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Chemical Hazards and Safety Measures in Chemistry Laboratories

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الساعة الثامنة مساءً

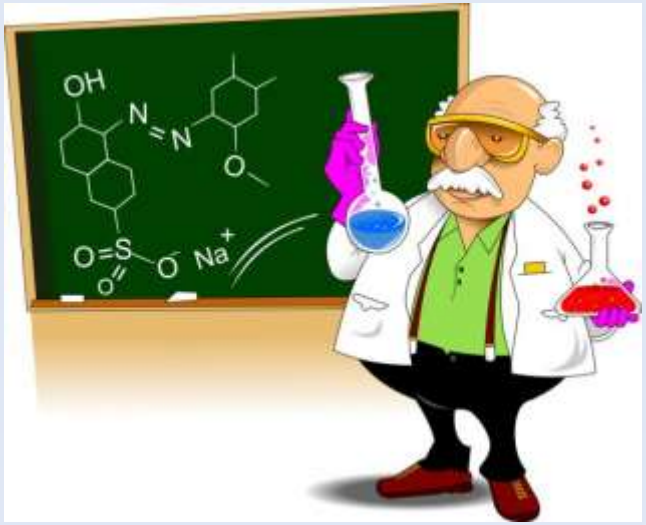
Aim of workshop

- Identify chemical hazards.
- Classification of chemical hazards.
- Safety precautions to consider while working in a chemistry lab.

A chemical **hazard** is any substance that can cause a health problem when ingested or inhaled.

They include toxins, dangerous chemicals, residue of excess chemicals used in processing food products.

The terms "**hazard**" and "**risk**" are frequently used interchangeably!



Types of chemical hazards

- Asphyxiants ; Carbon monoxide and cyanide.
- Corrosives; Sulfuric acid and sodium hydroxide.

- Irritants ; ethyl acetate and sodium carbonate.
- Flammable; Methanol, acetone, propane, and butane. **Diethyl ether** is extremely flammable and is often one of the most dangerous fire hazards often found in the laboratory.
- Carcinogens; Benzene, cadmium, formaldehyde, and vinyl chloride.

Routes of Exposure:

-Inhalation

-Ingestion

-Dermal absorption

-Injection

The Globally Harmonized System (GHS) is an internationally adopted system for the classification and labeling of hazardous chemicals.

Exploding bomb

(for explosion or reactivity hazards)

Flame

(for fire hazards)

Flame over circle

(for oxidizing hazards)

Gas cylinder

(for gases under pressure)

Corrosion

(for corrosive damage to metals as well as skin, eyes)

Skull and crossbones

(can cause death or toxicity with short exposure to small amounts)

Health hazard

(may cause or suspected of causing serious health effects)

Exclamation mark

(may cause less serious health effects or damage the ozone layer)*

Environment*

(may cause damage to the aquatic environment)

RAMP concept

R **Recognize the hazards**
A **Assess the risks of the hazards**
M **Minimize the risks of the hazards**
P **Prepare for emergencies from uncontrolled hazards**

R Recognize the hazards:

Read Safety Data Sheet (SDS) or Material Safety Data Sheet (MSDS) and chemical labels.

SDS Section Numbers and Headings	
Section 1: Identification	**Section 9:** Physical and chemical properties
Section 2: Hazard(s) identification	**Section 10:** Stability and reactivity
Section 3: Composition/information on ingredients	**Section 11:** Toxicological information
Section 4: First-aid measures	**Section 12:** Ecological information
Section 5: Fire-fighting measures	**Section 13:** Disposal considerations
Section 6: Accidental release measures	**Section 14:** Transport information
Section 7: Handling and storage	**Section 15**: Regulatory information
Section 8: Exposure controls/personal protection	**Section 16:** Other information

Material Safety Data Sheet

Methanol (Methyl Alcohol)

Airgas

Section 1. Chemical product and company identification

Product name : Methanol (Methyl Alcohol)

Supplier : AIRGAS INC., on behalf of its subsidiaries
259 North Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283
1-610-687-5253

