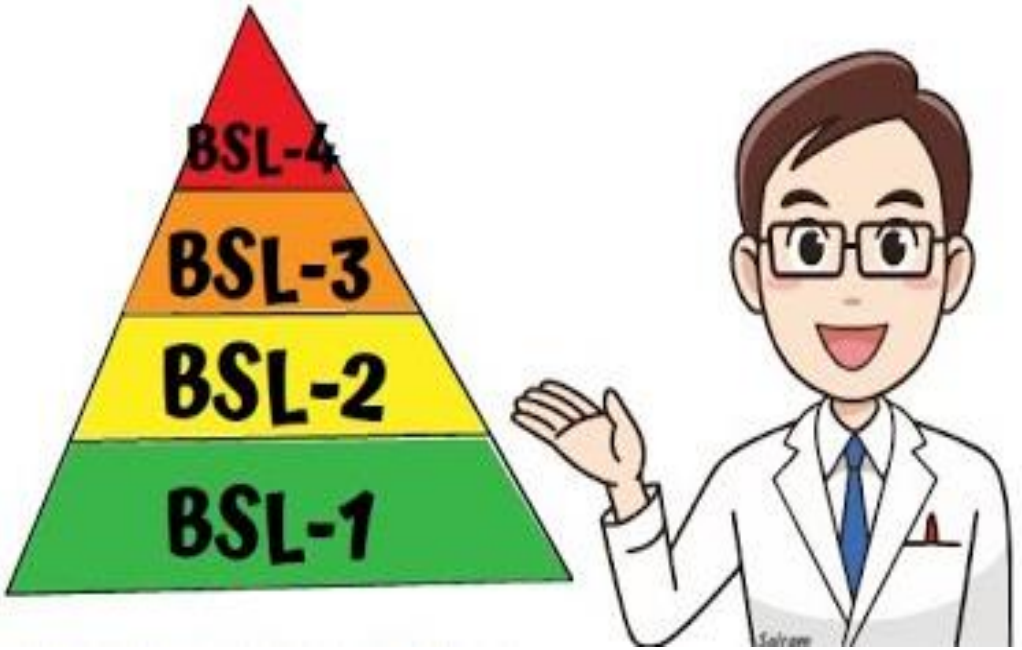


Lab-1
Biosafety and Risk Assessment

Introduction

Biosafety is the application of safety precautions that:

- **Reduce labortorian risk of exposure to infectious material.**

- **Limiting contamination of the work environment and ultimately the community.**

Biosafety preventing lab. acquired infections:

- Bacteria
- Viruses
- Fungi
- Human blood
- Unfixed tissue
- Human cell line
- Recombinant DNA

Biosafety protect against general laboratory hazard.

- Fire
- Breakage of glassware
- Sharps
- Spillages
- Pressure equipment & gas cylinders
- Extremes of heat & cold
- Chemical hazards
- Biological hazards
- Radiation

Biosafety cont..

- According to the **Centers for Disease Control and Prevention (CDC)**, scientists and lab technicians have to be very aware of microorganisms while handling or testing clinical specimens.
- The regulations outline precautions, special practices, and decontamination procedures for labs that work with infectious agents.
- Based on the degree of hazard there is **a strategic risk assessment** which includes **4 risk groups** and **4 laboratory biosafety levels (BSL)**.

Classification of risk groups:

Group 1: **No or low individual and community risk**

- Microorganism is unlikely to cause human or animal disease.

Group 2: **moderate individual risk low community risk**

- The pathogen can cause human or animal disease but is unlikely to be serious
- Effective treatments and preventive measures are available
- The risk of spread of infection is limited

Group 3: High individual risk low community risk

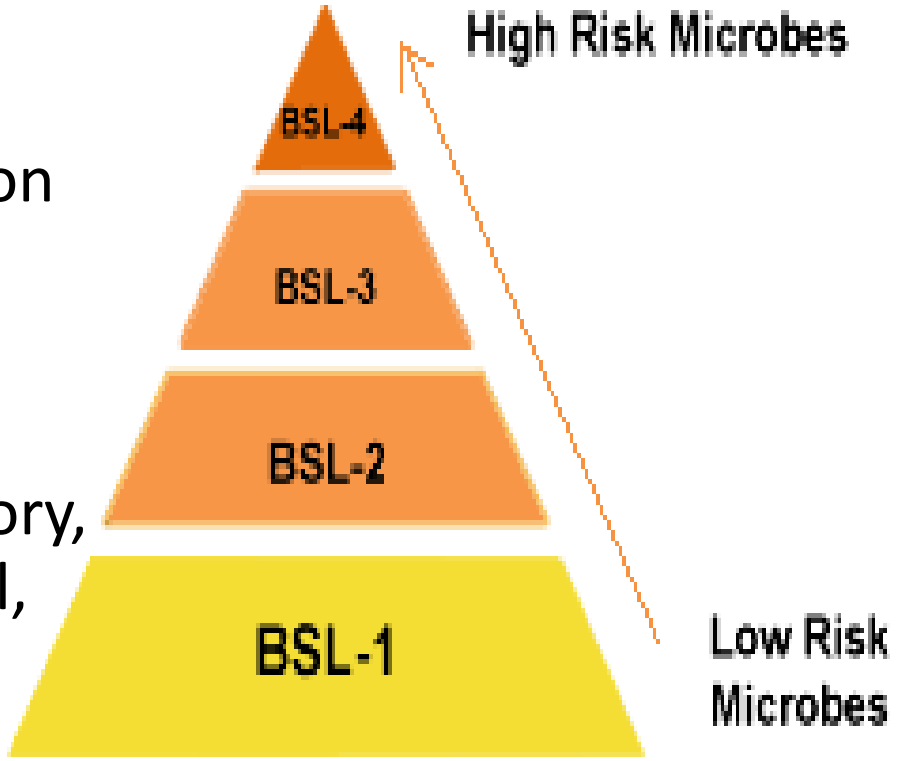
- Include pathogens that is usually cause serious human or animal disease .
- Effective treatment and the preventive measures are available

