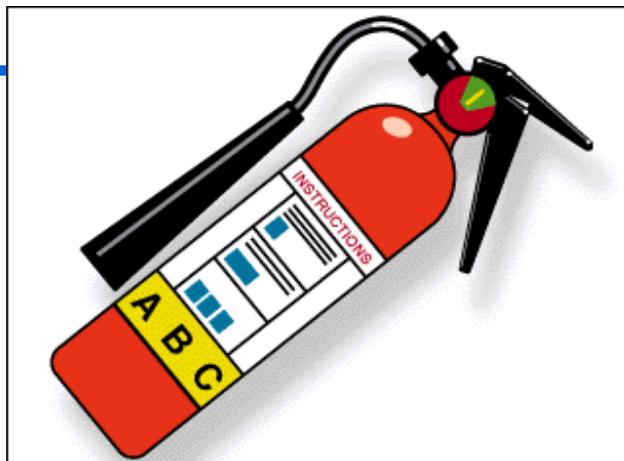
- **A** Extinguish by cooling or smothering.
(water)
- **B** Extinguish by inhibiting release of combustible vapors or interfering with the chemical reaction-release of OH radicals.
(CO₂ or dry powder: monoammonium phosphate)
- **C** Extinguishing agent must ***not*** be conductive.
(CO₂ or dry powder)
- **D** Extinguishing agents must absorb heat and not react with the metal.
(special dry powder, sand)
- **K** (Special liquid chemicals)





Fire Extinguishers

Dry Chemical



CO₂



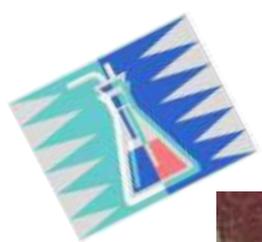
Water



Placed within ~15-25 m



Annual & Monthly inspections



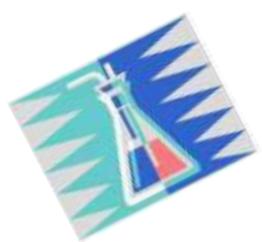
Large Fire Extinguisher





Fire Extinguishers

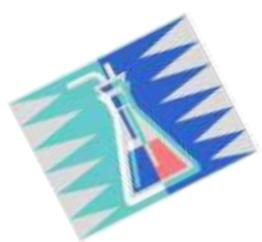




Fire Alarm Systems

- **Will it be recognized and followed?**
 - Audible, visual, public address systems...
- **What about deaf or blind employees?**
 - Are there “dead spaces”...
- **System reliability**
 - System failure may not be obvious
 - Supervised systems (built-in monitoring)
 - Testing, maintenance and backup systems





Fire Detection & Alarms

- **Thermal**

- **Heat**

- Fixed temp
- Rate of rise
 - ~6 to 8 C/min (12 to 15°F/min)



Issues:

Testing

Dust, corrosion, hot processes, weather, mechanical damage



- **Smoke**

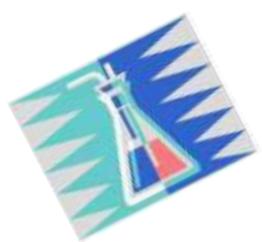
- Photoelectric
 - IR from smoke
- Ionization
 - Ionize smoke

- **Flame Detectors**

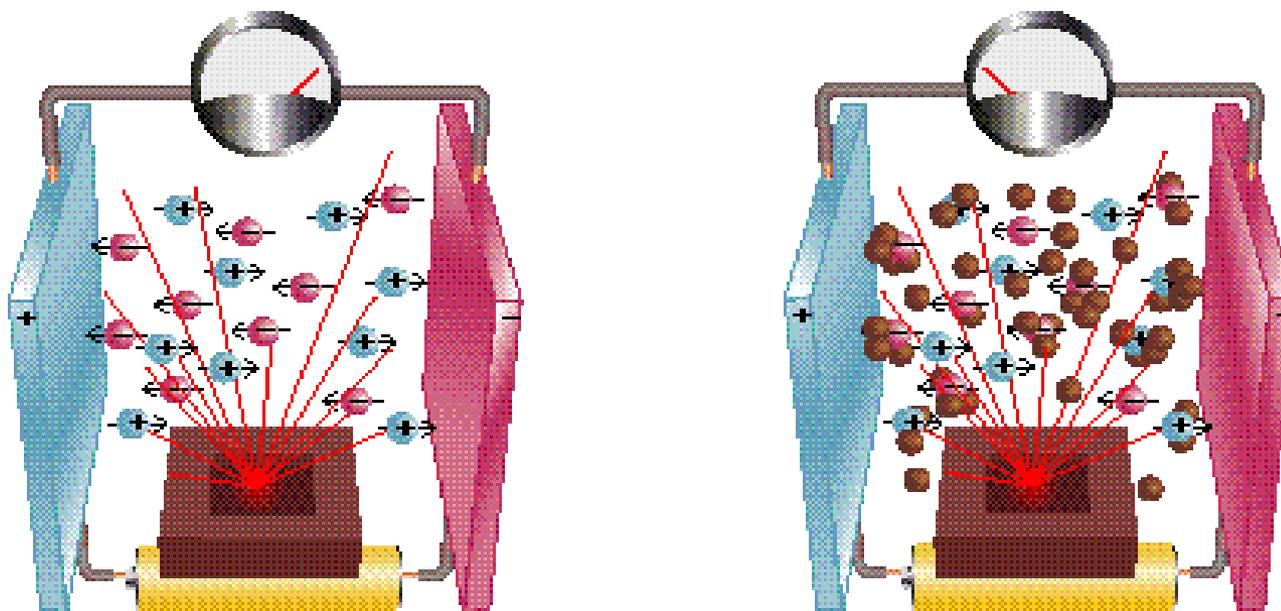
- Flames – IR or UV

- **Gas Sensors**

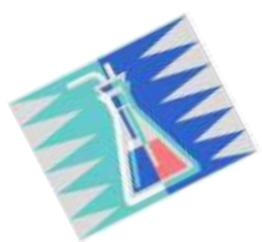




Smoke Detectors



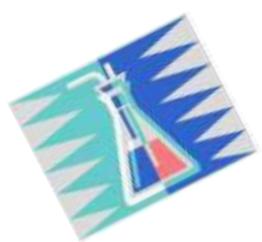
- Alpha particles from Americium-241 (red lines) ionize the air molecules (pink and blue spheres).
- The ions carry a small current between two electrodes.
- Smoke particles (brown spheres) attach to ions reducing current and initiate alarm.



False Alarms



False alarms
may be
triggered by
construction
dust created
during
renovations



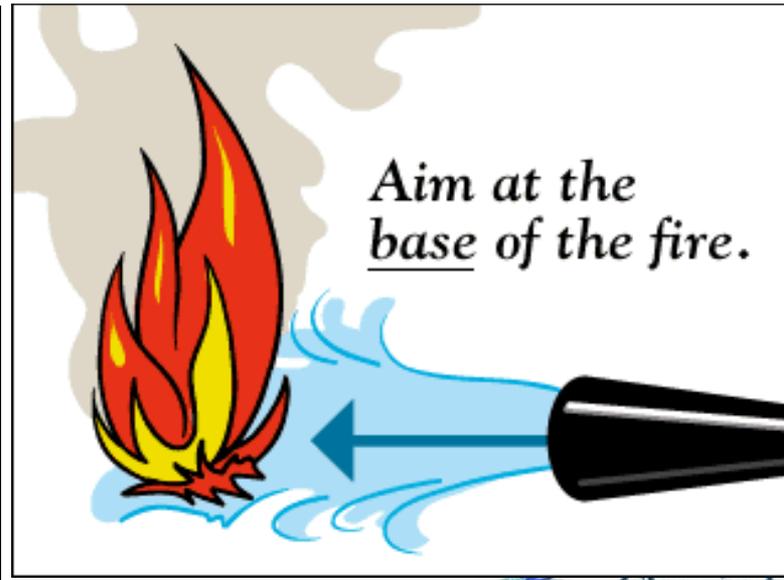
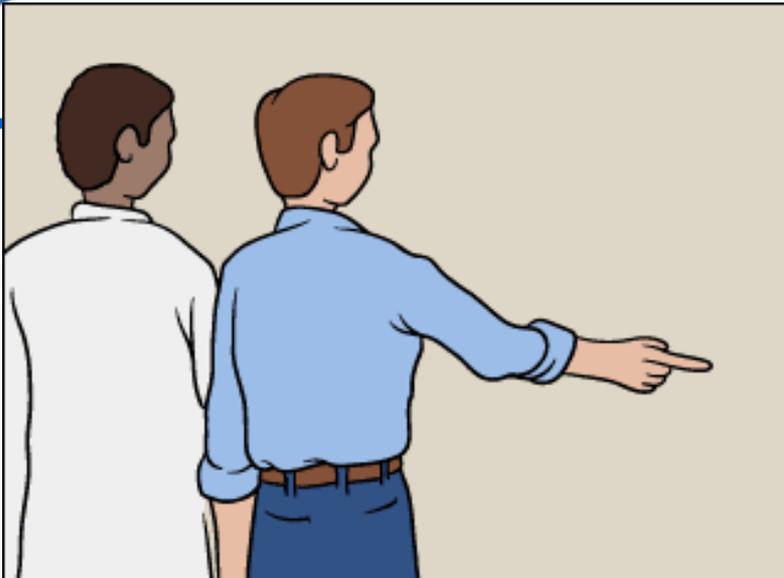
Manual Pull Stations

- Manual Pull Stations are devices located on the wall (usually near an exit)
 - Sends a signal to the building's fire alarm system when activated
 - Places the building into alarm



People are reluctant to sound fire alarms!

