



General Chemicals and Lab Safety

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Occupational Health and Safety (CH161)

Ghulam Ishaq Khan Institute of Engineering Sciences & Technology

1st Quiz Announcement

- In 7th week (14th to 18th Oct. 2024)
- For date, day, time and venue please keep checking your emails!
- Lecture 1- Lecture 5
(Short Questions/MCQ's)



What are Chemical Substances?

3

A chemical substance is a material with a specific chemical composition.

- Example: Water (H_2O): Always consists of the same ratio of hydrogen and oxygen atoms.
- Some chemicals we use daily include cleaning products, cosmetics, plastics, paint, dyestuffs, sugar, solvents, etc.

Chemical substances can exist as solids, liquids, or gases while remaining the same substance.

- Example: Water and steam are different forms of the same substance.

Chemical Hazard:

**Any chemical that can cause
illness, injury, or an emergency.**



Chemical Hazards

4

Physical Hazards



Corrosive to metals



Flammable



Oxidising



Gas under pressure



Explosive

Health Hazards



Health hazard



Corrosive



Serious health hazard



Acute toxicity



Hazardous to the environment

Environmental Hazards

1. Corrosive:

- Corrosive substances are chemicals that have the potential to **harm** or **damage** living tissue through a burning or destructive process.
- Examples:
 - **Strong Acids:** Such as sulfuric acid.
 - **Strong Alkalis:** Like caustic soda.
- Many household cleaning products, such as **kitchen oven cleaners**, and **dishwasher crystals** fall into the category of corrosive substances.
- It **destroys** and **damages** other substances with which it comes into contact. It may attack a great variety of materials, including **metals**.



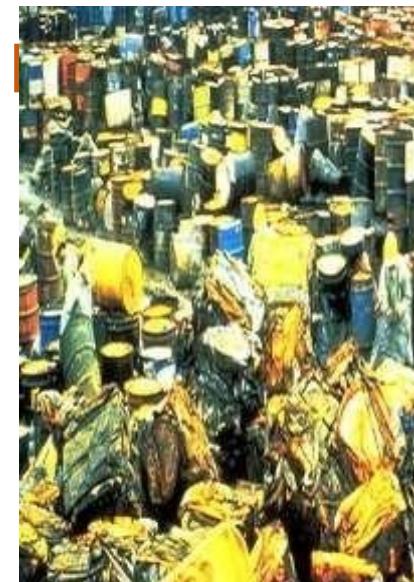
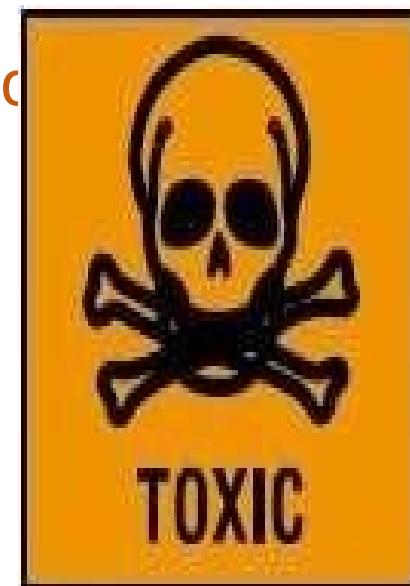
2. Explosive:

- Explosive, is a reactive substance that contains a great amount of potential energy that can produce an explosion if released suddenly, usually accompanied by the production of **light, heat, sound, and pressure**.
- Detonate/Explode if exposed to **fire, heat, shock and friction**.
- **Types of Explosive Energy:**
 - **Chemical Energy:** such as nitro-glycerine or dust.
 - **Pressurized Gas:** such as gas cylinders or aerosol cans.
 - **Nuclear Energy:** such as in the fissile isotopes **uranium-235** and **plutonium-239**.



