



Biosafety Levels

Laboratory Locations

BSL-1: high schools, community colleges, municipal drinking water treatment facilities.

BSL-2: local health departments, universities, state laboratories, private laboratories (hospitals, health care systems), industrial laboratories (clinical diagnostic companies)

BSL-3: state health departments, universities, private companies, industry, the federal government (NIH, CDC)

BSL-4: only 15 facilities in the US

- 9 federal (CDC, NIH), 4 universities (Georgia State University, University of Texas Medical Branch), 1 state, 1 private.
- Renovations are underway at several labs, new facilities proposed at additional sites.

1. Biosafety Level -1 (BSL-1)

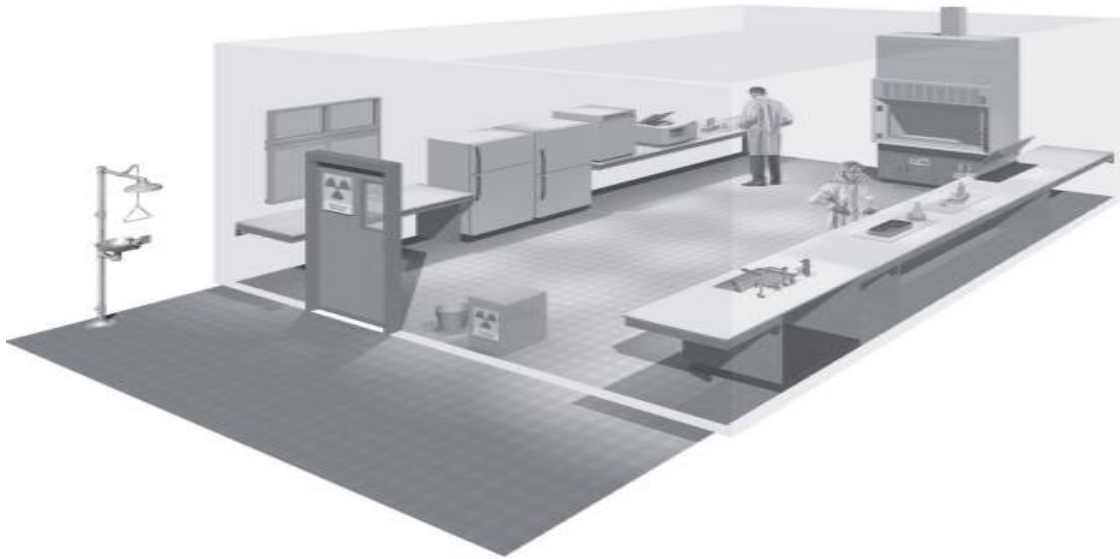
Biosafety Level 1 (BSL-1)

- Work with **microorganisms not known to consistently cause disease** in healthy adult humans
- Basic level of containment:
 - Standard microbiological practices
 - No special primary or secondary barriers recommended (other than a sink for hand washing)
 - No special practices

Biosafety Level 1 (BSL-1)

Design

- Access controls
- Sinks
- Impervious bench tops
- Easily cleaned surfaces
- Adequate illumination



Organisms

The common organisms that require Biosafety Level-1 containment include less hazardous organisms like *Agrobacterium radiobacter*, *Aspergillus niger*, *Bacillus thuringiensis*, *Escherichia coli* strain K12, *Lactobacillus acidophilus*, *Micrococcus leuteus*, *Neurospora crassa*, *Pseudomonas fluorescens*, *Serratia marcescens*.

2. Biosafety Level-2 (BSL-2)

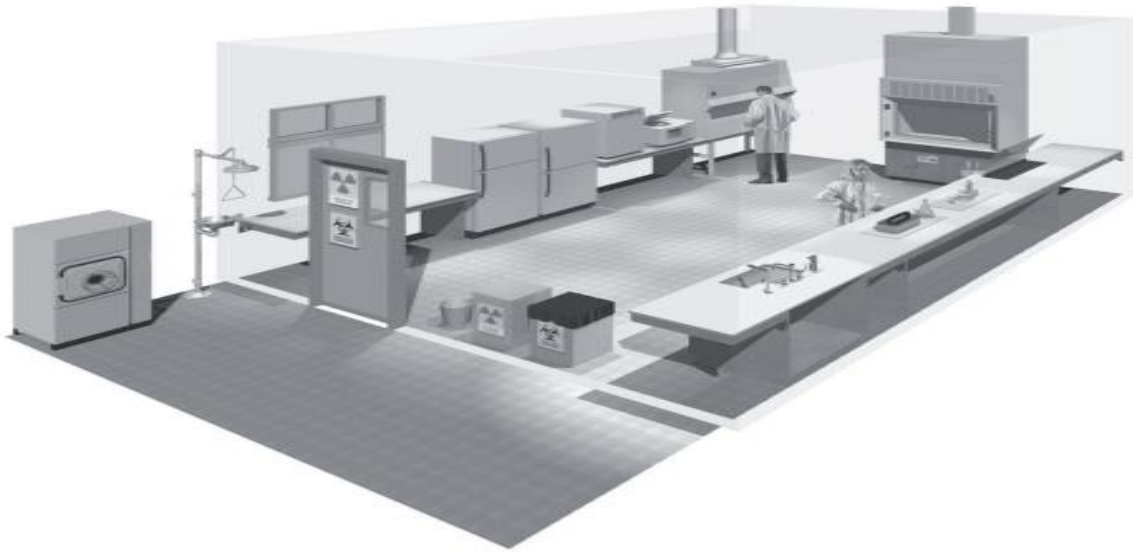
Biosafety Level 2 (BSL-2)