Responding To A Fire





Employee Training



Few employees know how to *effectively* use extinguishers!

Need for training:

- Upon initial employment
- Annual refresher

Emergency Response (phone numbers)

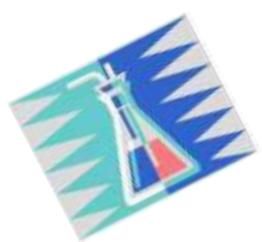


Using a Fire Extinguisher



- P** Pull
- A** Aim
- S** Squeeze
- S** Sweep

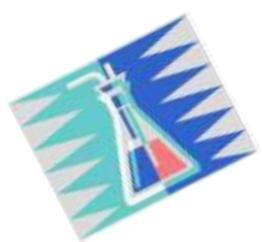




Water

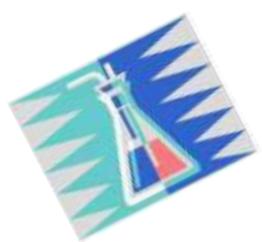


- **Water is highly effective on Class A fires, by cooling down the fire and surrounding atmosphere.**
- **Water is usually available.**
- **It can be used to cool down the firefighting team to prevent heat exposure.**



Disadvantages

- Water should **NOT** be used to control a B or C fire.
- Inadequate pressure or too high pressure can cause problems.
- The volume of water can be restricted by the length of water lines and hoses (frictional loss ~ 3500 Pa for every 3 meters of 4 cm diameter hose).
- The fire nozzle can clog due to non-filtered materials in the lines.
- Hydrogen can be produced if water is applied to very-hot fires.



Electrical Fires



Pull the plug out or switch off the power at the fuse box. This may stop the fire immediately.



Smother the fire with a fire blanket, or use a dry powder.



Never use water on it.





WHAT TO DO IF SOMEONE CATCHES ON FIRE

If ***you*** should catch on fire:

STOP - where you are

DROP - to the floor

ROLL - around on the floor

This smothers the flames, possibly saving your life.

Remember ***STOP, DROP and ROLL***

If a ***co-worker*** catches on fire:

Smother flames by grabbing a blanket or rug
Wrap them in it.

Could save them from serious burns or death.





WHEN NOT TO FIGHT A FIRE

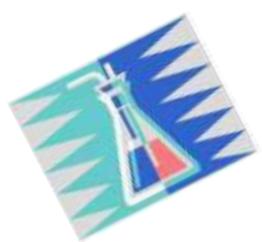
Don't fight a fire, when:

- It is bigger than a waste paper bin
- One extinguisher is not enough
- The fire is spreading beyond the spot where it started
- Smoke is affecting your breathing
- You can't fight the fire with your back to an escape exit
- The fire can block your only escape
- You don't have adequate fire-fighting equipment



DON'T FIGHT THE FIRE YOURSELF

CALL FOR HELP

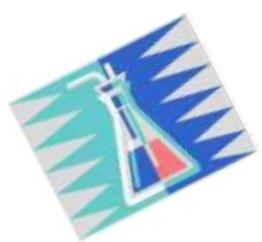


Remember

When...

- The extinguisher runs out of agent
- Your path of escape is threatened
- The extinguisher proves to be ineffective
- You are no longer be able to safely fight the fire

...LEAVE THE AREA IMMEDIATELY!



Storage Guidelines

- ❖ All storage must be at least 1 m from electrical panels. In some emergency situations it will be necessary to access these panels quickly.

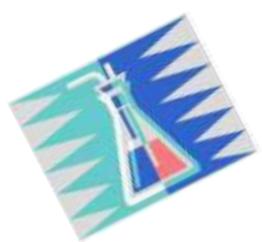


Improper Storage in front of Electrical Panel

- Maintain at least 1 m clearance from heating surfaces, air ducts, heaters, and lighting fixtures.
- Storage of combustible materials in mechanical rooms is prohibited.

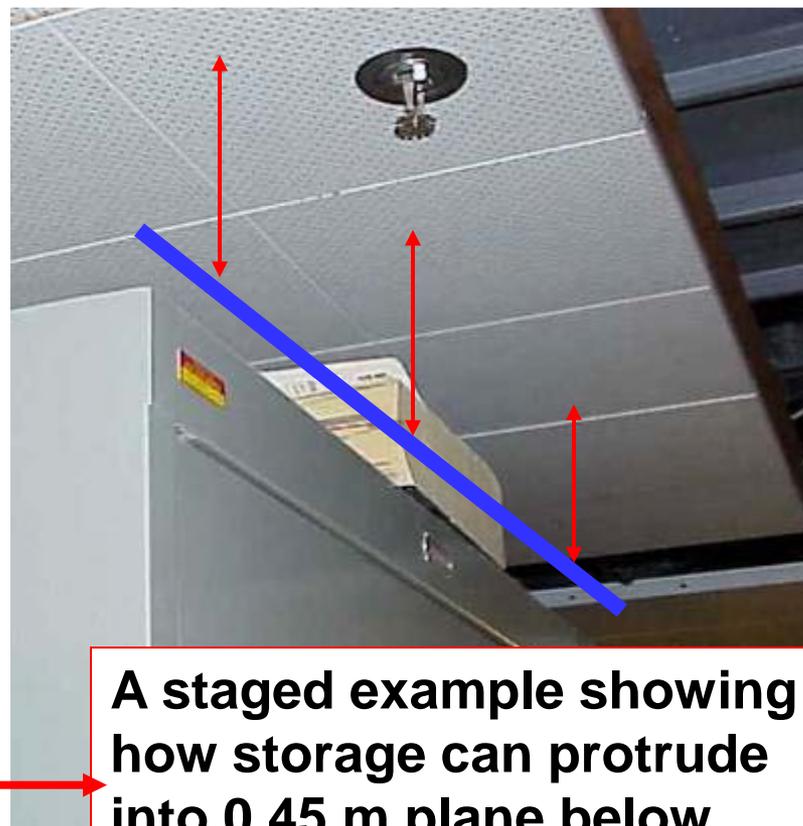


Improper Mechanical Room Storage



Storage Guidelines

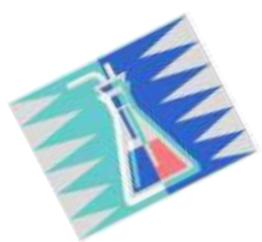
- ❖ No storage is allowed in corridors and stairwells. A cluttered hallway could slow down emergency evacuation.
- ❖ Storage must not exceed a plane of 0.45 m below sprinkler heads or smoke detectors. Storage that breaks this plane may prevent sprinkler heads from fully covering room during a fire.



A staged example showing how storage can protrude into 0.45 m plane below sprinkler heads.







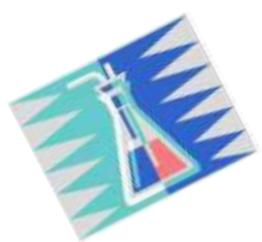
Myths about Sprinkler Systems

- **A sprinkler system will cause excessive water damage**
 - Sprinklers use a fraction of water compared with a fire hose.
 - Sprinklers release ~30 – 90 liters per minute compared to a fire hose at ~190 – 475 liters per minute.
 - Sprinklers operate very early in the fire development, and consequently require a smaller quantity of water.
- **When a fire occurs, every sprinkler head goes off**
 - Sprinkler heads are individually activated by fire.
 - > 50% of the fires are controlled by ≤ 4 sprinkler heads, and in many instances fires are controlled with one sprinkler.
- **The pipes burst due to freezing**
 - Sprinklers can be protected with various forms of frost protection, such as installing a dry system or providing heating elements to protect the sprinkler systems.