Group4: high individual and community risk

- A pathogen that is usually causes serious human or animal disease
- Can be readily transmitted from one individual to another directly or indirectly
- Effective treatment and preventive measures are not usually available

Biosafety Levels (BSL): practice and equipments

- The biosafety levels range from **BSL-1 to BSL-4**.
- Each biosafety level builds on the controls of the level before it.
- Every microbiology laboratory, regardless of biosafety level, follows standard microbiological practices.



Standard Microbiological Practices

1. Use of personal protective equipment **PPE** (such as lab-coats, latex gloves, and eye protection or face shields as needed depending on the type of work being done).

2. No smoking, eating, drinking, or storage of food in the laboratory.

3. Use of mechanical pipettes only (no mouth pipetting).

4. Frequent hand washing, especially after removing gloves and before leaving the lab.

5. Limits on access to the lab space & the door kept closed when working.

Cont…

6. Care to minimize splashes and actions that may create aerosols.

7. Decontamination of work surfaces after every use.

8. Decontamination of laboratory wastes before disposal by autoclave.

9. “Sharps" precautions, including special containers for disposing of needles and other sharp objects.

10. Maintenance of an insect and rodent control program.

BSL-1

The microbes **not known** to cause disease in healthy adults and present minimal potential hazard to laboratorians and the environment. examples are *Bacillus subtilis* and non-pathogenic *E. coli* species.

BSL-1 / Cont…

1. Laboratory practices

- Standard microbiological practices are followed.
- Work can be performed on an open lab bench or table.

2. Safety equipment

PPE, (lab coats, gloves, eye protection) are worn as needed.

3. Facility construction

- A sink must be available for hand washing.
- The lab should have doors to separate the working space with the rest of the facility.

BSL-2

- Used when work with MO cause human disease..
- A BSL-2 lab is generally required for working with any human-derived blood, other bodily fluids or tissues.
- In working with BSL-2 agents, the primary hazards to personnel are accidental needle sticks, potential infection through exposure to the eyes and nose (mucous membranes), and ingestion of infectious materials but usually not by inhalation.
- Example of MO include :measles virus, many ***staph aureus,*** ***Salmonella*** **species, pathogenic** ***Toxoplasma*** **species,** ***Clostridium botulinum*** **and hepatitis B virus**

BSL-2 / Cont…

1. Laboratory practices

- Access to the laboratory is restricted when work is being conducted.

2. Safety equipme

- Appropriate (PPE) is worn, including lab coats and gloves. Eye protection and face shields can also be worn, as needed.
- All procedures that can cause infection from aerosols or splashes are rformed within a biological safety cabinet **(BSC)** .
- An autoclave or an alternative method of decontamination is available for proper disposals.

3. Facility construction

- The lab has self-closing doors.
- A sink and eyewash are readily available.

BSL -3

- the microbes can be either indigenous or exotic.
- They can cause serious or potentially lethal disease through respiratory transmission.
- Agents studied in a BSL-3 lab include: ***Mycobacterium tuberculosis***, **Saint Louis encephalitis virus**, ***Francisella tularensis***, and ***Coxiella burnetii***

BSL-3 / Cont…

1. Laboratory practices

- Laboratorians are under medical surveillance and might receive immunizations for microbes they work with.
- Access to the laboratory is restricted and controlled at all times.

2. Safety equipment

- Appropriate PPE must be worn, and respirators might be required .A
- The work must be performed within an appropriate BSC .B

3. Facility construction

- A hands-free sink and eyewash are available near the exit.
- Exhaust air cannot be recirculated, and the laboratory must have sustained directional airflow by drawing air into the laboratory from clean areas towards potentially contaminated areas.
- Entrance to the lab is through two sets of self-closing and locking doors .C

BSL-3 /Cont..

BSL-4

- BSL-4 is the highest level of biological safety.
- There are a small number of BSL-4 labs in the United States and around the world.
- The microbes in a BSL-4 lab are dangerous and exotic, have a high risk of aerosol-transmitted infections (transmissible, infectious, spread).
- Infections caused by these microbes are frequently fatal and without treatment or vaccines.
- Examples of microbes worked with in a BSL-4 laboratory include **Ebola and Marburg viruses**.

