جامعة الانبار –كلية العلوم-التقنيات الاحيائية

سلامة وامن حيوي

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محاضرة رقم 4

BIOHAZARD

Biosafety program goals

The goals of a Biological Safety Program, referred to as a Biosafety Program, are to protect laboratory workers, the public, and the environment from potentially hazardous biological agents.

Note: The term Biorisk is used to define the risks associated with the use of biological materials and encompasses both biosafety and biosecurity risks.

Personal protective equipment

Personal protective equipment (PPE) includes safety eyewear, face shields, gloves, appropriate respiratory protection, and lab coats.

PPE is most effective when used to supplement primary control methods such as biological safety cabinets, safety centrifuge cups, and other containment devices.

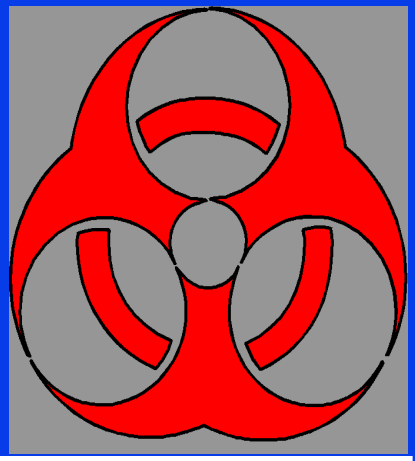
Personal protective equipment, continued

PPE is considered the least desirable primary containment method because its failure results in direct exposure of personnel to the biological agent

Note: *PPE is designed to protect laboratory workers from serious exposure to biohazardous materials, and should be used in conjunction with appropriate engineering and administrative controls. At a minimum, staff must use lab coats, safety glasses, and gloves whenever there is a potential for skin contact, splash, or aerosols.*

Standard Microbiological Practices

- NOT permitted in laboratories:
  - Eating
  - Drinking
  - Smoking
  - Handling contact lenses
  - Pipetting by mouth
  - Storing food and drink



Footwear and miscellaneous clothing guidelines

Open-toed shoes or sandals are not allowed in the lab.

In addition, wearing shorts or other clothing that exposes the lower legs is generally considered unsuitable in laboratories because it increase the potential for skin contamination and absorption of contaminants.

Facility design

The design of a facility is important in providing a barrier to protect people working inside and outside the laboratory, as well as to protect people or animals in the community from infectious agents that may be accidentally released from the laboratory.

Facility design must be commensurate with the laboratory's function and the recommended biosafety level for the agent being used or stored.

Facility design

In general, the facility design should include:

- Doors for access control
- Sink for handwashing
- Floors made of vinyl or similar material that is easy to clean (no carpets)
- Benchtops made of materials that are impervious to the chemicals used
- Fixed windows; if the windows can opened, they should have screens

Biosafety levels (BSLs)

Laboratories are classified into four biosafety levels (BSLs) representing a combinations of laboratory practices and techniques, safety equipment, and laboratory facilities.

Each combination is specifically appropriate for the operations performed and the documented or suspected routes of transmission of the infectious agents, as well as for the laboratory function or activity.

The recommended biosafety level for an organism represents the conditions under which the agent can be ordinarily handled safely.