More Myths about Sprinkler Systems

- **Sprinkler systems might accidentally go off**
 - Sprinklers are very reliable; the chances of going off without mechanical assistance are 1 in 16 million; Fork lift truck drivers soon learn to avoid them.
- **Smoke detectors provide enough protection**
 - Smoke detectors provide early warning and save lives, but do nothing to extinguish a fire or protect those physically unable to escape on their own.
 - Too often, battery operated smoke detectors fail to function because the batteries are dead or have been removed.
- **Sprinklers are designed to protect property, but are not effective for life safety**
 - Sprinklers can reduce property losses up to 85%.
 - Combining sprinklers and early warning systems can reduce overall injuries, loss of life and property damage by 50%.



Fire Safety Planning

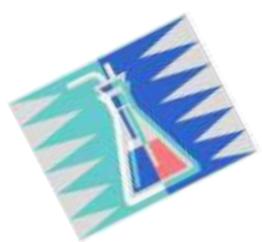
- **Construction**
 - Building materials
 - Fire-resistive ratings (minutes to hours)
 - Interior finishes (3 classes: A, B, & C)
- **Containing the fire**
 - Stair enclosures and fire walls
 - Separate building units or zones (control spread)
 - Fire doors
 - Smoke, heat and noxious gases control
 - Exits
- **Egress**
 - Two ways out, exit to safe area



Egress – Exit Route

- Exit routes must be permanent
 - Exits must be separated by fire-resistant materials
 - Openings into an exit must be protected by an approved self-closing fire door that **remains closed or automatically closes in an emergency**
 - Unobstructed
- Well marked

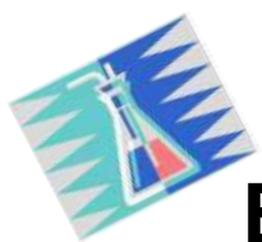




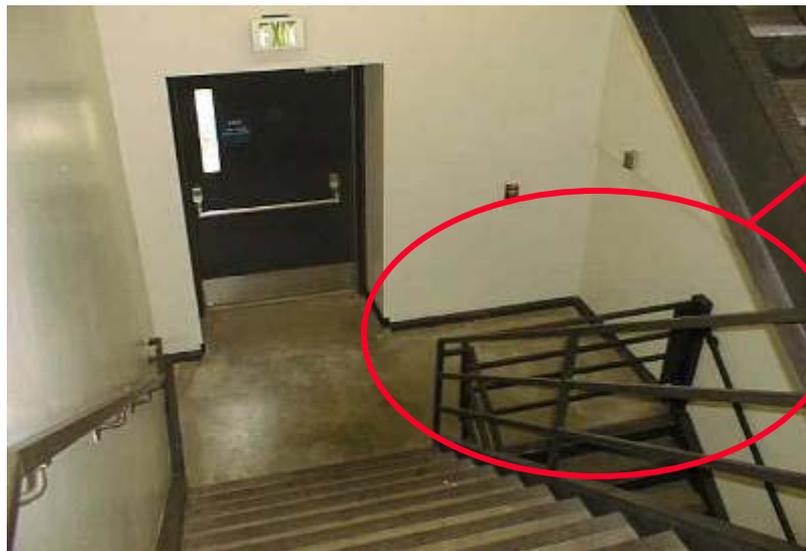
Egress – Exit Route

- **Exit Doors:**
 - Must *not* be Blocked or Locked
 - Can use a panic bar
 - Must be well marked
 - *Open in direction of travel*





Best Practices: Safety During a Fire...



- Stairs have a bar blocking the steps going down to indicate ground level fire egress
- Keep fire exits and stairwells free from any obstruction to allow for an easy exit during a fire emergency





Emergency Lighting





Proper storage of Flammables is an important part of Fire Safety



Limit quantities stored

Safety cans

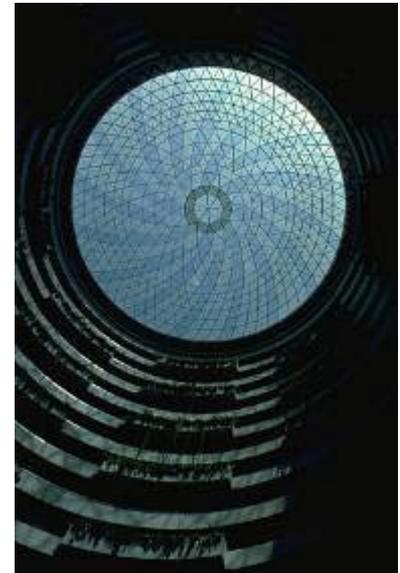
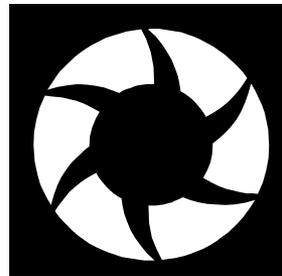
Secondary Containment

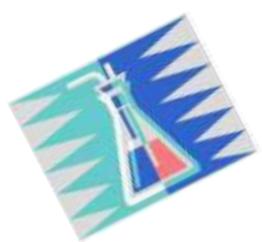
Flammable storage cabinets, rooms or buildings



Ventilation

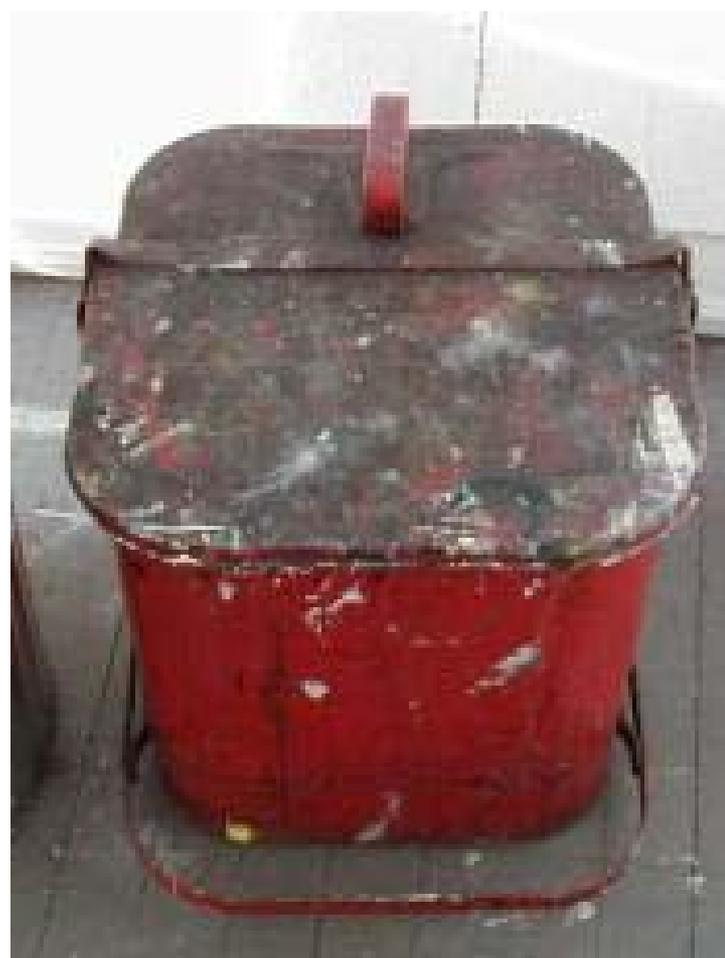
Always provide adequate ventilation to reduce the potential for ignition of flammable vapors.

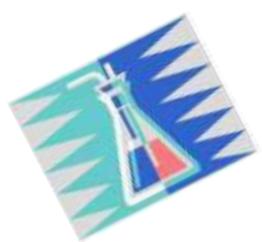




Storage Containers

- Oily Rags
- Drying process exothermic
- Container (reduces fire risk)
 - Limits oxygen.
 - Encourage air circulation to remove heat.
 - Limits access to ignition source.

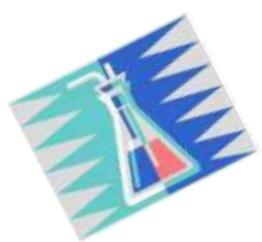




Storage Containers

- **Containers should be tightly sealed when not in use.**
- **Approved safety cans are recommended for smaller quantities.**
 - The spring-loaded safety cap prevents spillage.
 - Prevents vapors from escaping
 - Acts as a pressure vent if engulfed in fire
 - Prevents explosions and rocketing of the can

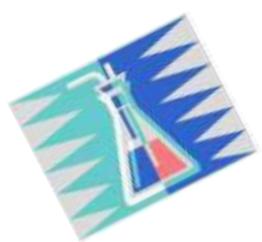




Flame Arrester Screen

- Prevents fire flashback into can contents.
- Double wire - mesh construction
- Large surface area provides rapid dissipation of heat from fire so that vapor temperature inside can remains below ignition point.