Synonym : Methanol; Carbinol; Methyl hydroxide; Methylol; Monohydroxymethane; Wood alcohol; CH3OH; Colonial spirit; Columbian spirit; Hydroxymethane; Wood naphtha; Alcool methylique; Alcool metilico; Columbian spirits; Metanolo; Methylalkohol; Metylowy alkohol; Pyroxylic spirit; Wood spirit; Rcra waste number U154; UN 1230; Pyro alcohol; Spirit of wood

Material uses : Other non-specified industry: MANUFACTURE OF FORMALDEHYDE AND DIMETHYL TEREPHTHALATE; CHEMICAL SYNTHESIS (METHY AMINES, METHYL CHLORIDE, METHYL METHACRYLATE, AUTOMOTIVE FUELS); ANTIFREEZE; SOLVENT FOR NITROCELLULOSE, ETHYLCELLULOSE, POLYVINYL BUTYRAL, SHELLAC, ROSIN, MANILA RESIN, DYES; DENATURANT FOR ETHYL ALCOHOL; DEHYDRATOR FOR NATURAL GAS; FUEL FOR UTILITY PLANTS (METHYL FUEL); FEEDSTOCK FOR MANUFACTURE OF SYNTHETIC PROTEINS BY CONTINUOUS FERMENTATION; SOURCE OF HYDROGEN FOR FUEL CELLS; HOME HEATING OIL EXTENDER.

MSDS # : 001065

Date of Preparation/Revision : **4/27/2010.**

In case of emergency : 1-866-734-3438

Section 2. Hazards identification

Physical state : Liquid. [CLEAR, COLORLESS, FLAMMABLE, POISONOUS LIQUID WITH CHARACTERISTIC PUNGENT ODOR]

Emergency overview : WARNING!

FLAMMABLE LIQUID AND VAPOR. MAY CAUSE TARGET ORGAN DAMAGE, BASED ON ANIMAL DATA.

Flammable liquid. Keep away from heat, sparks and flame. Avoid breathing vapor or mist. Avoid contact with skin and clothing. May cause target organ damage, based on animal data. Use only with adequate ventilation. Keep container tightly closed and sealed until ready for use.

Target organs : May cause damage to the following organs: gastrointestinal tract, upper respiratory tract, skin, eyes, central nervous system (CNS).

Potential acute health effects

Eyes : May cause eye irritation.

Skin : May cause skin irritation.

Inhalation : No known significant effects or critical hazards.

Ingestion : No known significant effects or critical hazards.

Potential chronic health effects : **CARCINOGENIC EFFECTS**: Not available.
MUTAGENIC EFFECTS: Not available.
TERATOGENIC EFFECTS: Not available.

Medical conditions aggravated by over-exposure : Pre-existing disorders involving any target organs mentioned in this MSDS as being at risk may be aggravated by over-exposure to this product.

See toxicological information (section 11)

SAMPLE LABEL

CODE _____
Product Name _____
} **Product Identifier**

Company Name _____
Street Address _____
City _____ State _____
Postal Code _____ Country _____
Emergency Phone Number _____
} **Supplier Identification**

Hazard Pictograms

Signal Word
Danger

Keep container tightly closed. Store in a cool, well-ventilated place that is locked.
Keep away from heat/sparks/open flame. No smoking.
Only use non-sparking tools.
Use explosion-proof electrical equipment.
Take precautionary measures against static discharge.
Ground and bond container and receiving equipment.
Do not breathe vapors.
Wear protective gloves.
Do not eat, drink or smoke when using this product.
Wash hands thoroughly after handling.
Dispose of in accordance with local, regional, national, international regulations as specified.

In Case of Fire: use dry chemical (BC) or Carbon Dioxide (CO_2) fire extinguisher to extinguish.

First Aid
If exposed call Poison Center.
If on skin (or hair): Take off immediately any contaminated clothing. Rinse skin with water.

} **Precautionary Statements**

Highly flammable liquid and vapor.
May cause liver and kidney damage.
} **Hazard Statements**

Supplemental Information

Directions for Use
_____
_____
_____

Fill weight: _____ Lot Number: _____
Gross weight: _____ Fill Date: _____
Expiration Date: _____

N,N-diisopropyl ethylamine 99%

CAS Number: 7087-68-5
Size: 100 mL
Supplier: Aldrich
Date Acquired: 30 Jun 2016

DANGER

Highly Flammable liquid and vapor. Harmful if swallowed. Causes serious eye damage. Toxic if inhaled. May cause respiratory irritation.