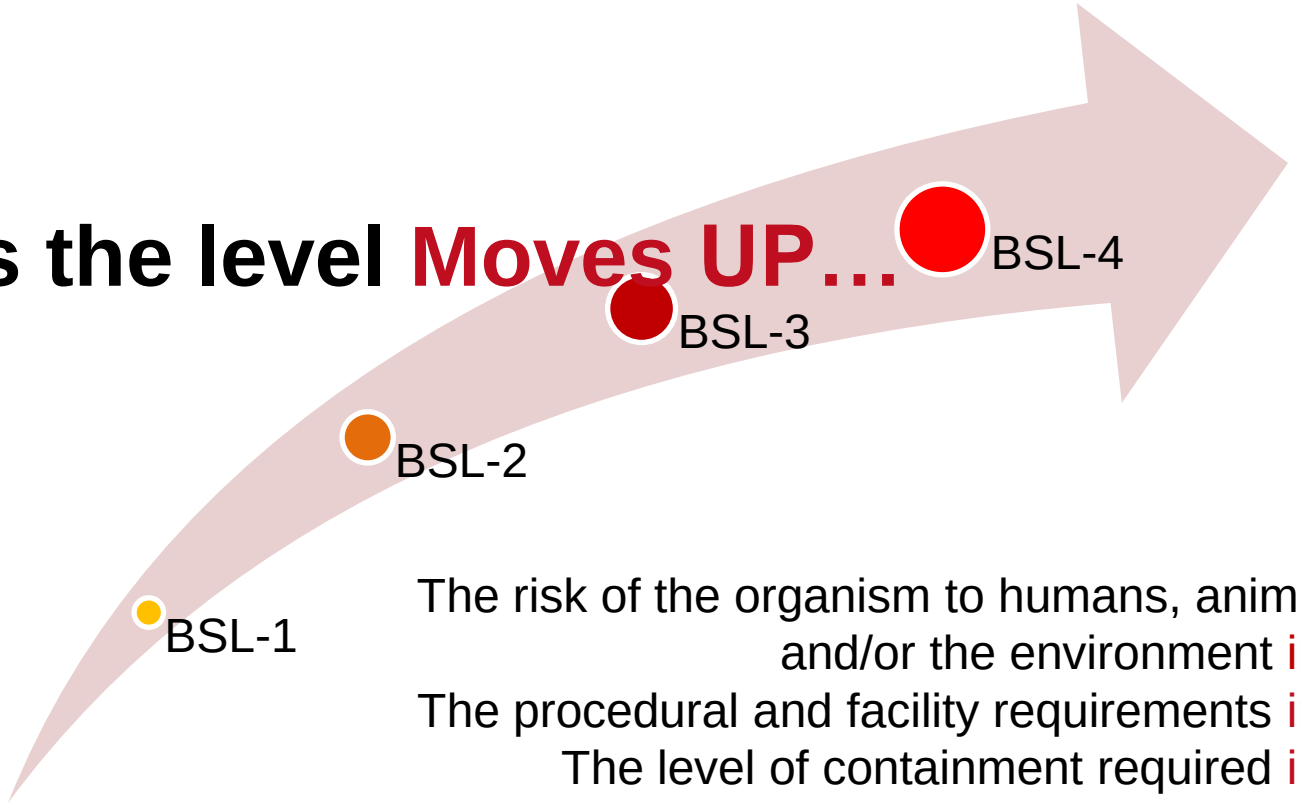
As a general rule, a biosafety level should be used that matches the highest RG classification of the organisms involved.

Biosafety levels of containment

There are four Biosafety Levels:

BSL	Practices	Safety Equipment (Primary Barriers)	Facilities (Secondary Barriers)
1	Standard microbiological practices	None required	Open bench top, sink required
2	BSL-1 practices plus: • Limited access • Biohazard warning signs • Sharps precautions • Biosafety manual defining details of program such as safe practices, PPE use, waste disposal, decontamination and sterilization practices, etc.	Primary barriers: • Class I or II biosafety cabinets or other physical containment devices used for all manipulations of agents that cause splashes or aerosols of infectious materials PPE: • Laboratory coats, gloves, face protection as needed	BSL-1plus: • Non-fabric chairs and other furniture easily cleanable • Hand washing sink • Autoclave available • Eyewash readily available
3	BSL-2 practices plus: • Controlled access • Decontamination of all wastes • Decontamination of lab clothing before laundering • Baseline serum	Primary barriers: • Class I or II biosafety cabinets or other physical containment devices used for all manipulations of agents PPE: • Laboratory coats, gloves, respiratory protection as needed	BSL-2 plus: • Physical separation from access corridors • Hands-free handwashing- sink • Self-closing double door access • Exhaust air not recirculated • Negative airflow into laboratory • Eyewash readily available in lab
4	BSL-3 practices plus: • Clothing change before entering • Shower on exit • All material decontaminated on exit from facility	Primary barriers: • All procedures conducted in Class III biosafety cabinets or Class I or II biosafety cabinets in combination with full-body, air supplied positive pressure suit	BSL-3 plus: • Separate building or isolated zone • Dedicated supply/exhaust, vacuum and decontamination system

Biosafety levels of containment



- The risk of the organism to humans, animals, plant and/or the environment increases.
- The procedural and facility requirements increases.
- The level of containment required increases.
- The degree of protection for personnel, the environment and the community increases.

