

BIOLOGICAL SAFETY

Introduction

The following sections provide general safety guidelines and procedures for biological safety. This chapter covers the following topics:

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For more detailed information and resources, please visit the EH&S [Biological Safety](#) web page.

Biosafety Principle

Biological hazards include e.g., pathogenic microbes (human, animal or plant pathogens), toxins, venoms, human blood, certain body fluids, cells/tissues, recombinant deoxyribonucleic acid, and genetically modified agents. Biological safety (i.e., biosafety) or biohazard control is management of biological hazards through proper application of engineered containment and administrative controls. The term containment refers to a series of safe methods for managing infectious agents in the laboratory. The purpose of containment is to reduce or eliminate human and environmental exposure to potentially harmful agents. The primary principle of biosafety is thus containment.

Primary and Secondary Containment

There are two levels of biological containment: primary and secondary. Primary containment protects people and the immediate laboratory environment from exposure to infectious agents. Good microbiological techniques and safety equipment provide sufficient primary containment. Examples of primary barriers include safety equipment such as biological safety cabinets (BSCs), enclosed containers, and safety centrifuge cups. Occasionally, when it is impractical to work in BSCs, personal protective equipment, such as laboratory coats and gloves may act as the primary barrier between personnel and infectious materials.

Secondary containment protects the environment external to the laboratory from exposure to infectious materials. Good facility design and operational practices provide secondary containment. Examples of secondary barriers include work areas that are separate from public areas, decontamination facilities, hand-washing facilities, special ventilation systems, and airlocks.

Elements of Containment

Ultimately, the three key elements of biological containment are:

- 1) laboratory practices,
- 2) safety equipment, and
- 3) facility design.

To ensure minimal exposure, employees must assess the hazards associated with their work and determine how to apply the biosafety principle appropriately.

IMPORTANT:

Employees working with infectious agents or potentially infectious materials must be aware of the hazards associated with their work. Employees must be trained and proficient in biosafety procedures and techniques.

General Biosafety Guidelines

Biohazardous materials require special safety precautions and procedures. Follow the guidelines below when working with infectious agents:

Clothing Guidelines:

- Always wear appropriate [Personal Protective Equipment](#) (PPE) such as a laboratory coat, gloves, and a mask, if applicable, when working with infectious agents or infected animals. Add boot/shoe covers and eye protection/face shields when necessary.
- Wear gloves over laboratory coat cuffs.
- Never wear contact lenses when working with infectious agents.
- Do not wear potentially contaminated clothing outside the laboratory area.

Remove contaminated clothing as follows:

- Remove boot/shoe covers.
- Remove gloves by peeling them from the inside out. Do not let the glove to make a snapping sound since that would splash any material on the glove's surface to the air.
- Take off eye protection/face shield.
- Remove overall clothing protection. If clothing protection will be reused, hang in approved, controlled area. Otherwise discard.
- Remove mask/respirator by untying or lifting the straps up and over from the back of your head and away from your face.
- Properly dispose used personal protective equipment in containers lined with a red biohazard bag and marked with the biohazard symbol. These containers must be closeable and prevent leakage during collection, handling, processing, storage, transport, or shipping.

Infectious Agents Handling Guidelines:

- Use mechanical pipetting devices and minimize aerosol production.
- Add disinfectant to water baths for infectious substances.
- Use sealed rotors, sealed buckets, or a guard bowl cover complete with gasket as well as safety centrifuge tubes (tube or bottle carrier with sealable cap or "O" ring cap) for potentially infectious samples or otherwise hazardous samples. Before use, the tubes should be checked for cracks. Always wait at least 10-30 minutes after the centrifuge has completely stopped to allow any aerosolized leakage to settle, especially if the samples are potentially infectious.
- Always use secondary leak-proof containers when transporting samples, cultures, inoculated Petri dishes, and other containers of biohazardous materials.

Working with Sharps Guidelines:

- To avoid accidental sticks, place hypodermic needles directly into the sharps containers and do not recap, bend, break, clip, or remove from disposable syringes.
- Use needle-locking or disposable needle units.
- Do not attempt to treat (decontaminate) sharps yourself for any biohazard.
- Do not allow the containers to become overfilled. They should not be more than $\frac{3}{4}$ full when picked up.
- Do not force anything into a sharps container. If it is full, start a new one.
- Never put your hands in a used sharps container.
- Do not dispose of these containers with the regular trash or incinerate them. Contact the EH&S Office at 817-272-2185 for disposal!

Personal Hygiene Guidelines:

Do not touch your face when handling biohazardous materials!

Wash your hands thoroughly:

- after working with any biohazard.
- after removing gloves, laboratory coat, and other contaminated protective clothing.
- before leaving the laboratory area.
- before eating, drinking, or applying cosmetics (never eat, drink, or apply cosmetics in the work area!)

Work Area Guidelines:

Ensure that warning signs are posted on laboratory doors if biohazardous agents are handled in the laboratory. These signs should include the universal biohazard symbol and the approved biosafety level for the laboratory. EH&S maintains a register of all laboratories and personnel working with infectious agents and provides appropriate warning signs after receiving [Human Pathogen Registration](#).

- Keep laboratory doors shut when experiments involving biohazardous agents are in progress and limit access to laboratory areas when unoccupied.
- Protect house vacuum system during aspiration of infectious fluids by collecting contaminated fluids into a suitable decontamination solution. An in-line HEPA filter is used to protect the vacuum system from aerosolized microorganisms.
- Decontaminate work surfaces daily and after each spill.
- Decontaminate all potentially contaminated equipment and completely decontaminate equipment before having maintenance or repair work done.
- Transport contaminated materials in leak-proof containers.
- Keep miscellaneous materials (i.e., books, journals, etc.) away from contaminated areas.

Universal Precautions:

[Universal precautions](#) is a method of infection control—recommended by the Centers for Disease Control and Prevention (CDC)—in which all human blood, certain body fluids, as well as fresh tissues and cells of human origin are handled as if they are known to be infected with human immunodeficiency virus, hepatitis B virus, and/or other bloodborne pathogens. The universal precautions include specific recommendations for use of gloves, gowns, masks, and protective eyewear when contact with blood or body secretions containing blood is anticipated. (see [Exposure Control Plan for Bloodborne Pathogens](#))