3. Toxic:

- Toxic chemicals are substances with the potential to harm the environment, living organisms, and human health through various modes of exposure, including inhalation, ingestion, or skin absorption.
- Toxic substances can impede or disrupt the normal functioning of one or more organs within the body, such as the kidneys and liver.
- Examples of Toxic Chemicals:
 - Ammonia
 - Chlorine
 - Hydrochloric Acid



4. Oxidizing

- Oxidizing agents are substances that, while not necessarily combustible themselves, can facilitate combustion in other materials, typically by providing oxygen.
- Common Oxidizing Agents:**
 - Oxygen
 - Sulphuric Acid
 - Hypochlorite (ClO^-)
 - Chlorine



5. Harmful:

- Many materials encountered in the workplace can pose health risks. These substances may include:
 - Dust, gases, or fumes that can be inhaled.
 - Liquids, gels, or powders that may contact your eyes or skin.
 - Harmful micro-organisms that can lead to infection, allergic reactions, or toxicity.
- **Examples:** paints, cleaners, flour dust, solder fume, blood or waste
- **Categories of Harmful Substances:**
 - Laboratory Chemicals
 - Bulk Chemicals

Risks associated with harmful substances can often be minimized or eliminated by following provided instructions, including the use of personal protective equipment (PPE).



6. Extremely Flammable:

- **Highly Flammable Liquid:** A liquid with a flash point below 32°C.
- **Flash Point:** The lowest temperature at which a liquid emits vapors in concentrations sufficient to create a combustible mixture with air near its surface.
- **Common Laboratory Solvents and their Flash Points:**
 - Ethanol: +12 °C
 - Toluene: +4 °C
 - Acetone: -19 °C
 - Diethyl Ether: -45 °C



Health effects of exposure to chemicals

Acute Toxicity

An adverse health effect following a single exposure to a chemical (e.g., skin contact with insecticides, accidental ingestion of a chemical).

Carcinogen

A chemical that causes or can potentially cause cancer (e.g., breathing in asbestos fibres, skin contact with used motor oils).

Chronic Toxicity

An adverse health effect following repeated exposure to a chemical, which can occur following a relatively short exposure (e.g., weeks) or longer-term exposure (e.g., years).

CMR

A chemical that is Carcinogenic, Mutagenic or Toxic to Reproduction.

Corrosive

A chemical that causes irreversible damage to skin, eyes or airways (e.g., strong acids and strong bases such as concentrated hydrochloric acid or concentrated hydroxides).

