LABORATORY HYGIENE & SAFETY

Dr. T. Geetha
Assistant Professor
Department of Chemistry
St.Mary's College, Thrissur

Laboratory Hygiene & Safety

Laboratory is a place that provides facilities and controlled conditions for carrying out scientific experiments and research

Laboratory Hygiene & Safety

- **Safety** is freedom from danger, injury, or damage**.**
- Being safe -actions by you & by others
- always seek to do those things that prevent incidents that might cause injury and harm.

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Laboratory Hygiene & Safety

To ensure safety we must

- **R**ecognize hazards.
- **A**ssess the risks of hazards. - **RAMP**
- **M**inimize the risks of hazards.
- **P**repare for emergencies.

Laboratory Hygiene & Safety

- A **hazard** is a potential source of danger or harm
- chemicals -inherent hazardous properties
- safety - minimizing, managing, or controlling these hazards

Laboratory Hygiene & Safety

- **Risk** is the probability of suffering harm from being exposed to a hazard or unsafe situation.

- The level of risk depends on many things beyond the inherent hazard of a chemical. For example, the amount of the chemical, the form it is in (gas, liquid, or solid), and how you handle the chemical all affect the level of risk

Laboratory Hygiene & Safety

- **Risk i**s the probability of suffering harm from being exposed to a hazard or unsafe situation

level of risk –

- the amount of the chemical,
- the form it is in (gas, liquid, or solid),
- and how you handle the chemical

Laboratory Hygiene & Safety

Three factors **contribute** to safety:

- **environmental**
- **person factors**
- **behavioral factors**

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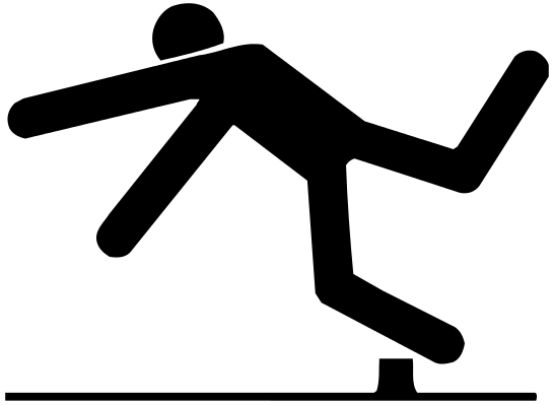
environmental factors including facilities, location, equipment, procedures, and standards



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- **person factors** - attitude, beliefs, personality, knowledge, skills, and abilities

Laboratory Hygiene & Safety

behavior factors including safe and risky practices

anything out of place- move it back out of the way

Laboratory Hygiene & Safety

Safety Rules for Laboratories

1. **Follow instructor**

2. **Wear proper eye protection**

3. **Wear clothing that protects against exposure and provides protection from spills. -lab coat**

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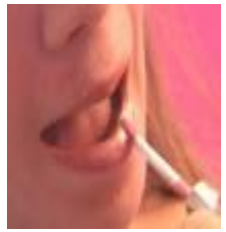
- Avoid loose cloths
- Confine long hair
- Avoid wearing dangling jewelery
- Do not use personal handkerchief in lab

Laboratory Hygiene & Safety

- Do not eat, drink, smoke chew gum, apply cosmetics, or take medications in the laboratory



- Do not use laboratory glassware & equipment to prepare & store food

Laboratory Hygiene & Safety

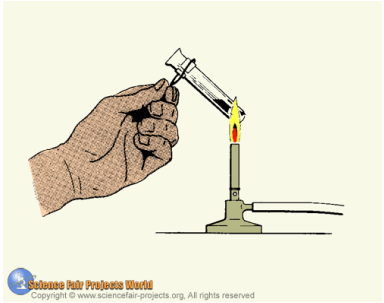
- Keep hands away from eye nose mouth face hair & open skin wound
- Clean all spills immediately & remove broken glassware
- Use books & journals only in clean area to prevent contamination
- In case of hazardous spill inform instructors
- There should be no boisterous conduct, excessive noise (radios, DVD players, iPods), or practical jokes in the laboratory.