Storage Areas

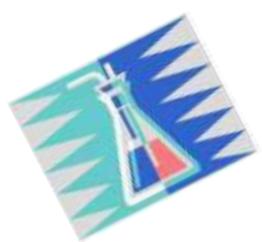
Flammables should be stored in an approved cabinet in a cool, well ventilated area to avoid pressure buildup and vaporization





Flammable Storage Cabinets

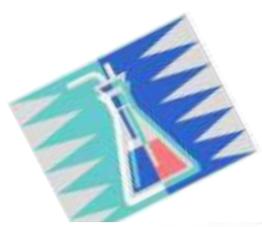




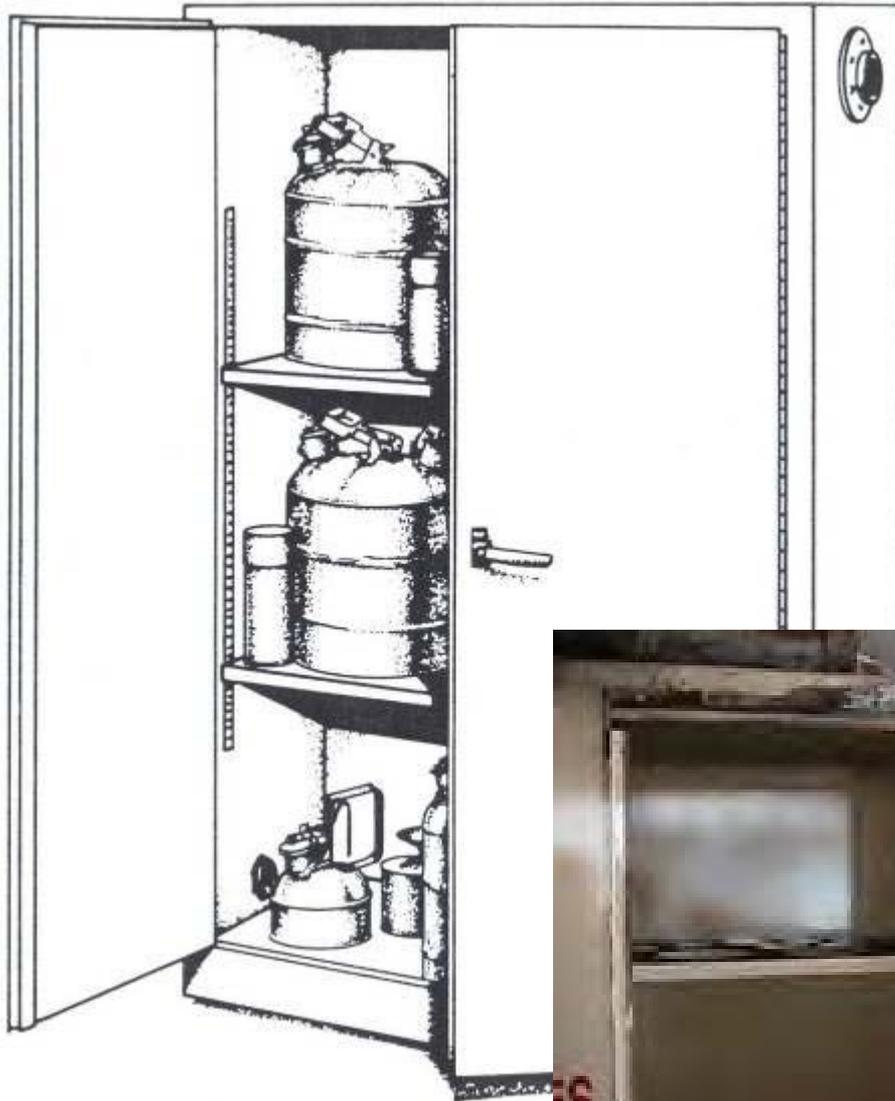
Storage Cabinets

- Not more than 225 L of Class I and/or Class II liquids, or not more than 450 L of Class III liquids permitted in a cabinet.
- Must be conspicuously labeled, **“Flammable - Keep Fire Away”**
- Doors on metal cabinets must have a three-point lock (top, side, and bottom), and the door sill must be raised at least 5 cm above the bottom of the cabinet.





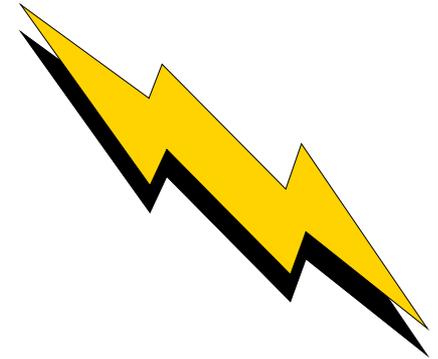
Flammable Storage Cabinets

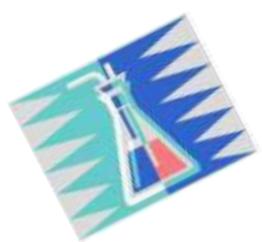




Static Electricity

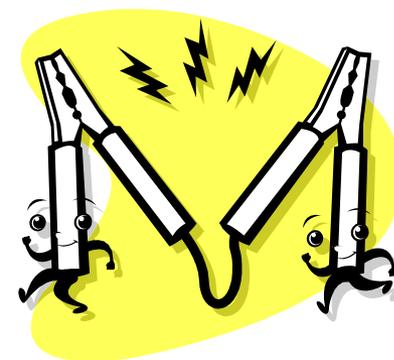
- **Generated when a fluid flows through a pipe or from an opening into a tank.**
- **Main hazards are fire and explosion from sparks containing enough energy to ignite flammable vapors.**
- **Bonding or grounding of flammable liquid containers is necessary to prevent static electricity from causing a spark.**

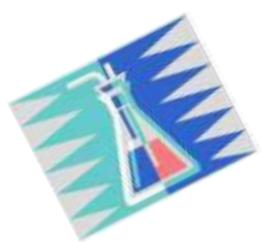




Transfer Techniques

- **Static electricity** is generated by contact and separation of dissimilar materials:
 - Fluid flow through a pipe or into a tank
 - Agitation or mixing
 - Splash filling of containers
- **Bonding and grounding:**
 - **Bonding:** eliminate charge difference between objects
 - **Grounding:** eliminate charge difference between object and ground; drain charge





Transfer Techniques

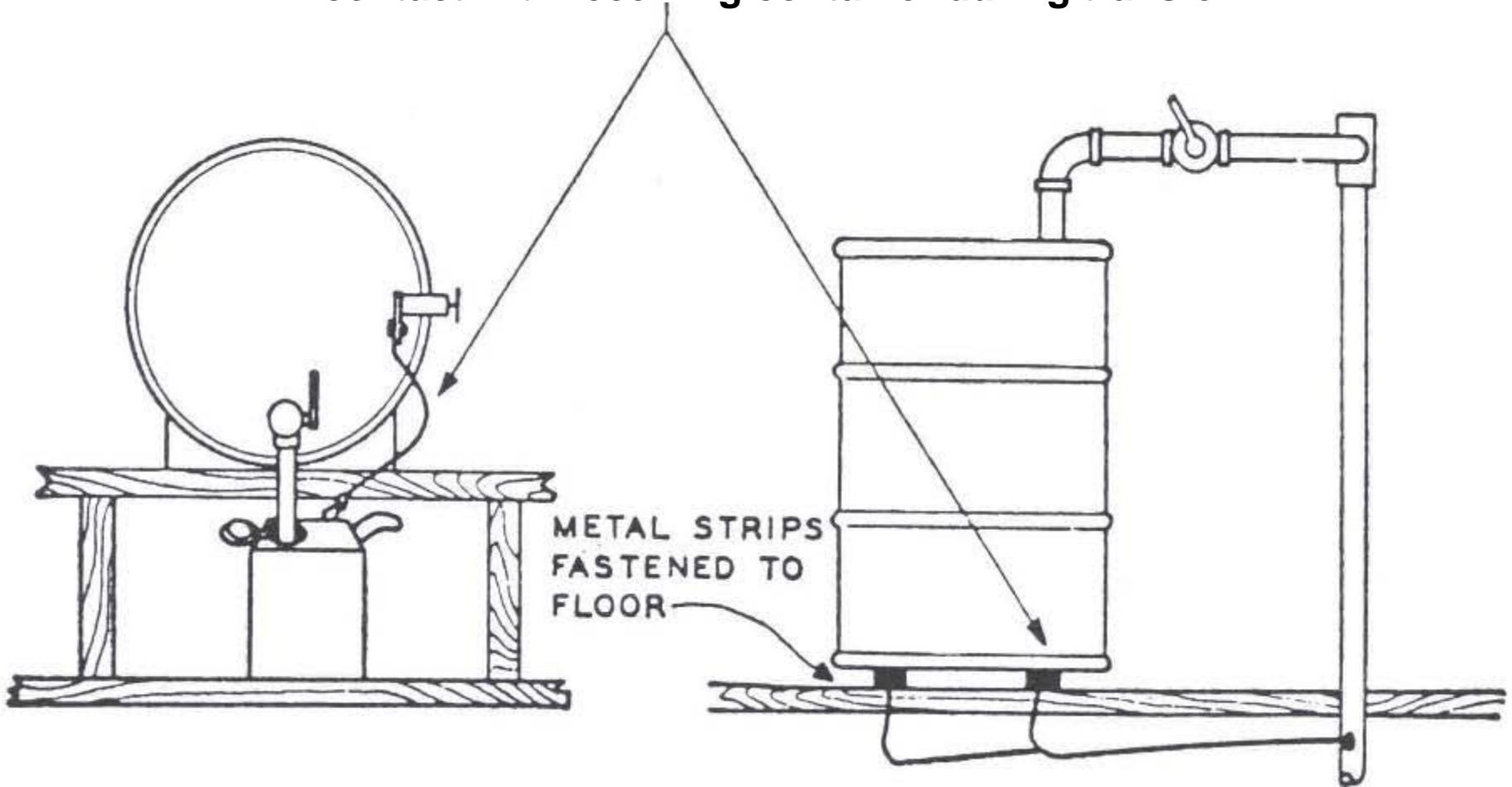
- **Bond containers**
 - Each container is wired together
 - One container is connected to a good ground point to allow any charge to drain away safely
- **Limit use of plastic containers to small volumes (< 4L)**
 - No easy way to bond plastic containers





