Introduction of biosafety and biosecurity

LAC3

General Laboratory Safety Guidelines

People who work in scientific laboratories are exposed to various hazards. Most workplaces have hazards that are well recognized (those of ordinary fire, for example) with well-defined actions to control the situation. Laboratories, however, involve a greater variety of possible hazards and some of these hazards need precautions not ordinarily encountered.

1- Electrical safety

2- Chemical safety

3- Fire safety

4- Biosafety

Electrical safety

The typical laboratory requires a large quantity of electrical power. This increases the likelihood of electrically related problems and hazards.

The severity and effects of an electrical shock depend on a number of factors, such as the:

a. Pathway through the body
b. The amount of current
c. The length of time of the exposure
d. Whether the skin is wet or dry.

Electrical safety

The following general principles should be applied to electrical safety

- All electrical outlets must be earthed
- All electrical equipment must be evaluated regularly.
- Do not route cords over metal objects such as emergency showers, overhead pipes or frames, metal racks, etc.
- If electrical equipment is unsafe, tell your supervisor or safety officer.
- If you or anyone else has received an electric shock from any item of equipment, no matter how small, make sure that no one else touches it until it has been investigated further.

Fire safety

The fire triangles or combustion triangles are simple models for understanding the necessary ingredients for most fires. The triangle illustrates the three elements a fire needs to ignite:

heat, fuel, and an oxidizing agent (usually oxygen).

FIRE SAFETY

CLASSES OF FIRE

A	Combustible solids such as wood, paper, and textiles
B	Flammable liquids such as petrol, diesel, and oils
C	Flammable gases such as propane, butane, and methane
D	Combustible metals such as magnesium, eleminium and lithium
E	Electrical equipment * not assigned by NFPA
F	Cooking oils and fats

TYPES OF FIRE EXTINGUISHER

Water
Fires involving solids only

Foam
Solids and burning liquids

Dry Powder
Solids, liquids gases, and electrical equipment

CO_2
Burning liquids and electrical equipment

Wet Chemical
Cooking oils and fats

EXTINGUISHING TECHNIQUE

Pull the pin
Aim at the base of the fire
Squeeze the handle

Pull the pin
Aim at the base of the fire
Squeeze the handle
Sweep from side to side

EXTINGUISHING METHODS

- Cooling, e.g, water
- Smothering, e.g. foam, fire blanket
- Starvation, e.g.

Chemical safety

Workers in microbiological laboratories are not only exposed to pathogenic microorganisms, but also to chemical hazards. It is important that they have proper knowledge of the toxic effects of these chemicals, the routes of exposure and the hazards that may be associated with handling and storage.

Safety data sheets (SDS), which describe the hazards associated with the use of a given chemical

The SDS is provide an easy to understand, standardized document that informs the user of important information regarding the material.

The SDS is a 16-section document containing details on properties, hazards, storage and transport, regulatory status, protective measures, and emergency procedures. These should be accessible in laboratories where these chemicals are used.

All laboratories should have in place a chemical hygiene plan and “Hazard Communication.

MATERIAL SAFETY DATA SHEET - (MSDS)

HEALTH HAZARD

4 - Deadly
3 - Extreme Danger
2 - Hazardous
1 - Slightly Hazardous
0 - Normal Material

FIRE HAZARD

Flash Points
4 - Below 73° F
3 - Below 100° F
2 - Below 200° F
1 - Above 200° F
0 - Will Not Burn

Acid..... ACID
Alkali..... ALK
Corrosive..... COR
Oxidizer..... OX
Radiation Hazard...☢
Use No Water....🚱

SPECIFIC HAZARD

4 - May Detonate
3 - Shock and Heat May Detonate
2 - Violent Chemical Change
1 - Unstable if Heated
0 - Stable

INSTABILITY HAZARD

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

- ☐  Safety Glasses
- ☐  Gloves
- ☐  Splash Goggles
- ☐  Synthetic Apron
- ☐  Face Shield & Eye Protection
- ☐  Full Suit
- ☐  Dust Respirator
- ☐  Boots
- ☐  Vapor Respirator
- ☐ Other: _____

Routes of exposure to hazardous chemicals may occur by:

1. **Inhalation**:

Chemicals may cause irritation, sensitization, allergic reactions, respiratory disease, or cancer.

2. **Contact**:

Contact with skin may cause chemical burns, conjunctivitis of the eyes, or systemic poisoning.