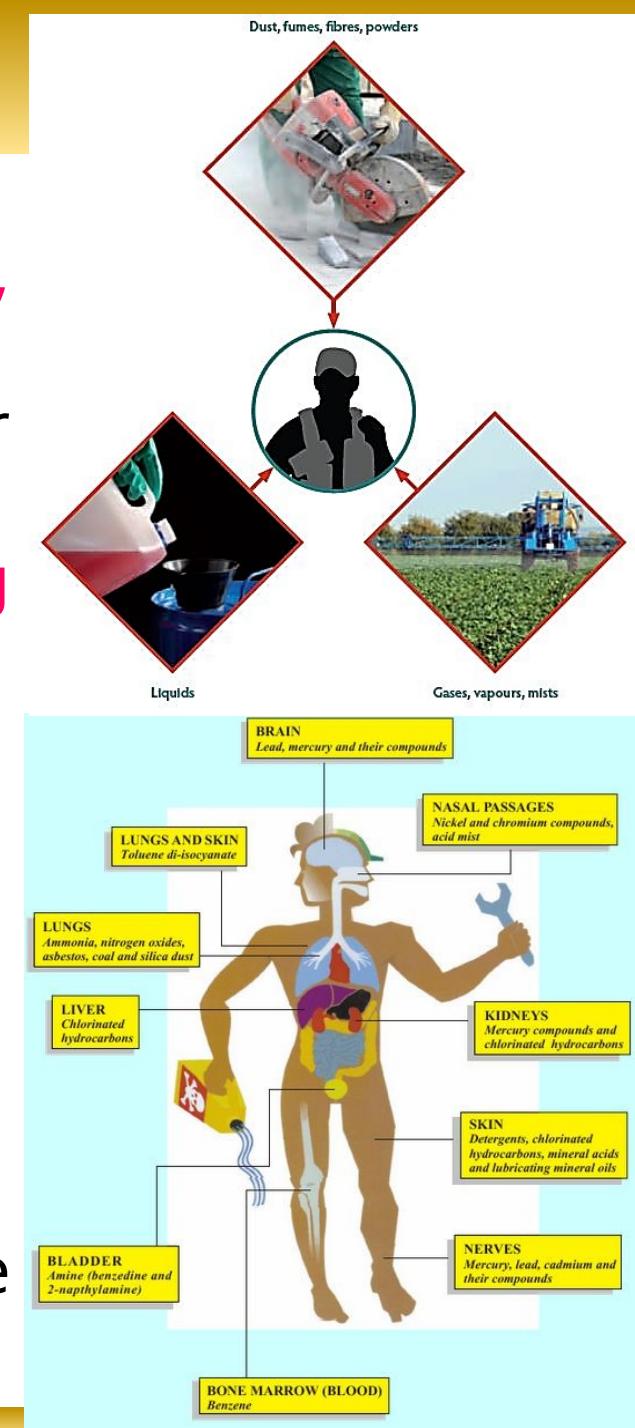
Irritant

A chemical that causes reversible damage to skin, eyes or airways (e.g., detergents or soaps).

Mutagen

A chemical that can cause permanent damage to genetic material in cells, which can possibly lead to heritable genetic damage or cancer (e.g., UV rays from the sun, benzene).

Health Risks of Chemical Exposures



1. Effects on Brain and Nervous System:

Examples of chemicals: pesticides, mercury, lead, solvents, CO gas.

2. Eye, Nose, and Throat Irritation:

(dryness, soreness, or pain)

Examples of exposures: acid mists, vapors, welding fumes, diesel exhaust.

3. Effects on the Lung:

Example: asbestos (associated with lung cancer).

4. Allergic Asthma:

Examples of exposures: flour dust, wood dust.

5. Liver Damage:

Example: exposure to vinyl chloride.

6. Allergic Contact Dermatitis:

Examples: nickel, latex, chromate (found in some cements).

7. Irritant Contact Dermatitis:

1. Absorption: How do chemicals attack the body?

Route: Through the skin or dissolving in eye fluids.

2. Inhalation:

Route: Breathing in vapors, fumes, or dust.

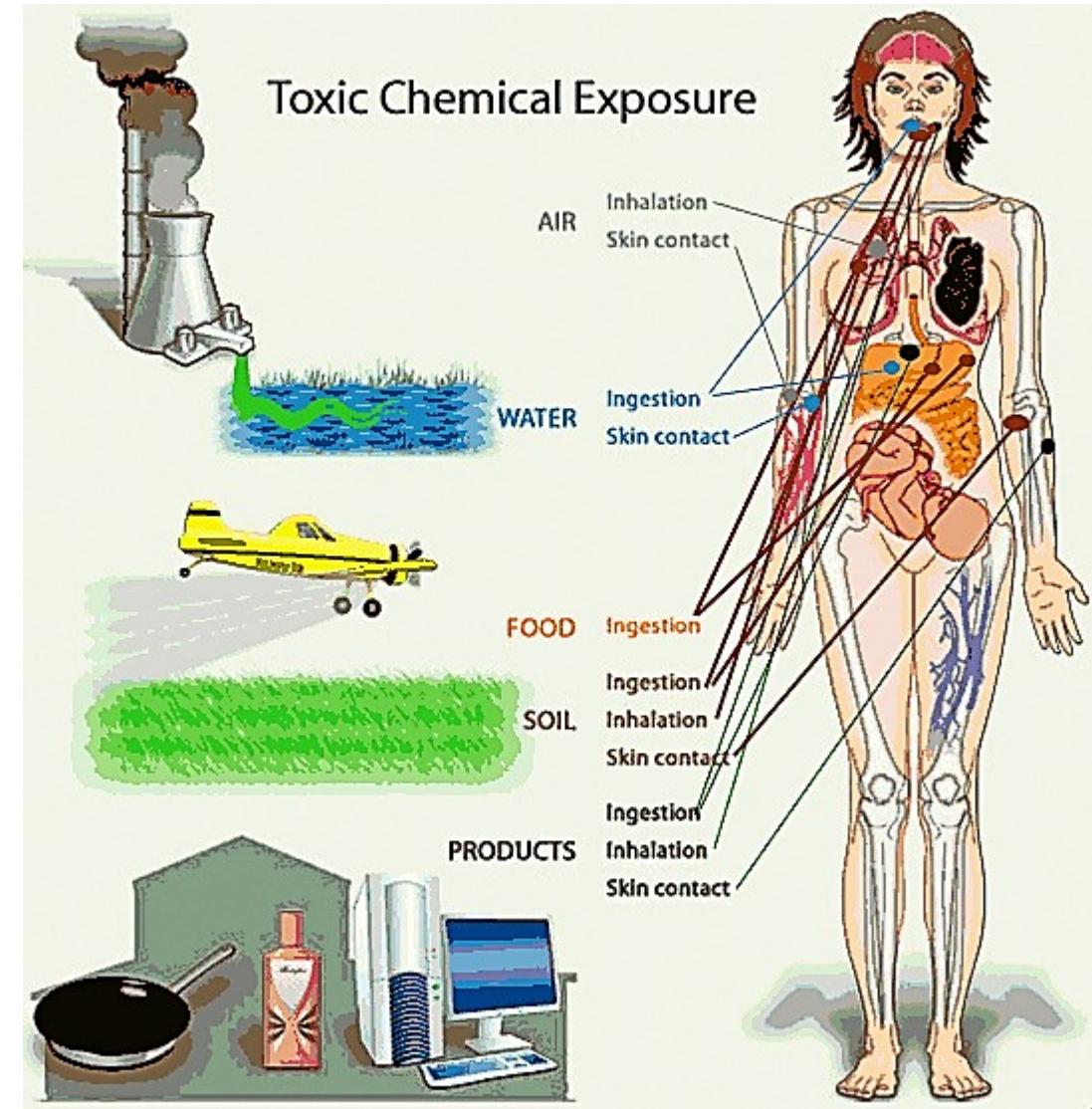
3. Ingestion:

Route: Typically, accidental.

Causes: Clear chemicals mistaken for drinking water or chemical splashes in the mouth.

4. Injection:

Route: Through needles, pipette tips, or cannulas.



How to Know if You Are Exposed:

1. Sensory Clues:

- Smell
- Taste

2. Physical Clues:

- Physical symptoms
- Changes in behavior

3. Measurement:

- Air sampling

If You Are Unsure How to Detect:

4. Consult Resources:

Check Material Safety Data Sheet

5. Seek Expert Guidance:

Contact Safety & Risk Services

How to Assess the Exposure?

1. Hazard Level:

How hazardous the chemical is.

2. Exposure Route:

What is the exposure route.

3. Duration:

How long you are exposed to the chemical (e.g., 5 min, 3 hours).

4. Frequency:

How often you are exposed (e.g., twice a week/month).

WHAT should I look for ??

- **Symptoms appear while you are at work.**
- **Symptoms get worse during the work week but go away when off.**
- **Fellow employees have reported similar symptoms.**
-



How will we respond to chemical exposure?

When Faced with Chemical Exposure:

1. Identify the Chemical:

Determine the substance involved.

2. Assess Concentration:

Evaluate the amount or concentration of the chemical.

3. Exposure Duration:

Consider how long you've been exposed.

4. Exposure Route:

Determine how you were exposed (e.g., inhalation, skin contact).