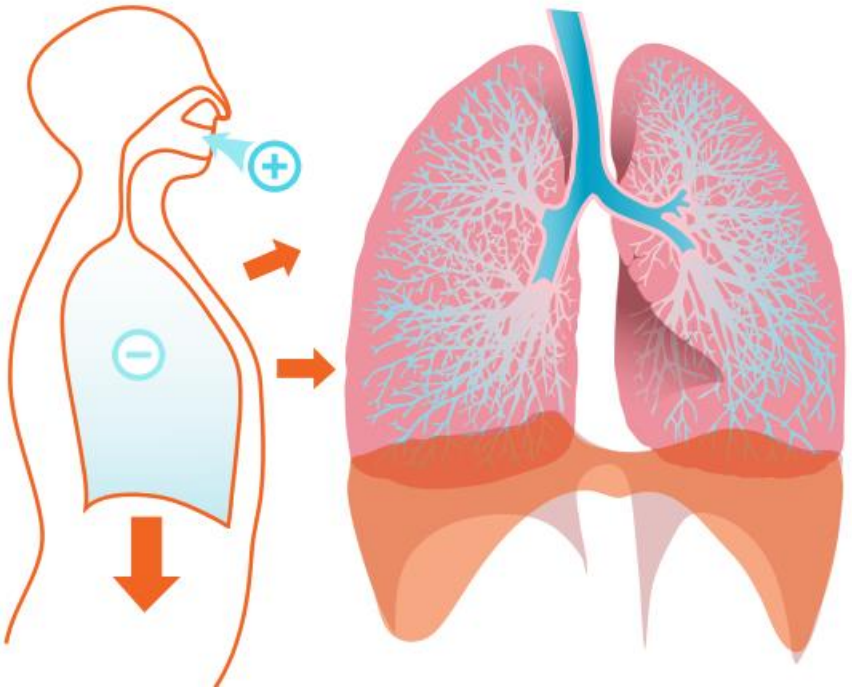
For specific information on Biosafety levels, please read the included narrative.

Routes of transmission

- **Skin and Mucous Membrane:** Contact with biohazardous materials can cause absorption through the skin or mucous membrane.
- **Percutaneous Inoculation:** Biohazardous materials may enter the body if the skin is penetrated or punctured by contaminated objects.

Routes of transmission, continued

- **Ingestion:** Biohazardous martials that inadvertently get into the mouth and are swallowed could result in infection of individuals.
- **Inhalation:** Inhalation hazards are a major route of exposure that occurs when biohazardous materials (e.g. in the form of vapors, gases, mists, or particulates) enter into the respiratory system.



Containment

The term “containment” is used to describe safe methods for managing infectious agents in the laboratory environment.

The three elements of containment include **laboratory practice and technique, safety equipment, and facility design.**

Containment can be classified as:

- **Primary Containment:** The protection of personnel and the immediate laboratory environment from exposure to infectious agents.
- **Secondary Containment:** Protecting the laboratory’s external environment from exposure to infectious materials.