Laboratory Hygiene & Safety

- Never taste any laboratory chemical
- When smelling a chemical, gently waft the vapors toward your nose.
- Do not directly inhale the vapors
- If any chemical spills on your skin or in your eyes - flush affected area with water - notify the instructor

Laboratory Hygiene & Safety

- Use test tube holder for heating test tube



- Know Location of emergency equipment

- If any chemical spills on your skin or in your eyes - flush affected area with water - notify the instructor

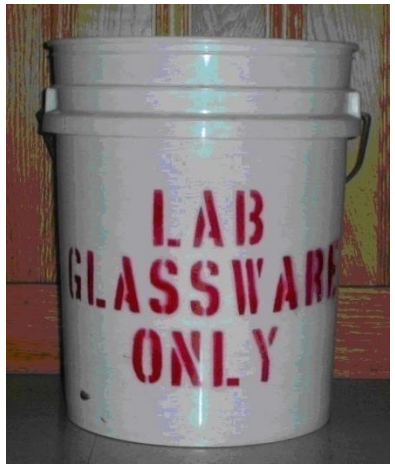
Laboratory Hygiene & Safety

- Do not work alone in the laboratory

- Do not heat flammable liquids with a Bunsen burner or other open flame

Laboratory Hygiene & Safety

- Label all containers with chemicals or solutions



- Dispose of waste chemicals in the containers provided

Storage & handling of chemicals

Chemical storage area

1. Located away from process area & occupied building
2. Constructed from fire resistant material
3. must have continuous ventilation
4. Checked periodically for odour
5. Passageways not to be blocked
6. Should not have floor drains tp prevent contamination with water
7. Proper posting in front of store room

Storage & handling of chemicals

8. Chemicals to be delivered to storage area for proper maintenance of inventory
9. All containers in good condition & properly closed
10. Tanks & containers properly labeled
11. Secondary containment for all liquid hazardous materials
12. reserve supply of chemicals kept minimum
13. Expired chemicals marked for disposal

Storage & handling of chemicals

14. Incompatible chemicals separated
    - Flammables – oxidizers
    - Strong acid – strong bases
15. Toxic & corrosive chemicals isolated
16. Acids stored in acid resistant containers
17. HNO_3, H_2SO_4, HCl stored in glass containers
    - HF in plastic or ceresin containers
18. Flammable solvent away from fire hazard, doors
19. Hazardous chemicals not stored above eye level
20. Large bottles stored no more than 2 feet above ground

Inside laboratory

1. Large quantity of chemicals not to be stored in lab
2. Working quantity of routinely used chemicals
3. Minimum quantity of hazardous chemicals
   - Lab -50L of flammable liquid
   - Bench - 500mL in closed vessel
4. Chemicals arranged in compatible families
5. Not arranged alphabetically

Inside laboratory

6. Shelf with small frontal barriers – prevent sliding
7. Chemicals not to be stored above eye level
8. Chemicals not to be stored on floor
9. Chemicals kept away from heaters & sunlight
10. Clearly & legibly labled
11. Refrigerator used to store chemicals not to store food

Inside laboratory

12. Chemicals that react vigorously with water kept away from possible contact

13. Toxic, volatile, carcinogenic & reactive chemicals tightly sealed with appropriate stoppers

14. Potentially explosives flammable chemicals stored only in rated or explosion proof refrigerators

15. Do not store chemicals in fume cupboard

16. Compressed gas cylinders kept upright, away from heat source without blocking exits

MSDS

Material Safety Data Sheet

- Information bulletin of a chemical that describes properties, health hazards, routes of exposure, precaution for safe handling, emergency first aid & control measures

Handling of chemicals

1. Familiar with chemical properties & hazards
2. Read label twice
3. Pour out only required quantity of chemicals –prevent waste
4. Transport chemicals on cart that can contain spills
5. Use non breakable & secured secondary containers for transportation of hazardous waste