- Work with **moderate-risk microorganisms** and agents (i.e. Hepatitis B virus, HIV, Salmonella, etc.)
- Basic level of containment:
 - Standard microbiological practices
 - Secondary barriers (i.e. hand washing sinks, segregated waste, BSCs available)
 - Special practices (i.e. immunization program, access controls)

Biosafety Level 2 (BSL-2)

Design

- Lockable doors
- Sinks with hands-free operation
- Impervious bench tops resistant to moderate heat & organic solvents
- Easily cleaned surfaces
- Eyewash available
- BSCs installed properly; away from doors



Organisms

The organisms that require BSL-2 laboratories include the pathogenic strains of *E. coli*, *Staphylococcus*, *Salmonella*, *Plasmodium falciparum*, *Toxoplasma*, Measles, Mumps, Rubella and Herpes Simples Viruses.

3. Biosafety Level-3 (BSL-3)

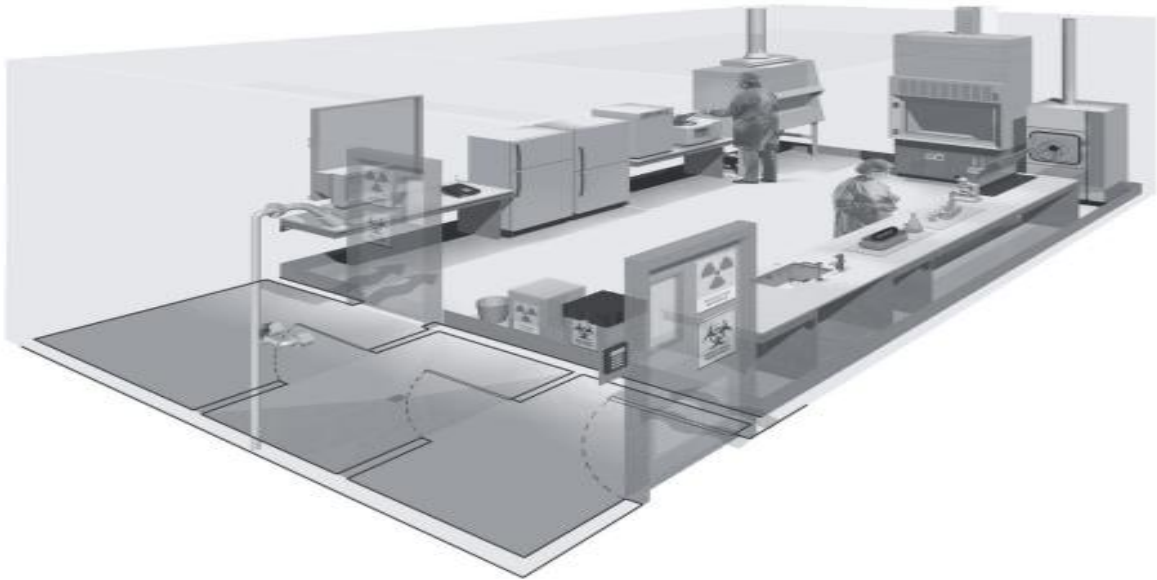
Biosafety Level 3 (BSL-3)

- Work with **indigenous or exotic agents with potential for respiratory transmission**; may cause serious or lethal infection (i.e. *Mycobacterium tuberculosis*, St. Louis encephalitis virus, and *Coxiella burnetii*)
- Basic level of containment:
 - Standard microbiological practices
 - Secondary barriers (i.e. BSCs required, directional air flow, anti-room entry)
 - Special practices (i.e. restricted access, solid front lab coat, autoclave required)

Biosafety Level 3 (BSL-3)

Design

- Restricted access; lockable doors – emergency “open”
- Sealed windows
- Hands-free sink near door
- Surfaces resistant to chemicals
- Monolithic floor; sealed room penetrations
- Ducted exhaust
- Decontamination method available



Organisms

The pathogens that require BSL-3 laboratories include HIV, H1N1 flu, *Yersinia pestis*, *Mycobacterium tuberculosis*, Coronavirus, Rabies Virus, West Nile Virus, Ricketts, etc.

4. Biosafety Level 4 (BSL-4)

Biosafety Level 4 (BSL-4)

- Work with **dangerous and exotic agents that pose a high individual risk of life-threatening disease**; may be transmitted via aerosols; no available vaccine or therapy (i.e. Ebola, Marburg)
- Basic level of containment:
 - Standard microbiological practices
 - Secondary barriers (i.e. BSCs, personal protective suits or Class III BSCs, directional air flow)
 - Special practices (i.e. isolated/restricted access facility, sealed rooms, treated waste)

Biosafety Level 4 (BSL-4)

Types

- Class III biosafety cabinets (cabinet line)
- Personal protective suits (suit lab)

Design

- Isolated facility; separate building
- Daily inspections of containment parameters
- Restricted access
- Changing rooms & showers
- Double door autoclaves
- All room penetrations sealed

Biosafety Level 4 (BSL-4)

Design

- ***Dedicated non-re-circulating ventilation***
- ***HEPA filtered supply and double HEPA filtered exhaust air***
- ***Occupants wear one-piece personal protection suits***
- ***Redundant systems***

Biosafety Level 4 (BSL-4)



Biosafety Level 4 (BSL-4)



Organisms

The BSL-4 level pathogens include the risk group IV organisms like Ebola virus, Central European Encephalitis virus, Hemorrhagic viruses, etc.

Note: To understand the previous homework question, you should see the link below:

- <https://microbenotes.com/biosafety-levels/>