Keep away from heat, hot surface, sparks, open flames and other ignition sources. No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof [electrical/ventilating/lighting/.../] equipment. Use [... refer to supplier]

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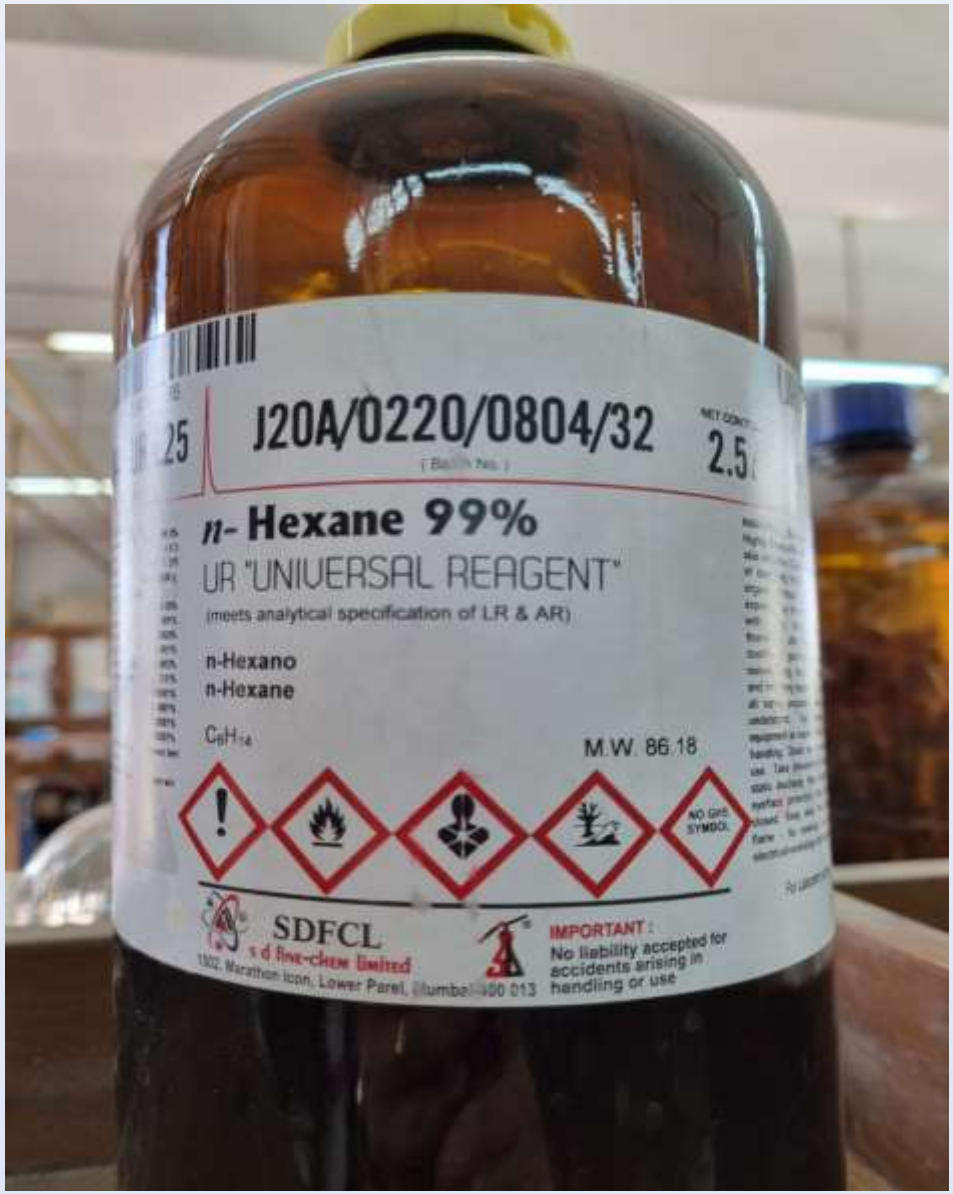
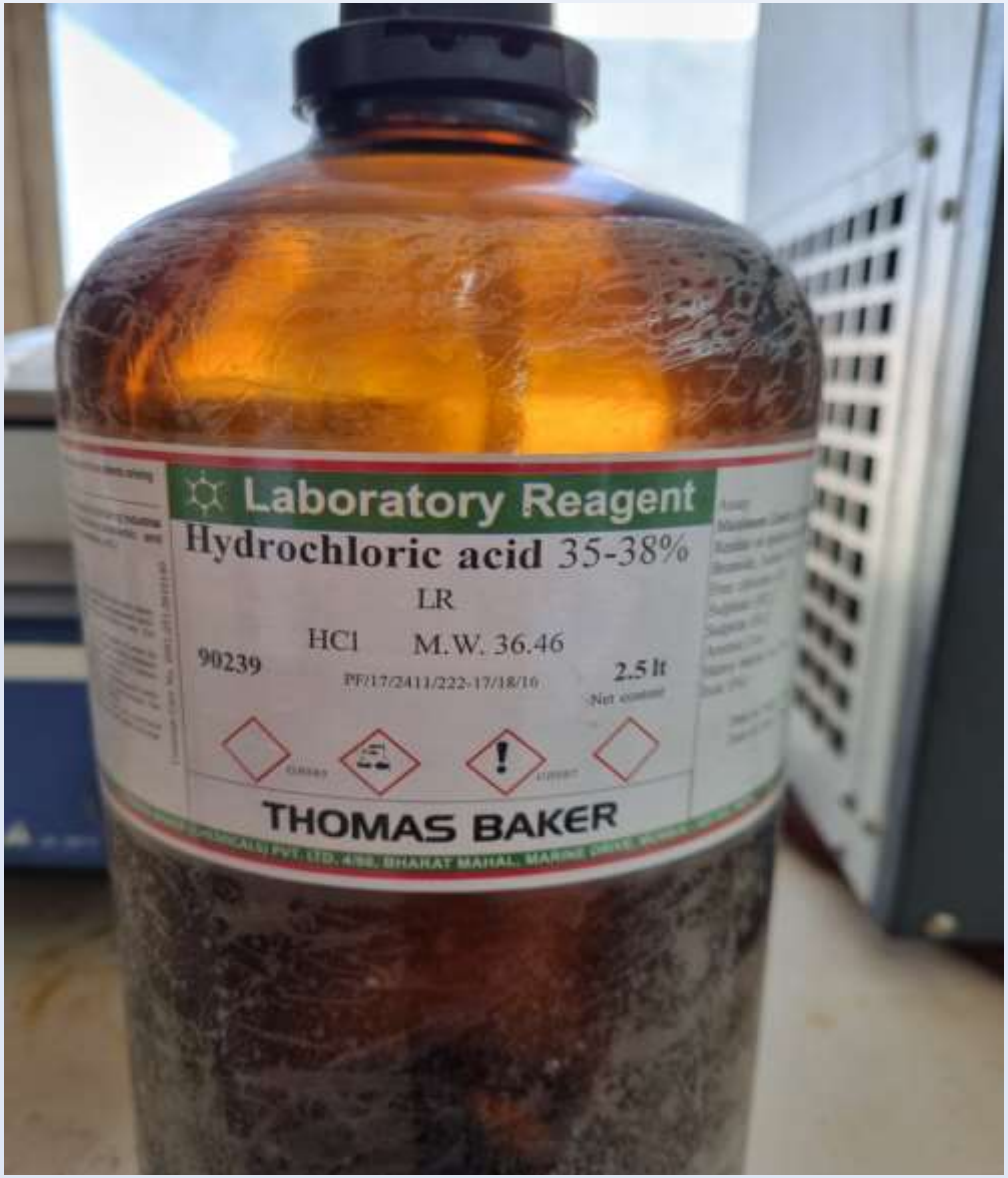

J20A/0220/0804/32
2.5
n-Hexane 99%
UR "UNIVERSAL REAGENT"
(meets analytical specification of LR & AR)
n-Hexano
n-Hexane
M.W. 86.18
NO GHS SYMBOL
SDFCL
s d fine-chem limited
IMPORTANT :
No liability accepted for accidents arising in handling or use


Laboratory Reagent
Hydrochloric acid 35-38%
LR
HCl M.W. 36.46
90239
PF/17/2411/222-17/18/16
2.5 lt
THOMAS BAKER

Incompatible compounds

“do not mix”

Incompatible chemicals are combinations of substances, usually in concentrated form, that react with each other

to produce very exothermic reactions that can be violent and explosive and/or can release toxic substances, usually as gases.”