Control of Static

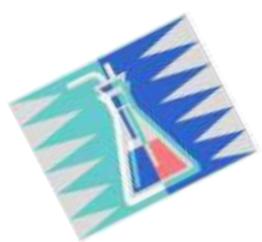
Bond wire necessary except where containers are inherently bonded together, or arrangement is such that fill stem is always in metallic contact with receiving container during transfer



Star Mart

\$8.99

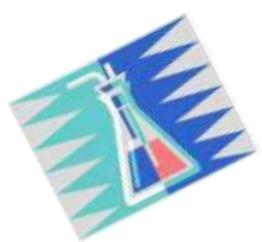




Fire Prevention Inspections

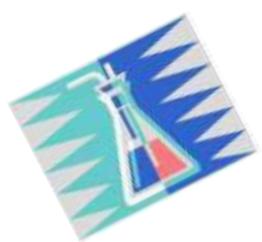
- **Minimize size of fires**
 - Control storage of combustible and flammable materials
- **Reduce possibility of a fire**
 - Control ignition sources
- **Ensure fire protection equipment is operational**
 - Fire extinguishers not blocked
- **Ensure exits are maintained**
 - Don't block egress pathways
 - Don't prop open fire doors





Violations





Violations

6-Way Multi-plug



Multi-plug



Any Questions?

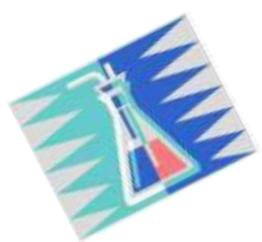




Break



Safe/Secure Transport of Chemicals



Transport References

UNECE, “Globally Harmonized System Of Classification and Labeling of Chemicals (GHS),” 1st edition, 2003, online,

http://www.unece.org/trans/danger/publi/ghs/ghs_rev00/00files_e.html

International Airlines Transportation Association, Dangerous Goods Regulations(DGR), 2008, not online,

<http://www.iata.org/ps/publications/9065.htm>

UN International Maritime Organization (IMO),

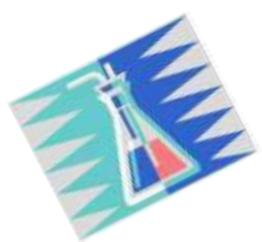
<http://www.imo.org/>

European Union (EU) Transport Activities

<http://europa.eu/>

US Department of Transportation (DOT)

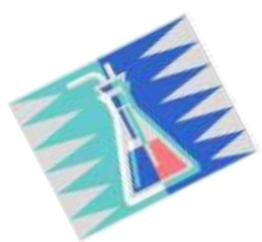
<http://www.dot.gov>



International Shipping Fines

- For international shipments fines are severe
 - up \$250,000 fine + 5 years prison in US
- Apply to scientists improperly transporting
 - samples
 - test material
 - specimens
- Dangerous Goods Regulations are set by:
 - IATA: International Air Transport Association





Modes of transport

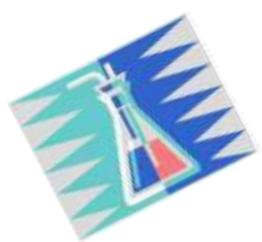


- Air
- Ship
- Rail
- Road



- Vehicle (car/truck)
- Cart, Bicycle
- Hand carry





Transport Destinations

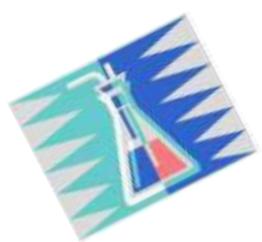
- International
- Domestic
 - Within the building
 - Within the organization
 - Same location, different building
 - Different location
 - Different City/Province/State/Island





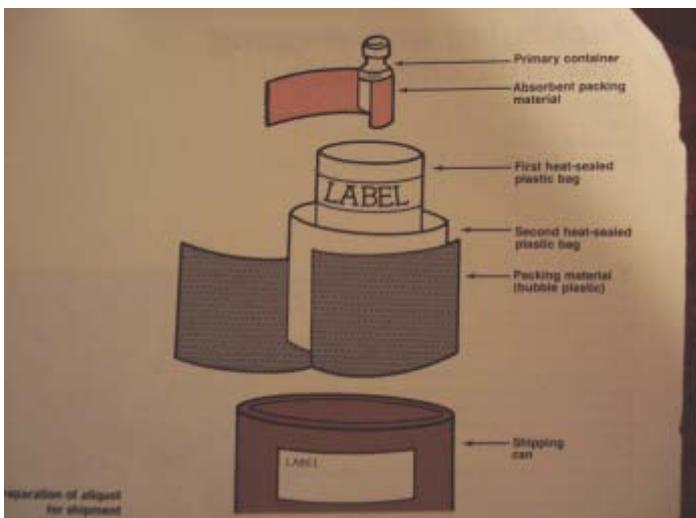
Always expect the unexpected

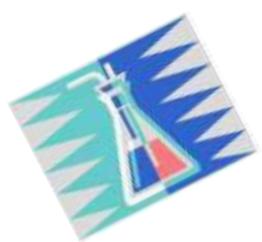




Universal Safety/Security Concept

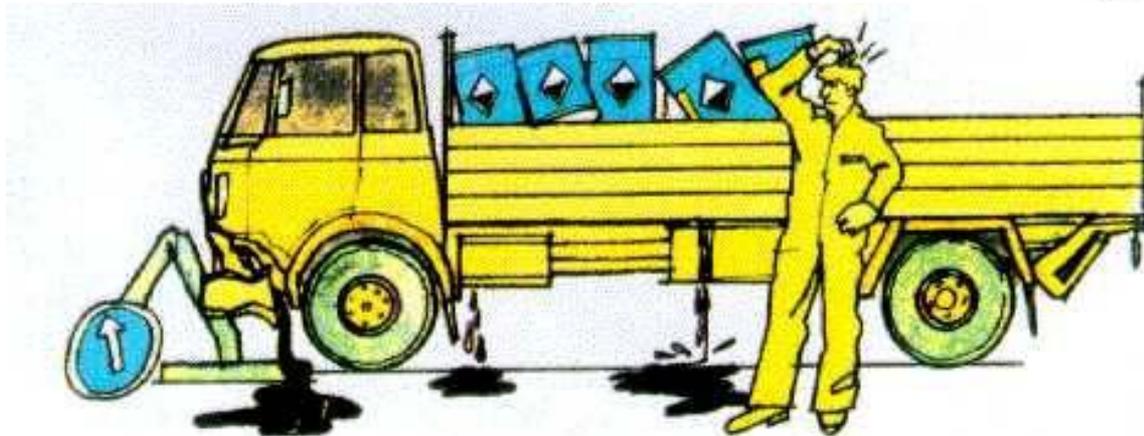
Container within a Container





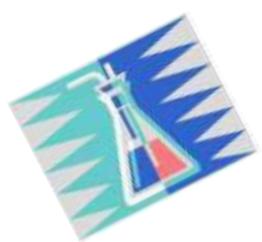
Take Precautions

- Proper Packaging
- Spill and leakage protection



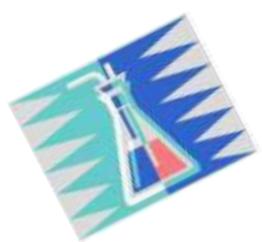
Small spills from many cars daily; when counted together make...