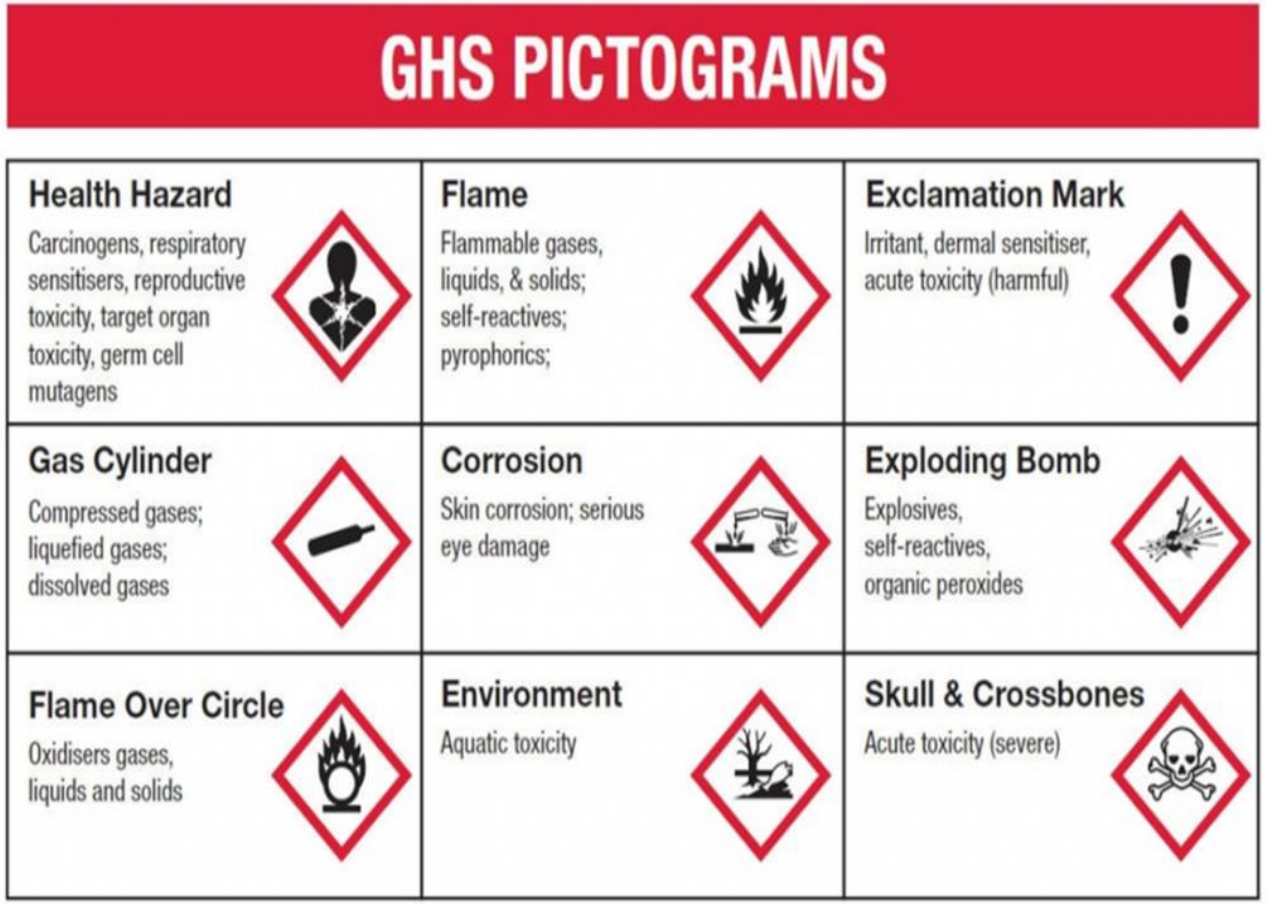
3. **Ingestion**:

Hazardous chemicals may be accidentally swallowed via mouth pipetting, or contamination of food or drinks.

4. **Through broken skin**:

Hazardous chemicals may enter the body via cuts, abrasions or needle-sticks

The Globally Harmonized System (GHS) of the Classification and Labeling of Chemicals



The main goals of biosafety are:

1. protecting laboratory personnel
2. protecting the community
3. protecting the environment

Examples of biosafety practices include:

1. wearing personal protective equipment (PPE)
2. proper use of biosafety cabinets
3. safe handling of sharps
4. correct waste disposal procedures

Simple Example

Wearing gloves while handling blood samples is considered a biosafety measure because it reduces the risk of accidental exposure.

The main objectives of biosecurity are:

1. preventing biological materials from being used as weapons
2. preventing unauthorized access to dangerous pathogens
3. ensuring proper inventory and accountability of biological materials

Example

Storing dangerous biological samples in locked refrigerators with restricted access is considered a biosecurity practice.

Difference between biosafety and biosecurity

Aspect	Biosafety	Biosecurity
Type of risk	Accidental	Intentional
Main focus	Protection from exposure	Control of access
Goal	Prevent laboratory accidents	Prevent misuse or theft
Example	Personal protective equipment(PPE)	Locked storage and access control

Both concepts complement each other and are essential components of laboratory risk management

Who is Responsible for Biosafety and Biosecurity?

Biosafety and biosecurity are not only the responsibility of laboratory management.

They require the participation of all individuals involved in laboratory work, including:

- Researchers
- laboratory technicians
- Students
- institutional administrators
- Anyone who enters the laboratory environment becomes part of the biosafety system.

Sources of Biological Hazards in Laboratories

Biological hazards may originate from several sources, including:

- clinical samples from patients
- bacteria and viruses used in research
- blood and body fluids
- contaminated laboratory equipment
- biological waste
- sharps such as needles and blades

These materials must be handled according to established biosafety protocols.

key Elements of Effective Biosafety and Biosecurity

Successful implementation of biosafety and biosecurity requires several components:

1. proper training of laboratory personnel
2. use of personal protective equipment (PPE)
3. safe storage of biological materials
4. laboratory access control systems
5. safe biological waste management
6. incident reporting and emergency response procedures

Together, these measures create a comprehensive system that minimizes biological risks.