BSL-4/Cont..

1. Laboratory practices

- Change clothing before entering.
- Shower upon exiting.
- Decontaminate all materials before exiting.

2. Safety equipment

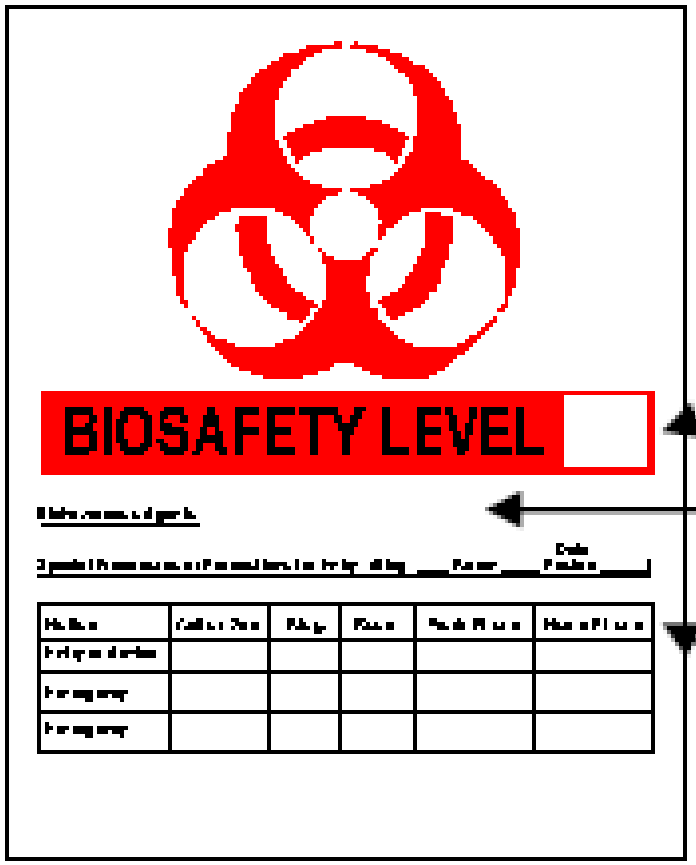
- Using an appropriate Class III BSC
- wearing a full body, air-supplied, positive pressure suit.

3. Facility construction

- The laboratory is in a separate building or in an isolated and restricted zone of the building.
- The lab has dedicated supply and exhaust air, as well as vacuum lines and decontamination systems.

Biohazard Sign According to

Example of biohazard sign that posted outside the lab, its level _____ and workers dealing with _____



The sign contains the following information:

The lab's biosafety level

The infectious agents under study

Contact information for the responsible person and 2 emergency contacts

General Hazard Avoidance

First Aid

- All laboratory workers should undergo simple first aid training
  - For ALL chemical splashes, wash with plenty of water for 10 minutes
  - Control bleeding with direct pressure, avoiding any foreign bodies such as glass
- Report all accidents to your supervisor or departmental safety officer

Glassware

- Never use glassware under pressure or vacuum unless it is designed for the job and suitably shielded.
- Dispose of chipped or broken glassware in a glass bin or sharps bin and not in a general waste bin.

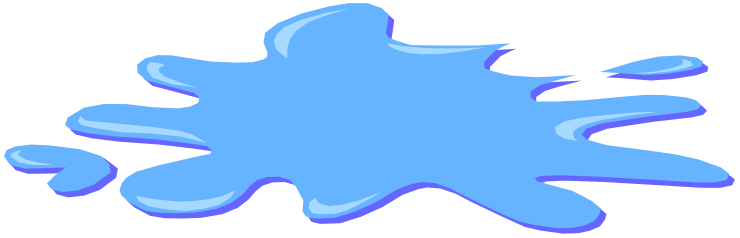
Flammable substances

- Use minimum quantity
- Store in special storage cabinet
- Use temperature-controlled heating sources
- Attend fire training annually.

Sharps:

- Recap, bend or break needles
- Discard needles into regular trash

Spillages



Biological spillages could be :cultures of micro-organisms, human or animal bodily fluids such as blood, urine, vomit or faces.

- Soak up spilled material with disposable towels
- Apply disinfectant for 10 minutes contact time.
- Wipe up spillage
- Disposes them as biologic waste
- If the spillage is blood, Gently pour bleach solution – 1 part bleach to 9 parts water – onto all contaminated areas. Let bleach solution remain on contaminated area for 20 minutes

Gas cylinder

- Never use without formal training
- Minimise the number in a laboratory
  - Store externally whenever possible
- Move only with a cylinder trolley
- Use regulators & control equipment suitable for the gas concerned
- If leakage occur,

➢ Close the valve directly

➢ Do not switch any light or flame

➢ Open all the doors if possible and contact with the supervisor.

Electrical Equipment

- Always do a visual check on electrical equipment before use.
- All portable electrical equipment must have a current “PAT test” sticker
- **NEVER** use defective equipment

Thank you