



Biosafety Levels

BIOSAFETY LEVELS (BSL)

- There are four levels of biosafety used to designate and regulate lab work with microorganisms.
- Each level is designed to prevent lab-acquired infections and to protect the environment from potentially hazardous agents.
- The higher the level of the biosafety lab, the more stringent the level of protection required to work in these areas.

BSL-1: Microorganisms not known to cause disease in healthy adult human beings.

- Potential hazards to laboratory personnel and the environment are minimal.
- Work is conducted on open bench tops using standard microbiological practices (lab coats, safety glasses and gloves).
- Lab personnel have specific training in the procedures conducted in the lab and are supervised by a scientist with general training in microbiology or a related science.
- BSL-1 labs are located in high school and college-level biology and chemistry classrooms and research institutions.

BSL-2: Microorganisms of moderate potential hazard to personnel and the environment.

- Lab personnel have specific training in handling pathogenic agents and are supervised by scientists competent in handling infectious agents and associated procedures.
- Access to the lab is limited when work is being conducted.
- All procedures in which infectious aerosols or splashes may be created are conducted in biological safety cabinets or other physical containment equipment.
- BSL-2 labs are located in research institutions, essentially all hospitals, and medical and veterinary schools.
- **An example of a microorganism that would be studied in a NBAF BSL-2 lab is the inactivated virus that causes foot and mouth disease.**

BSL-3: Microorganisms present in the United States, and foreign and emerging agents that may cause serious consequences in livestock but are not harmful to human beings because of available protective measures.

- Lab personnel have specific training in handling pathogenic microbes potentially lethal to animals and are supervised by trained scientists who are experienced in working with these agents and associated procedures.
- Access to the lab is controlled (i.e., card reader for entry; self-sealing, double door access, etc.)
- All procedures involving the manipulation of infectious materials are conducted within biological safety cabinets or other physical containment devices, or by personnel wearing appropriate personal protective clothing and equipment.
- BSL-3 labs have special engineering and design features to enhance safety.
- BSL-3 labs are located in research institutions, hospitals, and medical and veterinary schools.
- **An example of a microorganism that would be studied in a NBAF BSL-3 lab is the live virus that causes foot and mouth disease in cloven-hoofed animals.**



BSL-4: Microorganisms that pose a high risk of life-threatening disease and for which there is no known vaccine or therapy.

- Lab personnel have specific and thorough training in handling extremely hazardous infectious agents and fully understand all containment functions, practices, equipment and lab design characteristics.
- Lab personnel are supervised by trained scientists who are experienced in working with the microorganisms and with associated procedures.
- Access to the lab is strictly controlled. The facility is in a controlled area within a building, which is completely isolated from all other areas.
- There are four BSL-4 facilities currently operating in the United States in populated urban areas: Atlanta, Georgia; Fort Detrick, Maryland; Galveston, Texas; and San Antonio, Texas. There has never been a public exposure at a BSL-4 lab in the United States.
- **Examples of microorganisms that could possibly be studied in a NBAF BSL-4 lab include Nipah and Hendra viruses, both of which are emerging zoonotic diseases that can spread from their natural reservoir to human beings, and are often fatal.**