Example ; Acetone with Hydrogen peroxide, Iodine with Ammonia…etc

Note: There have been many explosions from inappropriate or inadvertent mixing of nitric acid with organic chemicals in waste containers.

								
Flammable liquids	**Acids**	**Bases**	**Oxidizers**	**Toxics**	**Compressed gases**	**Poison inhalation**	**Water reactive**	**Liquid nitrogen**
Do not store with acids or oxidizers Only store in refrigerators rated for flammables Keep quantities to a minimum (no 5 gallon cans permitted) Amounts over two(2) gallons: Store in an approved flammable cabinet	Do not store with bases, flammables, or cyanides Do not store under the sink	Do not store with acids May be kept with flammable liquids if in secondary containment	Do not store with flammable liquids or solids Do not store under the sink Avoid storage on wooden shelves	 And other **Health Hazards** Store on sturdy shelves below eye level or in secured cabinets Store separate from other hazard classes	Secure at all times even when empty Store away from heat sources Store with cap when regulator is removed Incompatible gases must be separated by a 30 minute fire barrier or 20 feet or line of sight	Store in a vented gas cabinet or a chemical fume hood Secure at all times Store with cap or plug in place	Do not store under the sink Store away from aqueous solutions Keep separate from other hazard classes	Store in a well ventilated area Consult EHS before storing 240L tanks
Examples Acetone Methanol Ether Hexane	**Examples** Sulfuric acid Hydrochloric acid Nitric acid Acetic acid	**Examples** Sodium hydroxide Potassium hydroxide Bleach	**Examples** Silver nitrate Ammonium persulfate Sodium periodate	**Examples** Sodium cyanide Sodium azide Aniline Ethidium bromide	**Examples** Helium Nitrogen Oxygen Hydrogen	**Examples** Carbon monoxide Chlorine gas Ethylene oxide Ammonia gas	**Examples** Sodium borohydride Hydrazine Sodium metal Phosphorus	**Example** LN
Special circumstances Combustible liquids (i.e. toluene) can be stored in the flammable cabinet if there is room.	**Special circumstances** Some acids are flammable (i.e. Acetic acid) but still store them with the acids.	**Special circumstances** Some bases are flammable (i.e. ethanol amine) but still store them with the bases.	**Special circumstances** Some acids are oxidizers (i.e. nitric acid) but still store them with the acids.	**Special circumstances** Inspect containers regularly.	**Special circumstances** Container volumes less than 5 liters (i.e. lecture bottles) can be stored lying down.	**Special circumstances** Consult with EHS when storing or using these materials.	**Special circumstances** There may be enough moisture in the air to react these materials. Use caution.	**Special circumstances** Liquid nitrogen tanks vent loudly periodically. Do not be concerned.

A:Assess the Risks of the Hazards

- Know what you are working with.
- Find and evaluate hazard information.
- Chemical Safety Levels (**CSLs**): Defined levels of hazard (1 through 4), based on a risk assessment conducted by a qualified individual.

CSL Level 1	Minimal health or physical hazard from chemicals No concentrated acids or bases, toxics, carcinogens, or teratogens. Less than 4 liters of flammable liquids
CSL Level 2	Low health or physical hazard from chemicals. Small amounts, less than 1liter, of concentrated acids or bases.
CSL Level 3	Moderate chemical or physical hazard. Lab work with concentrated acids, bases, toxic, other high hazard chemicals, or cryogenic liquids.
CSL Level 4	High chemical or physical hazard. Work with explosives or potentially explosive compounds, or frequent use of larger quantities of pyrophoric chemicals

M:Minimize the Risks of the Hazards

- Ensure that the proper concentrations are prepared.
- Ensure that all chemical bottles are properly labeled and stored and closed after use.
- Use the lowest concentrations and smallest volumes possible for all chemicals.