Handling of chemicals

6. Do not touch chemicals with hand
7. Do not smell chemicals directly
8. Do not taste chemicals
9. Do not hurry
10. While diluting add acid to water not vice versa

Handling of chemicals

11. Avoid mouth suction of pipette

12. Do not use damaged equipment

13. Ensure ventilation of lab

14. Close containers when not in use

15. Do not use metal spatula to handle peroxides – metals can catalyze their explosive decomposition, use ceramic, Teflon or wooden spatula

Simple First Aid – Electric shock

- Switch of source of electricity
- Check victim for breathing & heartbeat
- If unresponsive or shows abnormal breathing - CPR (Cardiopulmonary resuscitation)
- Arrange emergency medical aid

Burns

- Ist degree burns – outer layer of skin damaged
  pain low to moderate
  no blisters
  colour of affected area red

Burns

2nd degree burn – outer & second layer of skin

damaged

pain level high

blisters present

colour of area red

Burns

3rd degree burn – outer & second layer of skin & tissue below damaged

pain level high

no pain felt if nerves damaged

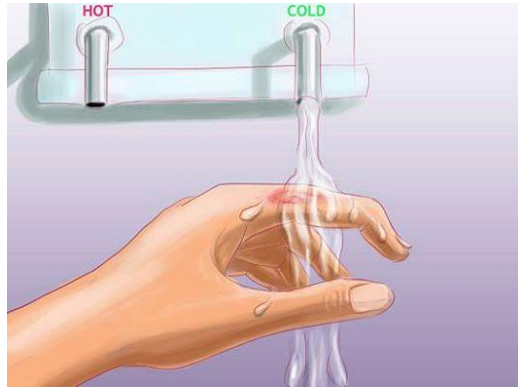
burn site white/charred

Initial steps for all burns

- Put out fire/ stop contact with source of burn
- If flames on cloth – Stop Drop Roll
- Burn hot jewelry or burnt clothing that does not stick to skin
- If sticking to skin do not pull it off
- Cut or tear around

Treatment for 1st & 2nd degree burns

- Hold under cool running water/immerse in water till pain subsides
- continue for 15 minutes
- For large area stay under safety shower for 10-15 minutes



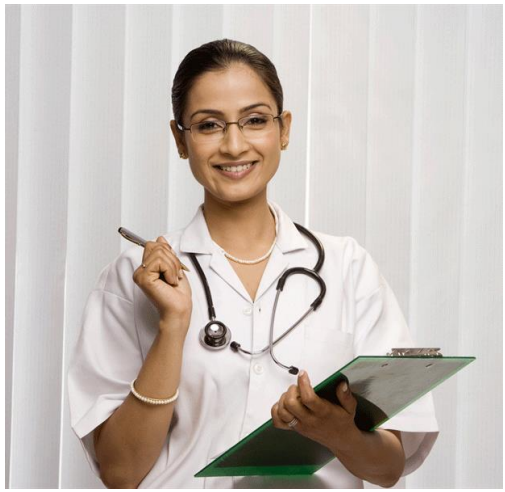
Treatment for 1st & 2nd degree burns

Don't - break blisters

apply ice, cream, honey, butter, cream

Cover with sterile non adhesive bandage

Seek medical advice



Treatment for 3rd degree burns

- Call for emergency medical help
- Cover burnt area with sterile, nonstick bandage or clean lint free cloth
- Do not soak in water
- Do not apply ointment, cream, butter etc

Cut by glass

MINOR CUTS

- let it bleed to wash out foreign particles
- Wash with antibacterial soap, cold running water
- Dry with sterile pad
- Apply antiseptic cream

Major cuts

Slicing into skin, punctured underlying blood vessel, significant bleeding

- **If no glass present**
  - Wash with soap & running water
  - If bleeding does not stop – absorbent pad over wound & apply pressure
  - Hold pressure for 15 minutes
  - Raise injured area above heart level
  - Get medical attention

Major cuts

Small glass piece in wound

- Wash with cool running water
- Flush glass out
- If glass piece suspected – do not apply pressure
- Lightly apply sterile dressing
- Get medical attention