What is a hazardous chemical shipment?

- Corrosives
- Dry ice
- Explosives
- Flammables
- Gases
- Flammable liquids
- Flammable solids
- Genetically modified organisms
- Infectious substances
- Magnetized material
- Oxidizing substances
- Radioactive substances
- Toxic substances
- Aerosols



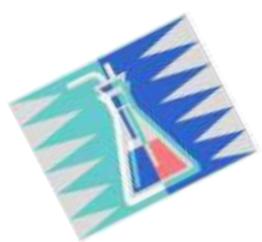
Are there special shipping requirements?

What are the physical and chemical properties?

dry ice, refrigeration?

Are specific containers required?
size, strength, composition

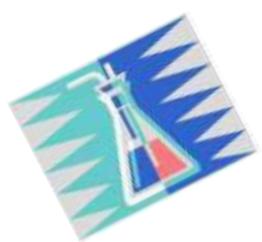




Specific transport concerns

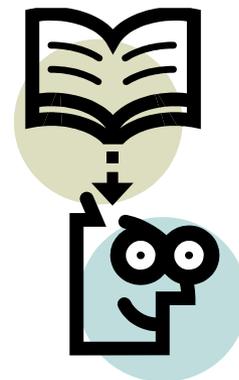
- Quantities, exclusions, limitations
- Restricted routes:
 - tunnels
 - bridges
 - populated areas





Sender/Shipper Should Know

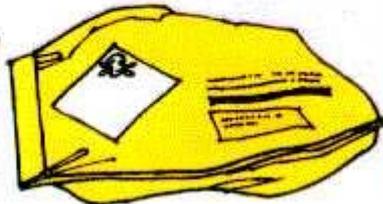
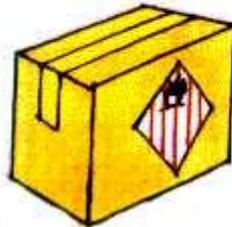
- Who transports the material?
- How is it transported?
- How is it packaged?
- Are transporters knowledgeable and prepared?
- Is there safety documentation?
- When did it leave, arrival time?
- Did all material depart and arrive as scheduled?





Labels and Placards

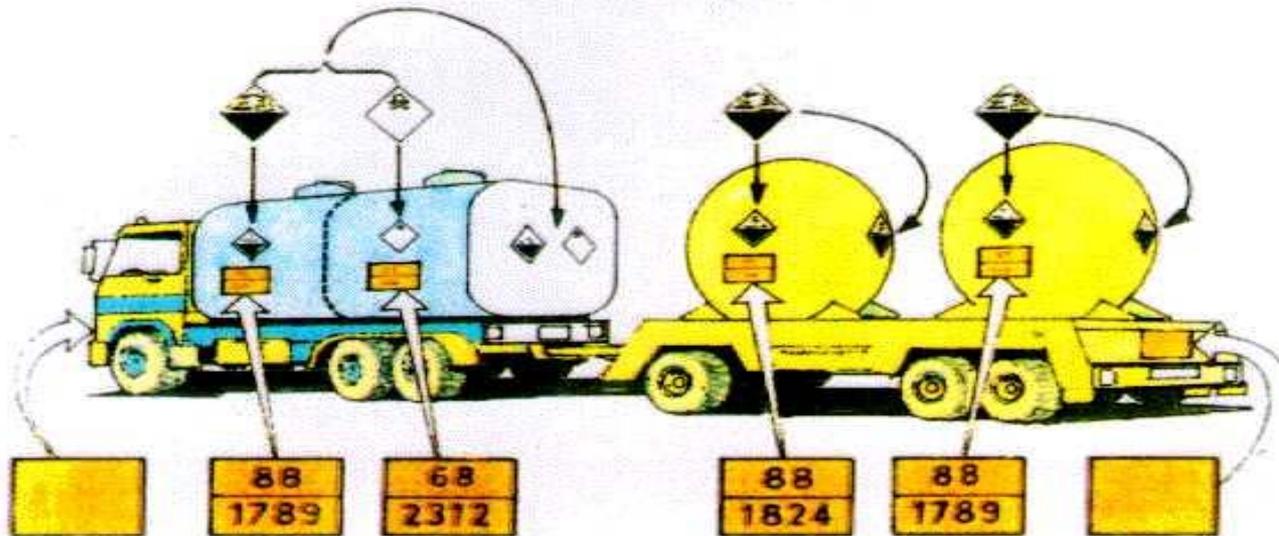
FLAMMABLE SOLID MATERIAL



TOXIC MATERIAL



CORROSIVE MATERIAL





Labels continued

HAZARDOUS WASTE
FEDERAL LAW PROHIBITS IMPROPER DISPOSAL
IF POSSIBLE CONTACT THE NEAREST POLICE SAFETY AUTHORITY
OR THE U.S. ENVIRONMENTAL PROTECTION AGENCY.

GENERATOR
NAME _____
ADDRESS _____
CITY _____ STATE _____ ZIP _____
PHONE NO. _____
SHIPPING NAME _____
CLASS _____
HAZ. WASTE CODES /
FORMER TENTS _____
UN / ICA _____

CONTENTS

DATE OF _____
COUNTRY _____
MARKING _____

IN THE EVENT OF A SPILL OF THE HAZARDOUS WASTE, CONTACT THE U.S. COAST GUARD
NATIONAL RESPONSE CENTER AT 800-424-9312 FOR INFORMATION AND ASSISTANCE.

HANDLE WITH CARE!
CONTAINS HAZARDOUS OR TOXIC WASTES

properly and fully identify material

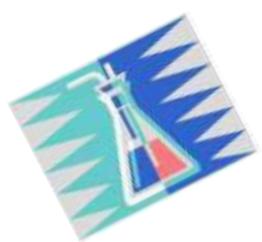
use proper, full chemical name
no abbreviations
ID codes, e.g., UN Numbers



specify

quantities, concentrations,
number of containers





Labels continued



indicate specific hazard class
according to regulations

include
emergency information
contact names
24/7 phone numbers

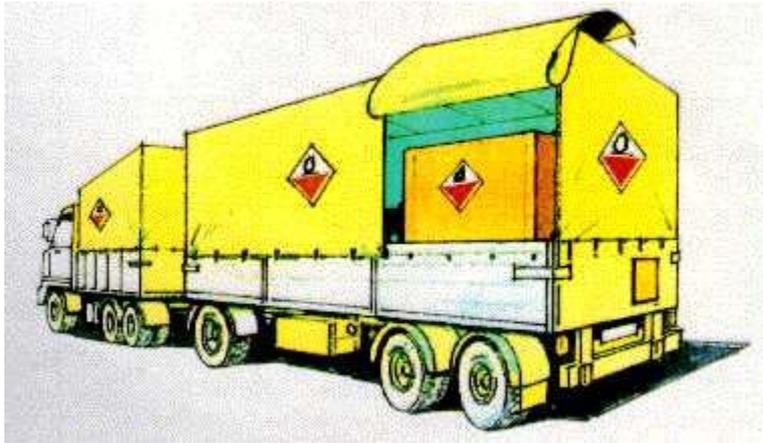


language(s)
proper universal symbols





Placards



size
shape
location (4 sides)
securely fixed
permanent markings





Documentation

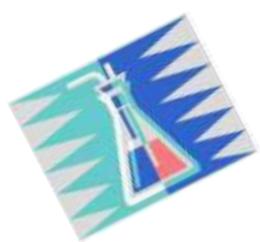


**shipping order
bill of lading
manifest**



**full shipper, receiver addresses
packing & labeling certification
verification of receipt**





Documentation continued

FLINN SCIENTIFIC INC.

"Your Safer Source for Science Supplies"

Material Safety Data Sheet (MSDS)

MSDS #: 5.00

Revision Date: September 24, 2002

Section 1 — Chemical Product and Company Identification

Acetic Acid; Glacial

Flinn Scientific, Inc. P.O. Box 219 Batavia, IL 60510 (800) 452-1261
CHEMTREC Emergency Phone Number: (800) 424-9300

Section 2 — Composition, Information on Ingredients

Acetic Acid; Glacial
Synonyms: vinegar acid, ethanoic acid
CAS#: 64-19-7

Section 3 — Hazards Identification

Clear colorless liquid, strong vinegar odor.
Corrosive, causes severe burns to eyes and skin. Moderately toxic by ingestion, inhalation and skin absorption. Fumes can be suffocating.
Class II Combustible Liquid.