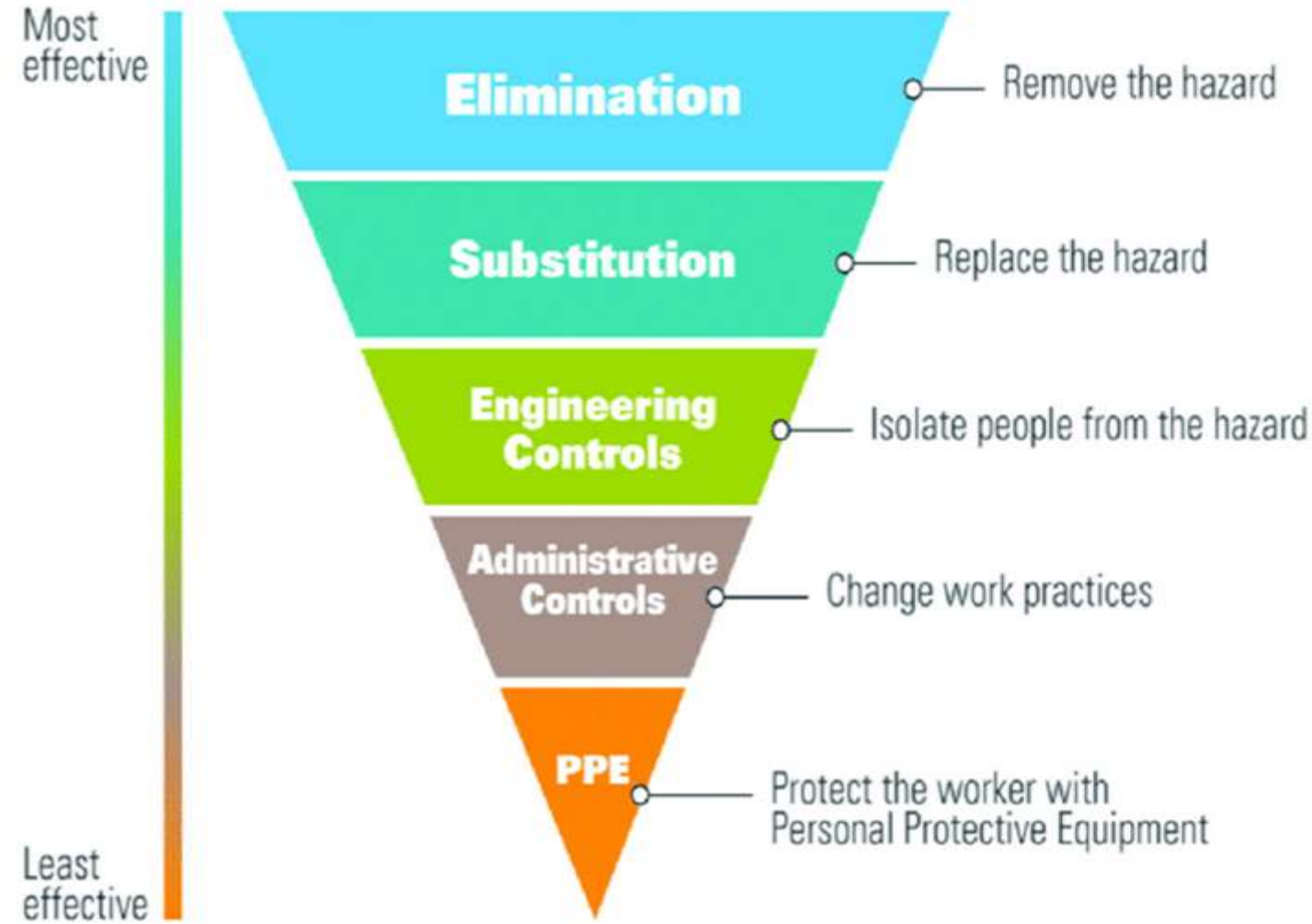
P: Prepare for emergencies from uncontrolled hazards

The Occupational Safety and Health Administration (**OSHA**) guides employers to protect employees in the workplace from chemical hazards

