Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third year)

Subject: Chemistry

Paper Code: CHD 102

Paper Title: Green Methods and Safety Aspects in Chemistry

Unit: 03

Unit Title: Introduction to Lab Safety

Module Name: Risks in a Chemical Laboratory

Module No: 10

Name of the Presenter: Ms. Priyanka R. Fernandes

Notes

RISKS IN A CHEMICAL LABORATORY

Lab Safety

- As laboratories involve numerous chemicals, procedures and operations, they require extensive safety precautions.
- Laboratory safety involves **chemical safety, fire safety, electrical safety**, and other safety issues.
- The laboratory environment can be a hazardous place to work. Hence, there is a great need to know the types of hazards.

What is a Laboratory Hazard?

- ***Hazard is an agent which has a potential to cause harm to a vulnerable target.***
- Danger or risk while working in the laboratory is called a *Laboratory Hazard.*

What is the difference between a “Hazard” and a “Risk?”

- **Hazard,** means the intrinsic property of a substance ***which has the potential*** to cause harm to the health of a person.
- **Risk,** means the ***likelihood*** that the potential for harm to the health of a person will be attained under the conditions of use and exposure and also the extent of that harm.
- The relationship between a hazard and potential for exposure defines risk.

❖ Laboratory Hazards are classified into the following:

1) Physical Hazards
2) Chemical Hazards
3) Biological Hazards
4) Ergonomic Hazards

- **Physical Hazard**

Examples include fire, injury, noise, radiation, high voltage apparatus & machinery with moving parts.

- **Chemical Hazard**

Flammable, toxic, carcinogenic, poisonous, corrosive, explosive (pyrolytic) and radioactive substances.

- **Biological Hazard**

Pathogenic microorganisms, animals, biological tissues, blood and other body fluids (human & animal).

- **Ergonomic Hazards**

Repetitive movements, improper set up of workstation etc.

❖ Chemical Hazards

- Cleaning agents and disinfectants, drugs, anaesthetic gases, solvents, paints and compressed gases are all chemicals that have the potential to become a chemical hazard.

❖ Exposure to chemical hazards can occur:

(i) During use

(ii) With poor storage.

- The use of chemicals in ***research laboratories*** is inevitable and the potential for harm or injury could be significant if they are misused or mishandled.

Fires can also break out in any laboratory if proper safety precautions are not observed.
Fire can be caused by:
Ordinary combustibles like paper, wood etc.

Flammable liquids such as ether, alcohols etc. and gases such as methane.

Metals - Magnesium and Potassium

Faulty electric circuits or appliances

Anhydrous Ammonia

- Is a colourless gas that has a ***strong smell*** and is toxic, corrosive and flammable.
- Can exist as a **liquid, gas or aerosol**.
- Is an **efficient refrigerant** having the ability to absorb large quantities of heat.
- Anhydrous ammonia is **generally safe** provided safe storage, handling, operating, and maintenance procedures are in place and being followed.

❖ **Health Effects:**

- Anhydrous ammonia can be harmful, with exposure to **300 ppm** being immediately dangerous to life and health.
- The effects of breathing in anhydrous ammonia range from **lung irritation to severe respiratory injuries,** with possible fatality at higher concentrations.

- Anhydrous ammonia is also **corrosive** to the skin, eyes and lungs.

KCN

- This colourless crystalline salt similar in appearance to sugar, is **highly soluble in water.** Most KCN is used in gold mining, organic synthesis and electroplating.
- In aqueous solution, KCN dissociates into hydrated potassium (K^+) ions and cyanide (CN^-) ions.
- KCN and (NaCN) are widely used in organic synthesis for the preparation of nitriles and carboxylic acids, particularly in the ***Von Richter reaction***.
- KCN is used as a ***photographic fixer*** in the wet plate collodion process.

❖ Health Effects

- KCN is highly toxic. Contact with acid releases highly flammable **HCN gas.**
- Reacts with strong oxidizers such as nitrates and chlorates, nitrogen trichloride, perchloryl fluoride, sodium nitrate, acids, alkaloids, chloral hydrate and iodine.
- Vapours may accumulate in confined areas (basement/tanks/ cars).
- Contact with metals may evolve flammable hydrogen gas. Containers may explode when heated or if contaminated with water.
- Gives off irritating or toxic fumes in a fire.

❖ Precautionary Measures to be taken:

1. **Storage near combustible substances must be avoided.**
2. They are incompatible with certain substances like chlorates, mineral acids and metal sulfides. **Contact can lead to violent decomposition.**
3. Should be stored in a sealed container.
4. Use for education and research purposes is considered but **not for individual use.**

5. **Eye:** If these chemicals come in contact with the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids.
6. **Skin:** If contacted the skin, immediately wash the contaminated skin with soap and water.
7. **Clothing:** Immediately remove the clothing, wash the skin with soap and water and get medical attention promptly.
8. **Breathing:** Respiratory support
9. **Swallow:** If swallowed, get medical attention immediately