FLINN AT-A-GLANCE
Health-2
Flammability-2
Reactivity-2
Exposure-3
Storage-3

0 is low hazard, 3 is high hazard

Section 4 — First Aid Measures

Call a physician, seek medical attention for further treatment, observation and support after first aid.
Inhalation: Remove to fresh air at once. If breathing has stopped give artificial respiration immediately.
Eye: Immediately flush with fresh water for 15 minutes.
External: Wash continuously with fresh water and mild liquid soap for 15 minutes.
Internal: Give 1 to 2 cups of water or milk, followed by a gastric antacid, such as milk of magnesia. Do not induce vomiting. Call a physician or poison control at once.

Section 5 — Fire Fighting Measures

Class II Combustible liquid. When heating to decomposition, emits irritating fumes.
Flash Point: 103 F (OC) Upper: 19.9% Lower: 4.0% Ait: 867 F
Fire Fighting Instructions: Use triclass, dry chemical fire extinguisher. Firefighters should wear PPE and SCBA with full facepiece operated in positive pressure mode.

NFPA Code
H-3
F-2
R-0

Section 6 — Accidental Release Measures

Restrict unprotected personnel from area. Remove all ignition sources and ventilate area. Contain spill with sand and absorbent material, neutralize with sodium bicarbonate or calcium hydroxide and deposit in sealed bag or container. See Sections 8 and 13 for further information.

Section 7 — Handling and Storage

Flinn suggested chemical storage pattern: Organic #1. Store with acids, anhydrides and peracids. Store away from Nitric Acid. Store in a dedicated acid cabinet and away from any source of water; if an acid cabinet is not available, store in a Flinn Saf-Cube. Use and dispense in a hood.

Section 8 — Exposure Controls, Personal Protection

Avoid contact with eyes, skin and clothing. Wear chemical splash goggles, chemical-resistant gloves and chemical-resistant apron. Use ventilation to keep airborne concentrations below exposure limits. Always wear a NIOSH-approved respirator with proper cartridges or a positive pressure, air-supplied respirator when handling this material in emergency situations (spill or fire).
Exposure guidelines: TWA 10 ppm, STEL 15 ppm (OSHA, NIOSH)

© 2002 Flinn Scientific, Inc. All Rights Reserved.

PAGE 1 OF 2

Safety Data Sheets

follow up documentation
require incident/accident
reports



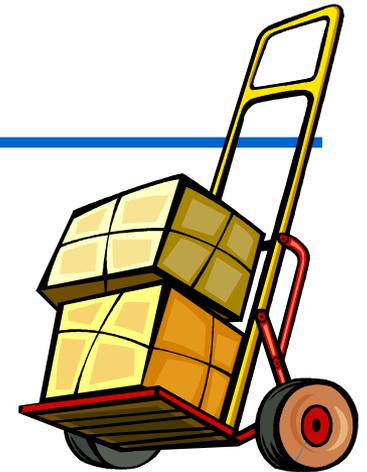


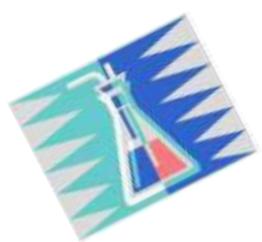
Handling

Where, how, who, packs shipment?

Special equipment needed to load & unload?

Where, how, who opens shipment?





Handling continued

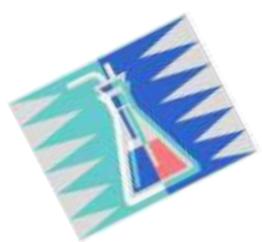
Should package be opened in a hood?

Is material radioactive?

Is monitoring equipment needed?

Is special storage needed on receipt?

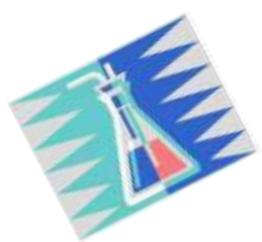




Who requires training?

- Managers
- Packers
- Handlers
- Loaders
- Drivers
- All shipping and receiving personnel
- Mailroom personnel



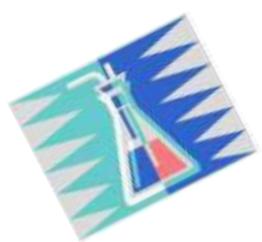


Emergency Preparation

- Transportation accidents/incidents:
 - Organization reports
 - Police reports
 - Emergency contacts
- Spill and leakage control:
 - prevention
 - minimization
 - spill clean up kits
 - PPE



Who is responsible of damages if a leaking drum spills dangerous material? You?



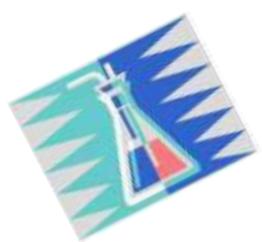
Emergency preparation continued

- Emergency contacts
 - Regulation requirements
 - local, national, international



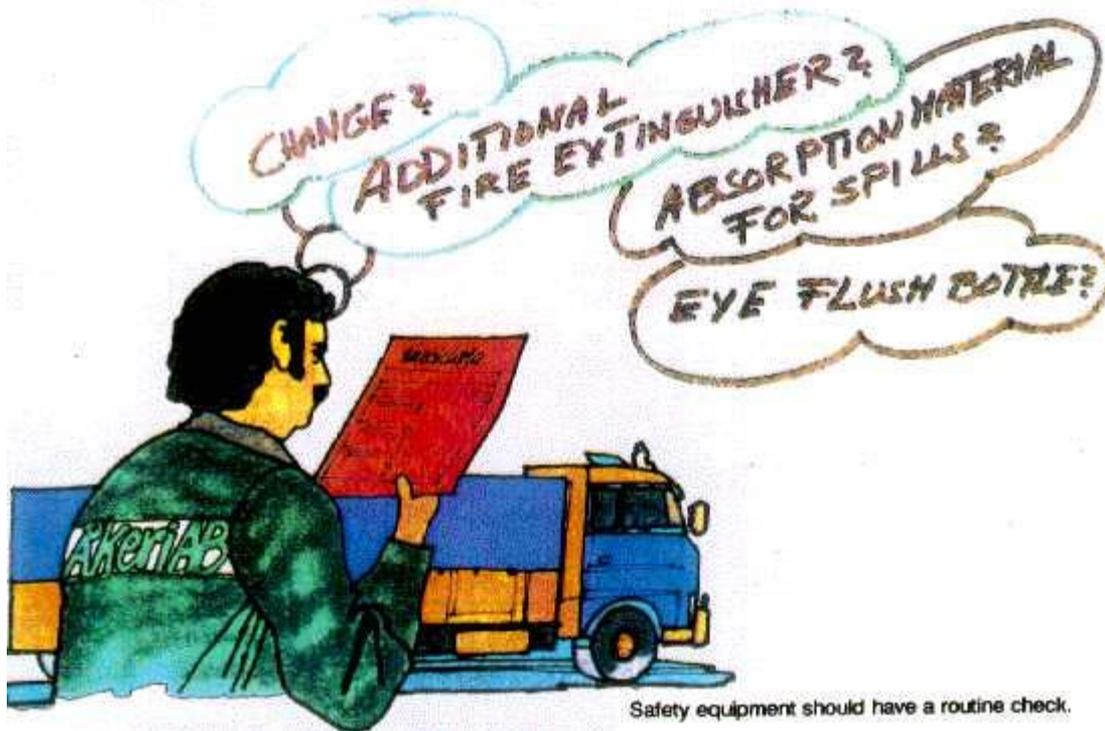
- Public relations
 - Designate spokesperson beforehand
 - Be responsive to public concerns





Plan ahead

- Have a plan
- Remember:
 - Anticipation
 - Recognition
 - Evaluation
 - Control





Unsafe Transport of Gas Cylinders





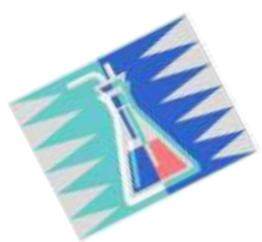
Acknowledgement

International Labour Organization (ILO)

International Occupational Safety and Health Centre (CIS)

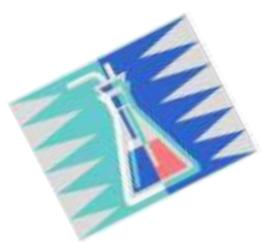
Programme on Safety and Health at Work and the Environment
(SafeWork)

<http://www.ilo.org/public/english/protection/safework/cis/index.htm>



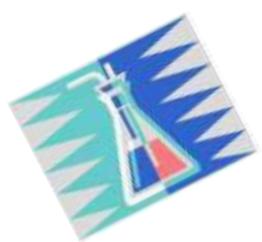
Any Questions?