Major cuts - Glass/object in wound

Do not

- remove object from wound – increase bleeding
- Apply pressure above wound

- Apply pressure on either side of wound
- Apply light dressing to stabilize object
- Build up padding around object till higher than object
- Bandage over without pressing
- Medical attention

Inhalation of poisonous gas

- Remove to prevent further inhalation
- Take to fresh air
- Give CPR
- Check MSDS for first aid information
- Do not attempt rescue unless safe to do so

Accidents due to acids & alkali

Skin contact

- Wash burnt area with large quantity of water
- Do not apply neutralizing or buffering agents
- Remove contaminated clothing
- Check MSDS for first aid

Eye contact

- Wash with large amount of running water
- Occasionally lift & lower upper lid
- Remove contact lens after hurried wash
- Medical attention

Disposal of sodium

- Add scraps of sodium to 95% ethanol in fume hood
- At least 20ml for 1g Na
- Solvent should not boil
- C_2H_5ONa formed
- When visually reaction is complete, add water with swirling
- Allow to stand, dilute & discard

Disposal of broken mercury thermometer

- Open all windows for ventilation
- Collect large piece of glass – zip bag
- Use flash light to check extend of spill
- Use index card to scoop mercury & small glass beads to zip bag
- Use flash light to locate remaining shiny mercury beads
- Use dropper, do not touch with hand

Disposal of broken mercury thermometer

- Wrap a piece of scotch tape around gloved index finger with sticky side out & dab contaminated area
- Used index card, dropper, tape, glove into zip bag
- Moisten Zn powder rub over contaminated area –leave for a day –solid amalgam formed
- 20% solution of Calcium polysulphide –solid mercuric sulphide formed
- Use index card to scrap of solid product –zip bag
- Zip bag, clothings etc sealed & disposed

Kodaikanal experience

- mercury thermometer factory in Kodaikanal - Hindustan Lever Ltd
- moved to India in 1983 after it was shut down in Watertown, New York

- Tons of mercury waste from broken thermometers
- agitation by environmental activist
- Environmental authorities ordered the company to collect and dispose of the waste

Kodaikanal experience

- Company plan to dispose waste flawed & lacked environmental safeguards
- Health problems caused by mercury depend on how much has entered your body
- Regardless of quantity, all mercury spills should be treated seriously

Kodaikanal experience

- 2003, the Tamil Nadu Pollution Control Board ordered the company to ship the mercury-laden waste back to the United States for proper disposal

- Waste packed into containers and brought to a port in Tamil Nadu for loading onto a ship bound for the U.S.

- The ship, carrying some 300 tons of mercury-contaminated waste from Kodaikanal, departed for Bethlehem Apparatus, a mercury recycling plant in Pennsylvania

Kodaikanal experience

$CaCl_2$ & silica gel - Desiccator

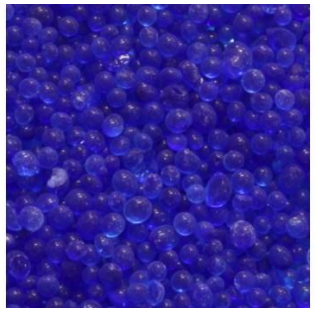
- Used for absorbing moisture/water
- CaCl2 – cheap, high capacity for water absorbtion
- Active mechanism - hydration – CaCl2.6H2O
- Water of hydration removed by heating
- Hazard – mild skin irritation with dry skin, burns wet skin
  Ingestion – irritates mucous memberane , gastrointestina
  problems

Silica Gel

- Chemically inert, non toxic
- Amorphous, granular & porous form of Silicon dioxide made from sodium silicate
- High surface area – best at Room Temp
- Active mechanism – adsorbtion, absorbs 40% of mass
- Reactivated by heating in a oven
- Can irritate eye, skin, respiratory system