- **Elimination/Substitution** – where the need for hazardous chemical usage is completely removed or an alternate less or non-hazardous chemical is used.
- **Engineering Controls** – where employers must implement changes that are physical to the workplace that helps to reduce exposure to the chemical hazard on the workers using or handling hazardous chemical substances

- **Administrative and Work Practice Controls** – changing how a work task is performed or establishing efficient workplace policies, protocols, processes, and control and monitoring mechanisms.
- **Personal Protective Equipment (PPE)** – using PPE such as respirators, gloves, protective full-body suits, etc., can help in reducing the workers' direct contact with the hazardous chemical.

Hierarchy of Controls



Dress appropriately (PPE)

No sandals, no clothes you love more than life, no contact lenses, and long pants are preferable to shorts or short skirts. Tie long hair back. Wear safety goggles(polycarbonate eye wear),breathing mask, gloves and a chemical and flame lab coat.

➢know how to use safety equipments:

-Eye wash station

- Fire Blanket
- Fire Hose
- Safety Shower
- Fire Extinguisher
- First Aid Station

Preparation for emergencies from chemical spills

- For a small liquid spill or splash that affects only a small area of skin, you should immediately flush the skin with flowing water for at least 15 minutes (30 minutes for bases).

- If skin or clothing is contaminated with larger spills of a liquid, you may have more serious consequences. You should go to the nearest safety shower immediately.

- If a solid chemical spilled on skin, it is advisable to brush the solid off before applying water.

- In case of fire a catch to body , it is important to lye on the floor , roll over and apply a Fire blanket.
- Use Fire extinguisher in case of fire.
- Broken glasses should not handled by hand, use a brush and a dustpan and convert them to broken glass disposal container.

Aspects Important to take in consideration

- Do not work alone in the lab.
- Consider all chemicals and specimens to be dangerous.
- Read the label before using the chemical.
- Do not remove anything out of the lab.

- Turn off heat sources where not in use.
- Do not handle broken glass with bare hand.

- Wash Hands regularly.
- Don't Taste or Sniff Chemicals, they are not food!
- Eating & Drinking is Prohibited.
- Smoking is banned.
- Do Not Pipette By Mouth – Ever!
- Don't Dispose of Chemicals Down the Drain and follow the waste disposal instructions.
- No Pacemakers or Metallic Implants: like in NMR instrument area.
- Workplace Rules Ban Horseplay Because It's Dangerous.

Recommendation

- Chemical safety is an integral part of an education in chemistry.
- Safety considerations should be woven into every part of the chemistry curriculum
- Assessing student mastery of chemical safety learning objectives should be a component of all laboratory experiences, including being a component of cumulative comprehensive examinations.
- Safety training should be treated as a critical component of preparing students to be successful as chemical professionals.

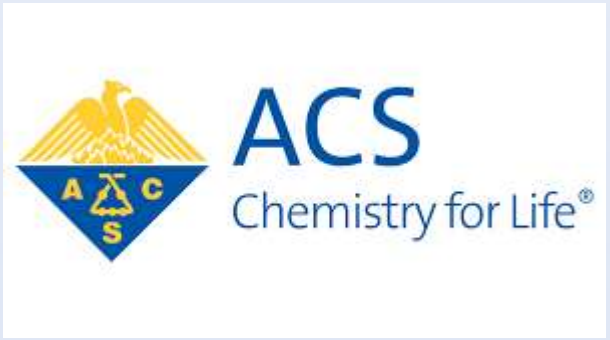
- Faculty and staff who supervise students in chemistry laboratories at all levels in higher education must themselves be familiar with chemical safety and safe lab.
- Provide PPE for all staff and students for free.

Summery

- ✓ Running a chemistry lab is a challenge, rules are not made to be broken and they are made for our safety not for humiliation.
- ✓ Safety in the laboratory does not happen by accident. It is the result of careful planning, recognizing the inherent hazards of working in a chemical laboratory environment, managing those risks, and being prepared for unexpected events.

Resources

AMERICAN CHEMICAL SOCIETY Guidelines for Chemical Laboratory Safety.




Stay safe
and
Thank you