REACH and the Global Harmonized System for the Labeling of Chemicals





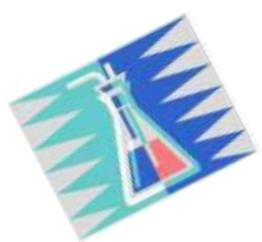
REACH



Registration, Evaluation, Authorisation of Chemicals

2007 EU regulation; replaces 40 existing acts to create a single system for all chemicals

- requires authorization to use, manufacture and import
- to track and manage chemical risks and provide safety information
- proposes to integrate REACH with GHS
- creates European Chemical Agency (ECHA, Helsinki, Finland)



REACH

Life of the chemical from Cradle-to-the-Grave



Manufacturing

Importing

Marketing

Use

Waste stream





REACH



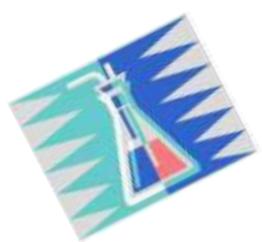
- **Comprehensive legislation to ensure European authorities know and condone what chemicals are used as they enter the EU supply train**
- **Objective is to protect human health and the environment by recognizing and classifying hazardous chemicals so they are handled safely**
- **REACH & GHS are not equivalent or optional but separate legislation with parallel requirements**



REACH



- **The responsibility for proving whether a chemical is hazardous or non-hazardous is on the manufacturer and supplier not the government**
- **The responsibility also includes documentation, tests, classification, risk exposure, labeling, safety data sheets**
- **ECHA will store the information in the International Uniform Chemical information Database (IUCLID)**



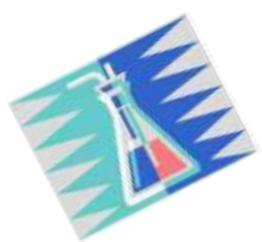
REACH

Four Steps

1. Registration
2. Evaluation
3. Authorization
4. Restriction



ECHA maintains database



REACH: Registration

Importers and manufacturers of substances in quantities over 1 ton/yr must register their substance with ECHA

Registration began June 2007

December 1, 2010

≥ 1000 tons per year

- carcinogenic, mutagenic, or reproductive toxin ≥ 1 ton per year
- substances classified as dangerous for aquatic environment ≥ 100 tons per year

June 1, 2013

- manufactured or imported at 100-1000 tons per year

June 1, 2018

- manufactured or imported at 1-100 tons per year



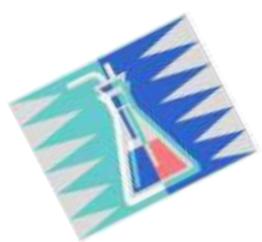
REACH: Evaluation

Authorities will review registration and request further information or testing to determine the impact of the substance on human health and the environment

Decides next steps:

- action for authorization
- align classification & label
- other action



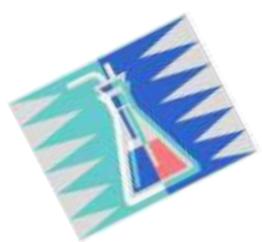


REACH: Authorization

Decisions on what substances require an authorization or restriction are carried out for substances that pose the most concern, such as carcinogens and mutagens

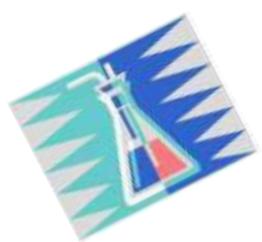
Three steps:

- SVHC (Substances of Very High Concern)**
 - carcinogenic, mutagenic and reprotoxic substances, persistent, bio-accumulative and toxic**
- Prioritize**
- Authorization provided**



REACH: Restriction

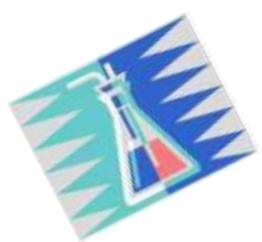
- **Limit uses**
 - Where no viable alternative exists, a research and development plan to derive a suitable alternative is developed
- **Ban substance**
 - where there is an unacceptable risk to human health and the environment.



REACH: Concern

A potential concern may be creating country specific safety data sheets and labels that are compatible with the GHS proposal





REACH: Resources

About REACH: <http://guidance.echa.europa.eu/>

http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

REACH Help:

http://echa.europa.eu/help_en.asp#helpdesks

About ECHA: <http://ec.europa.eu/echa>



Globally Harmonized System for Classification and Labeling of Chemicals (GHS)

International UN standardization for classification, safety data sheet format, and labeling of chemicals using pictograms, signal words, and hazard warnings

US OSHA is reviewing GHS for adoption



GHS

- **United Nations proposed system to internationally standardize chemical communication**
- **Countries will adopt on their own timeframe**
- **2008 - UN goal for world-wide implementation**



GHS Implementation

Intergovernmental Forum on Chemical Safety

(IFCS) – adopted GHS implementation goal of 2008. The US participates and agreed to work toward this goal

Japan, Korea, New Zealand – various stages of adopting & implemented GHS

European Union – 2010 deadline for GHS substance classification

Canada – Assessing how to adopt and implement GHS

United States – Assessing impact of GHS, plans to adopt GHS by 2009. DOT expects to have changes in place by 2009

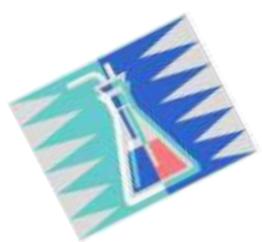


GHS Benefits



- Uniform Communication
 - Better Safety
- Improved International Trade
 - Lower cost





GHS Changes

MSDS now named: “SDS” (Safety Data Sheet)

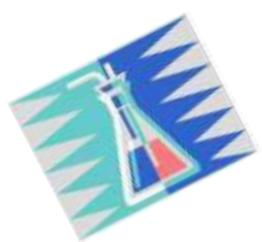
Labels will be standardized with:



- signal words
- hazard statements
- precautionary statements
- pictograms



- elimination of US, Canadian and EU labels

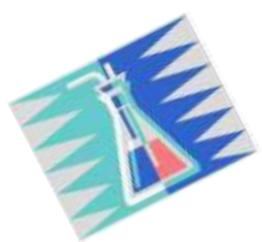


GHS Labeling

Information required on a GHS label:

- Pictograms
- Signal words
- Hazard statements
- Precautionary statements and pictograms
- Product identifier
- Supplier information



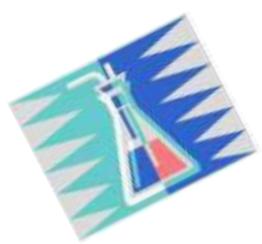


Changes to (M)SDS

GHS name: Safety Data Sheet (SDS)

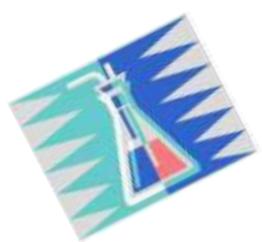
- **Format:**
 - 16 sections required in specified order (as per ANSI MSDS format in US Regulations presentation)
- **Reclassification:**
 - (MSDS) Health & Physical Hazards
 - (SDS) Environmental Hazards
- **Building Block Approach**
 - each country can select portions of GHS to adopt
 - Not every country will require all categories or all hazards





Examples of GHS Pictograms

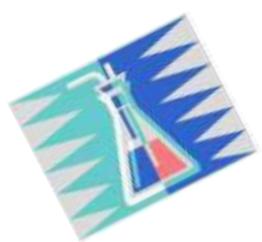




Differences between REACH and GHS

- REACH and GHS have different scopes but there are many links between the two regulations
- REACH aims to produce information on hazards, risks, and risk management
- GHS aims to harmonize classification and labeling of materials
- GHS is a UN recommendation which applies across countries, including the EU





Differences between REACH and GHS

- REACH intends to replace current EU classification criteria with GHS. REACH has provisions for safety data sheets based on GHS.
- GHS intends to apply classification and labeling beginning December 1, 2010, when the new GHS regulation will be available.
- Substances will be phased in the first 3.5 years. Mixtures will be given an additional 4.5 years for reclassification.





Globally Harmonized System



Resources



http://www.unece.org/trans/danger/publi/ghs/ghs_rev02/02files_e.html

http://www.unece.org/trans/danger/publi/ghs/presentation_e.html

<http://www.osha.gov/dsg/hazcom/ghs.html>