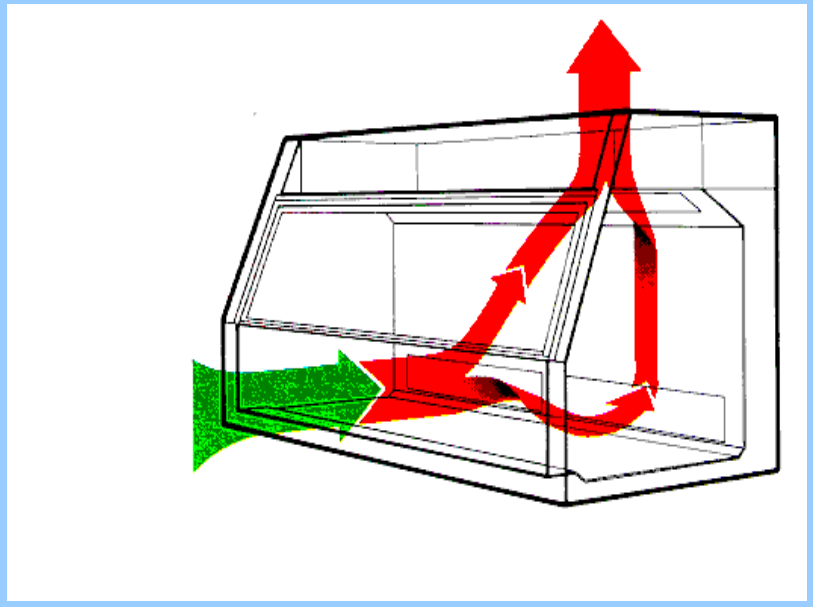
Types of Biological Safety Cabinets

- Biological safety cabinets
  - Class I
  - Class II
  - Class III

Class I Biological safety cabinets

- Open fronted
- Provides only worker protection

  NOT product protection

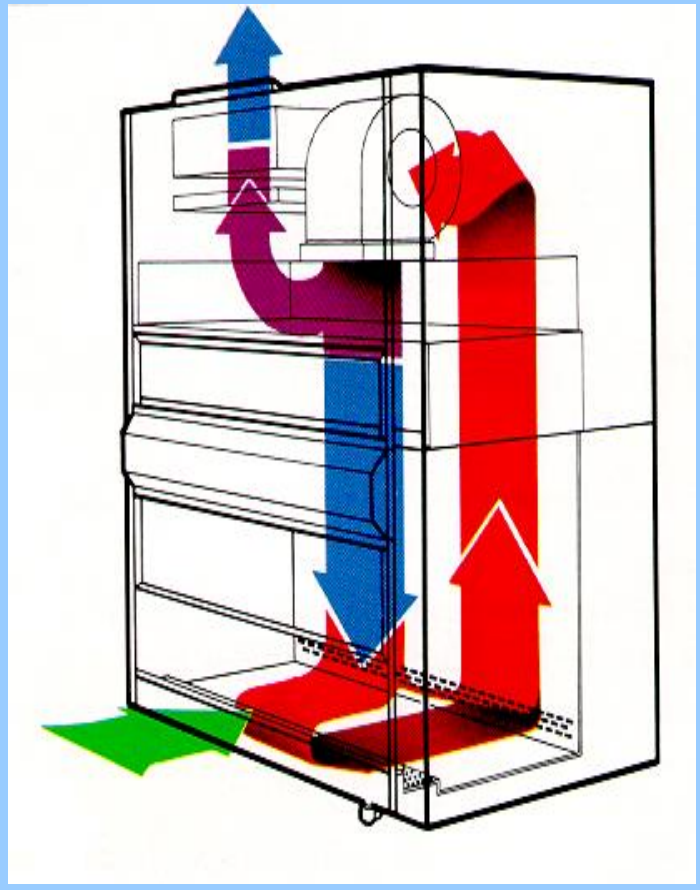


Ambient Air

Contaminated Air

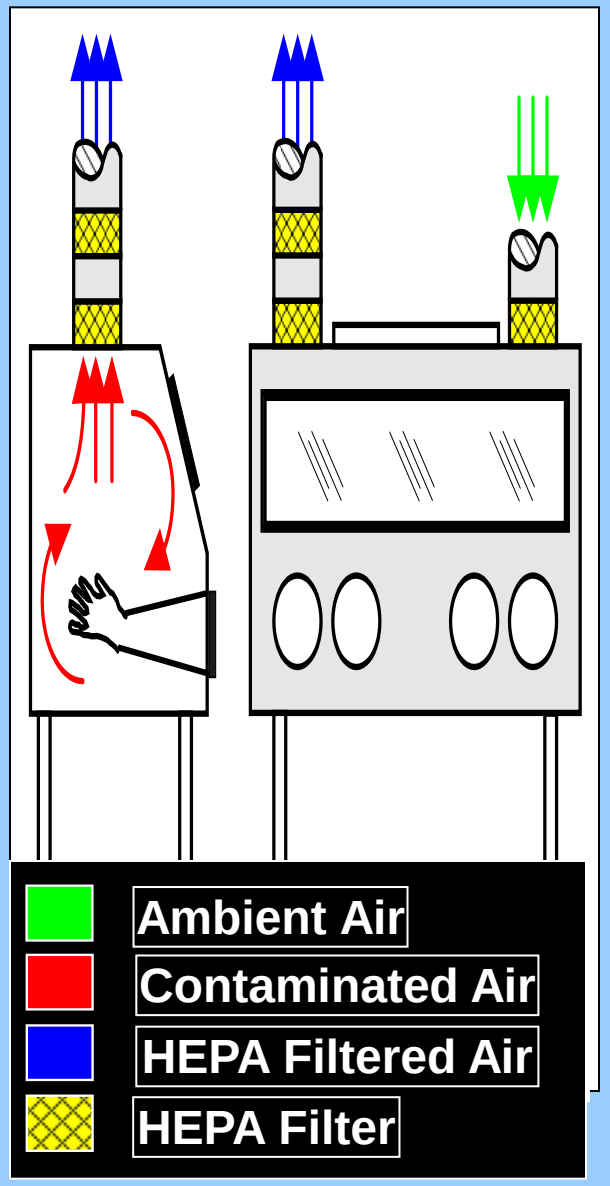
Class II Biological safety cabinets

- Provides HEPA-filtered, recirculated airflow within the cabinet
- Exhaust air is HEPA-filtered
- Provides personnel and product protection



Class III BSC

1. Ventilated cabinet - totally enclosed
2. Both supply and exhaust air are HEPA-filtered
3. Provides both personnel and product protection



Reference

1-Astuto-Gribble, L.M. & Caskey, S.A. 2014. Laboratory Biosafety and Biosecurity Risk Assessment Technical Guidance Document (No. SAND2014- 15939R). Sandia National Lab. (SNL-NM), Albuquerque, NM (United States).

2-World Health Organization Staff & World Health Organization. 2004. Laboratory biosafety manual. 3 rd. ed. World Health Organization