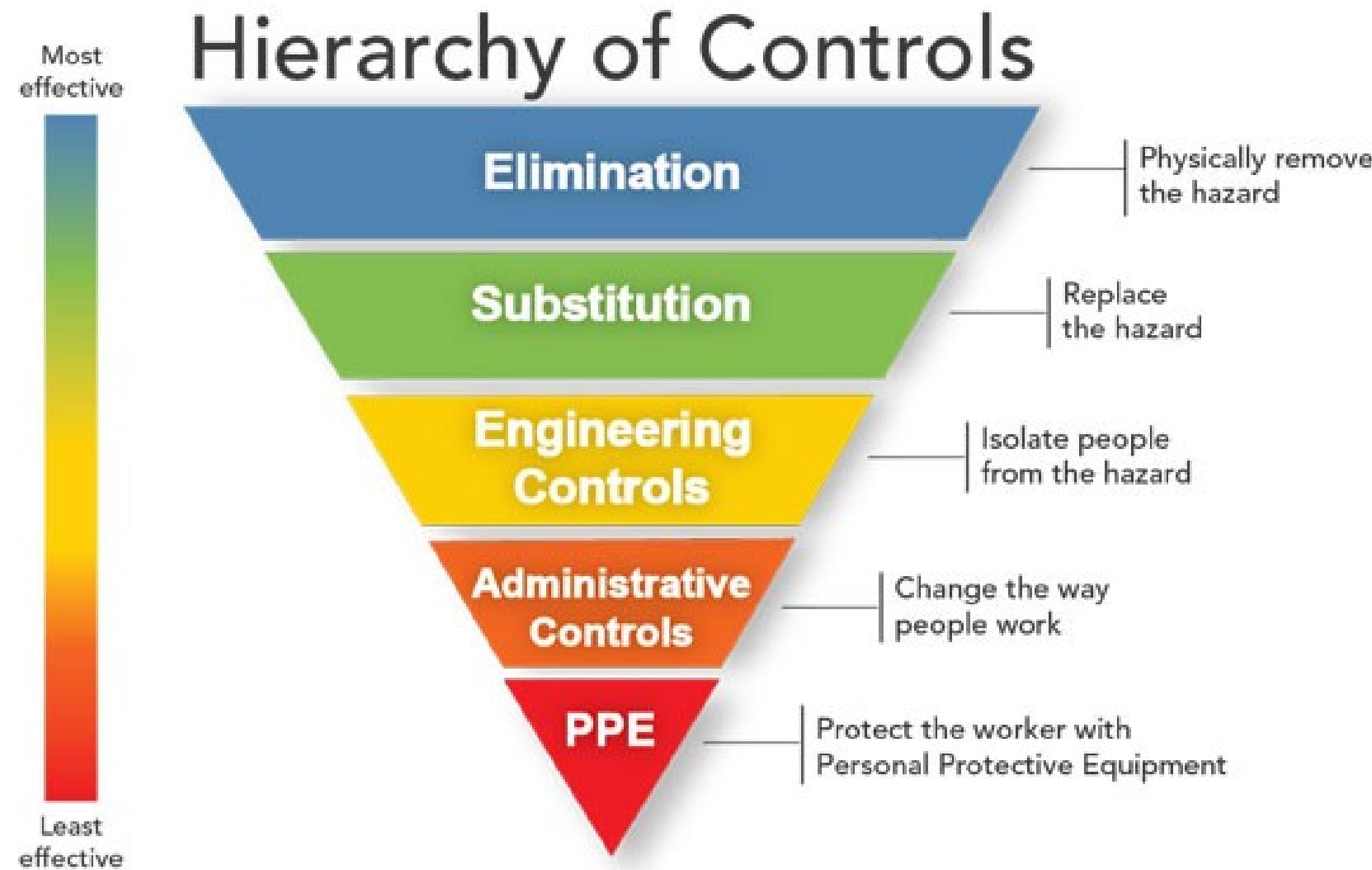
Additional Factors to Consider:

1. Age, gender, weight
2. Level of fitness
3. Level of exertion
4. Specific allergies
5. Presence of other chemicals in the body (e.g., drugs, tobacco)

Reducing Exposure

17

How can we reduce Employee Exposure?



Instructions for Dealing with a Chemical Spill

Stop, think – Is this a Major spill ?

IF, NO

- Remove contaminated clothing
- Use proper PPE
- Contain spill
- Notify workers in your area
- Seek MSDS for advice
- Notify the supervisor/security

IF, Yes

- Rescue
- Avoid the chemical
- Find the MSDS

Do not respond beyond your level of training

Response in the Case of a Chemical

**Stop, think – Fire
Can I extinguish ?
IF, Yes**

- Extinguish open flames
- Turn off gas / electricity
- Notify workers in your area
- Ventilate work area
- Notify supervisor / security

IF, NO

- Evacuate area immediately

- q Minimize waste from the start.
- q Never pour chemical waste down the drain.
- q Be aware of your chemical's classification.
- q Use a flame-resistant container labeled appropriately.
- q Remove the funnel from the waste container after use.
- q Follow proper procedures for mercury disposal, especially for broken thermometers.
- q Arrange for waste pick-up when necessary.



