Republic of Iraq
Ministry of Higher Education and Scientific
Al-Mustaqbal University College
Chemical Engineering and Petroleum Industries Department

Subject: Chemical Safety

Second Class

Lecture One

Introduction

Chemicals are widely used in our homes, laboratory experiments , manufacturing and agricultural facilities, as well as many other areas of society. Hazardous chemicals are commonly found in our workplaces. In spite of government regulations and company procedures, the risk always exists for any incident involving hazardous chemicals. This chemical safety course has been designed to introduce the safe use of chemicals to the workplace or laboratory .

Safety

is the **state** of being "safe"
Or the **condition** of being protected from harm or other non-desirable outcomes.
Safety can also refer to the **control** of recognized hazards in order to achieve an acceptable level of risk.

Chemical Safety

Chemical safety is the practice of handling chemicals in a safe manner, minimizing the hazard to public and personal health.

Or Chemical safety is the ***application*** of the best practices for handling **chemicals** and **chemistry** processes to minimize risk, whether to a person, facility, or community.

Chemical safety involves understanding the **physical**, **chemical**, and **toxicological hazards** of **chemicals.**

Is the chemical safety important in laboratory? Why?

Yes. Laboratory work often involves the use of hazardous chemicals. Before using a chemicals, lab workers must become informed about chemical hazards in addition to their safe handling, storage, and disposal.

Chemical Hazards

the hazard associated with a chemical depends on:

- what the specific chemical is
- what chemical(s) it is mixed with, if any
- the relative proportion of the chemical, if it is in a mixture or solution.

Types of Chemical Hazards

The Chemical Hazards are four basic types of hazards shown below:

Hazard Types	***Definition***	***Examples***
Flammable 	Material that will burn or ignite, causing fire or combustion. An ignitable chemical has a flashpoint less than 100° F. A combustible material will burn, but require a flame or elevated temperature plus a spark to start them; and has a flashpoint greater than 100° F but less than 200°F.	Flammables: methanol, acetonitrile, spray adhesive/mount Combustible: diesel fuel, mineral spirits
Corrosive 	Chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. pH < 2 and pH > 12.5	acetic acid, sodium hydroxide, photographic fixer
Reactive	Material that reacts violently or explodes under either ambient conditions or when in	Oxidizers: nitric acid Organic Peroxides:benzoyl

Hazard Types	***Definition***	***Examples***
	contact with air, water, or other chemicals. Oxidizers: materials that react strongly with organic materials, sometimes strongly enough to start fires Organic Peroxides: form friction and shock-sensitive explosives Water Reactive: react violently with water Air Reactive (pyrophoric): react violently with air Explosive: designed to explode violently	peroxide, methyl ethyl ketone peroxide Water Reactive:sodium metal, sodium borohydride Air Reactive: silane, t-butyl lithium Explosive: TNT, picric acid
Toxic 	Material that may cause harm to an individual if it enters the body. Carcinogen: a substance or agent that may cause cancer Mutagen: An agent that can induce or increase the frequency of mutation in an organism Poison: any substance that can impair function, cause structural damage, or otherwise injure the body Sensitizer: a substance that causes hypersensitivity or reactivity to an antigen, such as pollen, especially by a second or repeated exposure. Teratogen: An agent that causes malformation of an	Carcinogen: benzene, carbon tetrachloride Mutagen: bromine Poison: sodium azide, powdered pigments and inks (may contain toxic metals such as chromium and barium) Sensitizer:formaldehyde, phenol Teratogen: PCBs, mercury

Hazard Types	***Definition***	***Examples***
	embryo or fetus.	
Irritant 	Material that can cause harm to an individual in the following ways: Irritant: a substance that can irritate the skin or eyes Skin Sensitizer: a substance which can cause an allergic response following skin contact Acute Toxicity (harmful): a substance that may be fatal or cause organ damage from a single short-term exposure Narcotic Effect: A substance that can cause drowsiness, lack of coordination, and dizziness Hazardous to Ozone Layer (Non-Mandatory)	Powdered substances often have the irritant symbol.

Hazard Types	***Definition***	***Examples***
Environmental Hazard 	Toxic to aquatic animals.	Oils and oily debris can be in this class of hazards.

Material Safety Data Sheets (MSDS)

Each person working with chemicals should have access to the MSDS for all chemicals they use.

―Access" may be:

-A current hard copy of MSDS kept in a work area file or binder.

-or An electronic copy of MSDS.

Before using any chemical, read the appropriate Material Safety Data Sheet (MSDS).

A MSDS is a document that details information about chemicals and along with the container label is a good source of information for chemical safety. It provides the following information:

a. Identity of the chemical

b. The manufacturer's name and address

c. Hazardous ingredients

d. Exposure limits

where there are more than exposure limit :

i. *Permissible Exposure Limit* (*PEL*) or *Recommended Exposure Limit (REL)*

– This is the amount of a chemical that a person can be exposed to, averaged over an eight hour period, before it causes him/her harm.

ii. *Short Term Exposure Limit (STEL)*

– This is the amount of a chemical that a person can be exposed to, averaged over a 15 minute period, before it causes him/her harm.

iii. Immediately Dangerous to Life and Health (IDLH)

– This is the amount of chemical that immediately puts a person a risk of serious injury or death.

If this level is reach or exceeded, the area should be evacuated immediately!

e. Physical characteristics, such as:

i. Boiling point

ii. Vapor pressure

f. Chemical hazards, including the following:

i. Flammability

ii. Explosiveness

iii. Reactivity

g. Health hazards, including chemicals that are:

1) Toxins (both acute and long-term)

2) Carcinogens

3) Reproductive Toxins

4) Teratogens

5) Mutagens

6) Neurotoxins

7) Irritants

8) Routes of Entry

9) Emergency and first-aid procedures

10) Proper leak, spill, and disposal techniques

12) Proper storage and handling procedures

l. Other special provisions

Hint

Chemical analysis of hazardous substances in air, water, soil, sediment, or solid waste can best be performed by instrumental techniques involving

- gas chromatography (GC),
- high-performance liquid chromatography (HPLC),
- GC/mass spectrometry (MS),
- Fourier transform infrared spectroscopy (FTIR),
- and atomic absorption spectrophotometry (AA) (for the metals).

GC techniques using a flame ionization detector (FID) or electron-capture detector (ECD) are widely used.