Indicating type silica gel

- Incorporates Cobalt chloride
- Deep blue –dry
- Saturated with moisture - pink
- Reactivated by heating
- CoCl2 – highly toxic, carcinogenic,
- Leaches into ground water on disposal - Environmental hazard



Risk & Safety Phrases

System of hazard codes & phrases for labeling hazardous chemicals

- R Phrase – risk phrase – Hazard codes & associated phrase to indicate the nature of risk

Code	Phrase	Code combination	statement
R14	Reacts violently with water	R14/15	Reacts violently with water, liberating extremely flammable gas
R15	Contact with water liberates extremely flammable gases		
R45	May cause cancer	R45/46	May cause cancer and heritable genetic damage
R46	May cause inheritable genetic damage		

Risk & Safety Phrases

$CaC_2(s) + 2H_2O \longrightarrow Ca(OH)_2 + C_2H_2\ (g)$

- Acetylene flammable gas – R15

$Li_3N\ (s) + 3H_2O \longrightarrow 3LiOH\ (aq) + NH_3(g)$

- R14 – reacts violently with water

$2Na\ (s) + 2H_2O \longrightarrow 2NaOH + H_2\ (g)$

R14/R15 - reacts violently with water liberating extremely flammable gas

S phrase (safety Phrase)

Safety codes & associated phrases to indicate safety advice about dangerous substance & preparations

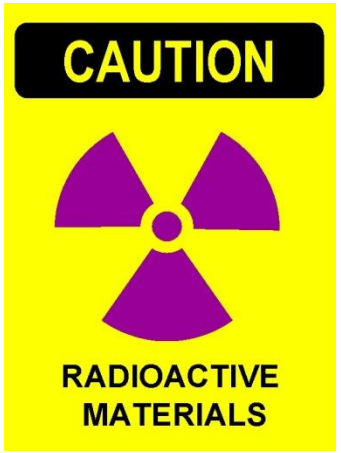
Code	Phrase	Code combination	statement
S37	Wear suitable gloves	S37/39	Wear suitable gloves and eye/face protection
S39	Wear eye/face protection		
S29	Do not empty into drains	S29/56	Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point
S56	Dispose of this material and its container at hazardous or special waste collection point		

Laboratory safety sign -pictograms

- All chemical labels must contain one or more pictogram

Symbol	Meaning	Symbol	Meaning
	E Explosive		O Oxidising
	F Highly flammable		T Toxic
	Xn Harmful		Xi Irritating
	C Corrosive		N Harmful for the environment

Laboratory safety sign -pictograms



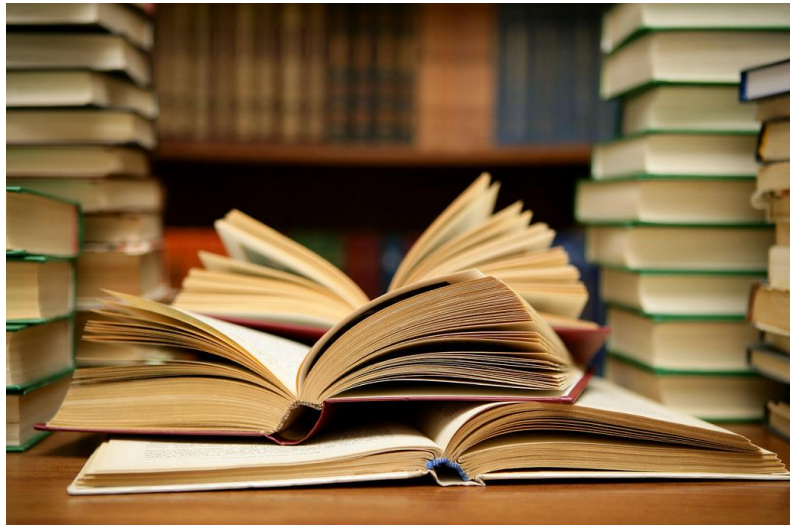
Toxic skin/ eye/respiratory tract irritant alert

Health Hazard Alert

Reference

Laboratory safety for chemistry students

– Robert H Hill & David C Finster



Thank You