LAB SAFETY



Lab Safety

1. Proper Dress & PPE

ü Eye Protection

- **Safety glasses**: flying particles, chemical splashes, dust
- **Splash goggles**: corrosive liquids, solvents, powders
- **Face Shields**: high-pressure systems

ü Respiratory Protection – normally not needed at GIK

ü Skin and Body Protection

- **Gloves**: see the MSDS for the correct type of gloves
- **Aprons and Lab coats**: strong acids and bases
- **Shoe**: always worn in lab, closed toe and closed heel

ü Hearing Protection – normally not needed at GIK



Lab Safety

2. Safety Equipment

- ü Identify safety equipment in the lab
- ü Safety shower and eye washer
- ü Fire extinguisher, Fire Blanket
- ü First aid kit
- ü Evacuation and emergency exit
- ü **Test each equipment regularly**
- ü



Lab Safety

3. Behaviour

- ü Respect the lab and your colleagues
- ü Follow the standard operating procedure
- ü Never eat, drink, chew gum or do makeup in the lab
- ü Never work alone
- ü Maintain good housekeeping
- ü Never place chemicals on the floor
- ü Never place glassware/materials on the edge of the bench

4. Chemical Hazards

Two tools for identifying chemical hazards:

1. **(Material Safety Data Sheet) MSDS**

- (one stop shop), chemical properties, Hazards and safety precaution
- Find the location of MSDS in the lab
- Review the MSDS

2. **Chemical Labels:**

- Globally Harmonized System of Classification and Labelling of Chemicals (GHS)

MSDS

- [SECTION 1:](#) Identification of the substance/mixture & company/undertaking
- [SECTION 2:](#) Hazards identification
- [SECTION 3:](#) Composition/information or ingredients
- [SECTION 4:](#) First aid measures
- [SECTION 5:](#) Firefighting measures
- [SECTION 6:](#) Accidental release measures
- [SECTION 7:](#) Handling and storage
- [SECTION 8:](#) Exposure controls/personal protection
- [SECTION 9:](#) Physical and chemical properties
- [SECTION 10:](#) Stability and reactivity
- [SECTION 11:](#) Toxicological information
- [SECTION 12:](#) Ecological information
- [SECTION 13:](#) Disposal considerations
- [SECTION 14:](#) Transport information
- [SECTION 15:](#) Regulatory information
- [SECTION 16:](#) Other information
-

Chemical Labels

- Every container of chemicals is labeled by the manufacturer.
- The **label** will tell you:
 - Name of chemical
 - Name, address and emergency phone number of manufacturer
 - Physical and health hazards
 - Precautionary measures
 - First-aid instructions
 - Proper handling/storage instructions

n-Propyl Alcohol

UN No. 1274
CAS No. 71-23-8



DANGER

Highly flammable liquid and vapor. Causes serious eye damage.
May cause drowsiness and dizziness.

Keep away from heat/sparks/open flames/hot surfaces. No smoking. Avoid breathing fumes/mist/vapours/spray. Wear protective gloves/protective clothing/eye protection/face protection.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present. Continue rinsing.

Fill Weight: 18.65 lbs.

Gross Weight: 20 lbs.

Expiration Date: 6/21/2020

Lot Number: B56754434

Fill Date 2/28/2014

BioNetwork Chemical Supply 200 W. Jones St. Raleigh, NC 27603 USA 704.

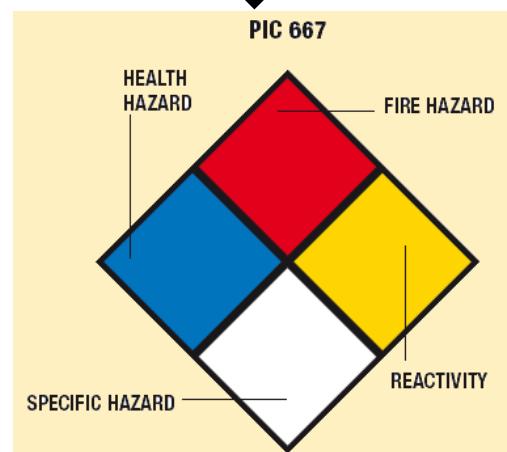
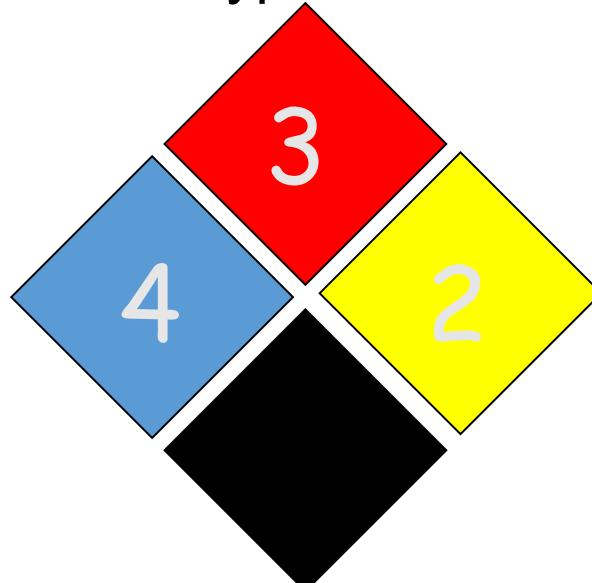
5. Safe Chemical Handling

1. Always add acid/base to a solvent, such as water.
2. Never remove chemicals from the lab.
3. Practice proper handling and use of Personal Protective Equipment (PPE).
4. Avoid inhalation of chemical fumes.
5. Utilize a fume hood when working with volatile chemicals.
6. Ensure chemical containers are tightly closed.
7. Evacuate the area in the event of a chemical spill.
8. Keep flammable chemicals away from all ignition sources.
9. Store flammable chemicals in a dedicated area.
10. Dispose of waste in accordance with Federal, state, and local regulations.

6. General Precautions

1. Avoid breathing vapors; use in well-ventilated areas.
2. Avoid skin contact and wash thoroughly with soap and water after handling.
3. Keep away from sparks, heat, and open flames.
4. Store in a tightly closed container.
5. Promptly remove and wash contaminated clothing.
6. Keep away from clothing and combustible materials.

NFPA-type label



Colors represent kind of hazard

- Red = fire
- Yellow = instability
- Blue = health
- Black/White = specific hazard & personal protection

Numbers show degree of hazard

- 0 = Minimal
- 1 = Slight
- 2 = Moderate
- 3 = Serious
- 4 = Severe

Black = specific hazard

- OX = Oxidizer
- ACID = Acid
- ALK = Alkali
- COR = Corrosive
- W = Use no water
- Other symbols:



Chemical Storage

Ü Labs have established separate Storage Areas for:

- Flammable and combustible organic liquids and solvents
- Acids
- Dry poisons, salts, and oxidizers
- Bases

Ü Chemicals are stored in:

- Chemical storage cabinets
- Flammable storage refrigerators (No food)
- Chemical storage refrigerators/freezers (No food)
- On shelves with retaining barriers

Storage Fundamentals

Ü Identify incompatible chemicals:

- Check the Material Safety Data Sheet

Ü Isolate and separate incompatible materials:

- Isolate by storing in another area or room.
- Degree of isolation depends on quantities, chemical properties and packaging.
- Separate by storing in same area or room, but apart from each other.

Storage of Flammable and Combustible Liquids

ü Storage must not limit the use of exits, stairways, or areas normally used for the safe regress of people.

ü Storage must be in:

- Closed metal containers inside a storage cabinet
- Safety cans
- An inside storage room

Emergencies can happen, So

- ü Avoid working alone in the lab.
- ü Know where emergency phone numbers are posted.
- ü Review MSDS.
- ü Know where to go and what to do in an emergency.
- ü Know the location of the closest safety showers, eyewashes, and fire extinguishers.

**THANK
YOU!**

