

University of Pittsburgh Safety Manual	EH&S Guideline Number: 05-003	
Subject: BIOSAFETY GUIDELINES AND BIOSAFETY LEVELS	Effective Date 07/19/2021 Review Date 01/16/2025	Page 1 of 7

BIOSAFETY GUIDELINES

The University intends to comply with all aspects of biosafety practice presented by CDC, NIH, and US Department of Health and Human Services in the latest published editions of [Biosafety in Microbiological and Biomedical Laboratories](#) and the [NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules](#).

Biological materials at the University shall include, but are not limited to:

- All human body fluids;
- Any unfixed tissue or organ other than intact skin from a human (living or dead);
- Human cell lines or cultures, human tissue cultures, human organ cultures;
- Non-human primate blood, body fluids or other tissues;
- Blood, body fluids or other tissues from experimental animals infected with microorganisms capable of causing disease in healthy adults;
- Liquid or solid culture medium or other materials containing biological agents capable of causing disease in healthy adults;
- Liquid or solid culture medium or other materials containing or potentially contaminated with recombinant or synthetic nucleic acid molecules;
- Samples from animals experimentally exposed to recombinant or synthetic nucleic acid molecules.

Strict adherence to standard microbiological practices and the use of Standard Precautions, defined as the assumption that all biological material contains potentially infectious agents, must be followed.

STANDARD PRECAUTIONS

The following listing of basic biosafety guidelines is considered fundamental to safe laboratory practice, but should not be viewed as comprehensive.

1. Mechanical pipetting aids shall be used when pipetting all material. Mouth pipetting is prohibited regardless of the material or manipulation.
2. Eating, drinking, storing food, expressing breast milk, handling contact lenses and applying cosmetics are not permitted in laboratory areas. Food should not be stored in refrigerators or freezers used to store biohazardous material.

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3. Plants and/or animals not associated with the work being performed are not permitted in the laboratory.
4. Hands must be washed immediately after procedures involving biological material manipulation or handling, after glove removal and routinely before leaving the laboratory. All labs using biological materials must be equipped with a sink having hot and cold running water dispensed by a mixing faucet, and have soap and disposable hand towels immediately accessible.
5. Workers should decontaminate their work area following work with biological material and immediately after any spill.
6. Liquid-barrier gloves should be worn to protect faculty, staff and students from infection through contact with biological materials. Gloves must be removed prior to exiting the laboratory.
7. Procedures for the safe handling of sharps must be instituted, and efforts should be made to minimize exposure to potentially infectious material through the evaluation and use of safety-engineered sharps.
8. Laboratory coats or gowns should be worn while handling biological material. All protective equipment and laboratory garments must not be worn outside the laboratory. Laboratory clothing must be disinfected or clearly labeled as potentially infectious or dirty before removal from the laboratory.
9. All procedures should be performed in a manner that reduces the generation of aerosolized material. Operations such as centrifugation, sonication, and blending are known aerosol-generating procedures. Procedures or activities expected to produce potentially infectious aerosols must be performed in a certified biological safety cabinet or other equipment with integral engineering controls to contain aerosolized material.

PROCUREMENT OF BIOLOGICAL AGENTS

All biological agents will be procured through a vendor approved by the University Purchasing Department. A University procurement card (P-Card) cannot be used to procure the following: controlled substances, drugs, prescriptions, gases, or radioactive materials.

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BIOSAFETY GUIDANCE FOR PRINCIPAL INVESTIGATORS

1. The Principal Investigator (PI) is responsible for training his/her personnel on the potential hazards of the specific agents involved in the research, and the specific techniques to be used to handle the material safely. The Biosafety Officer is available for consultation and assistance.

2. The Principal Investigator is responsible for proposing the Biosafety Level (BSL) for the research/teaching project and associated handling of biological materials. The Biosafety Level is the combination of lab practices, safety equipment and laboratory facilities specifically appropriate for the operations performed, the agents handled and the laboratory function. The BSL assignment will be reviewed and approved by the Biosafety Officer and if recombinant DNA is involved, the Institutional Biosafety Committee.
 - 2.1 The first step in Biosafety Level (BSL) determination is to investigate if a BSL or risk group has previously been assigned for the proposed biological agent.
 - 2.1.1 Current BSL assignments can be found in the latest editions of [Biosafety in Microbiological and Biomedical Laboratories](#), Health and Human Services, or the World Health Organization's [Laboratory Biosafety Manual](#).
 - 2.1.2 These BSLs were assigned assuming activities typically associated with the growth and manipulations of the quantities and concentrations of infectious agents required to accomplish identification or typing. If the protocol requires higher concentrations, larger volumes, or practices likely to endanger personnel, the BSL assignment may be increased.
 - 2.2 For purposes of recombinant DNA, risk groups are assigned based on the relative pathogenicity of an agent to healthy adults. Most often, risk group assignments equate to BSL, i.e. agents in risk group 2 are assigned to BSL-2. Risk Group assignments can be found in the Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules, NIH Guidelines.
 - 2.2.1 Risk group assignment should be used as a starting point for determining the BSL, but a thorough consideration of the agent and how it is to be manipulated must also occur. Factors to be considered in determining the BSL include agent factors (such as virulence, pathogenicity, infectious dose, environmental stability, route of spread, communicability, quantity, and the availability of vaccine or treatment), and gene product effects (such as toxicity, physiological activity, and allergenicity).
 - 2.2.2 Any strain that is known to be more hazardous than the parent (wild-type) strain should be considered for handling at a higher containment level. Certain attenuated strains or strains that have been demonstrated to have irreversibly lost known virulence factors may qualify for a reduction of the containment level compared to the risk group assigned to the parent strain.

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- 2.3 If the biological agent is not listed in these references, then the PI must assign a BSL using the best available information. Assistance in assigning BSLs is available from the Biosafety Officer, the Institutional Biosafety Committee, and the Biohazards Committee.

BIOSAFETY LEVELS

There are four internationally accepted biosafety levels. These levels represent a combination of laboratory practices, techniques, protective equipment and facility features.

1. Biosafety Level 1 (BSL-1)

- 1.1 Agents handled at BSL-1 are most often viable microorganisms not known to cause disease in healthy adults. Agents handled at BSL-1 are often used in undergraduate teaching laboratories and work with these agents may usually be performed on open laboratory benches.
- 1.2 BSL-1 practices and facilities represent a basic level of containment that relies on standard good microbiological practices, including those described in the Standard Precautions section, with no primary or secondary engineering barriers.
- 1.3 A sink for hand washing is required within the laboratory. Special containment equipment is not usually required for manipulations of agents at Biosafety Level 1.
- 1.4 An eyewash station should be readily available in the laboratory.
- 1.5 Biohazard warning signs indicating BSL-1 can be posted on entrances.

2. Biosafety Level 2 (BSL-2)

- 2.1 Agents handled at BSL-2 are moderate-risk, viable microorganisms associated with human diseases of varying severity in healthy adults. These agents can be hazardous through various exposure routes, but not inhalation. The vast majority of research with biological agents at the University is conducted at BSL- 2.

BSL-2 is necessary when work is performed using human-derived blood, body fluid, or tissues and using human cell lines where the presence of an infectious agent is unknown.
- 2.2 Biosafety Level 2 practices and techniques shall include all the standard microbiological practices used for Biosafety Level 1, in addition to limiting access to the laboratory.
- 2.3 Biohazard warning signs must be posted at each entrance to limit access to authorized individuals, provide contact and agent information, and indicate BSL-2 hazards.

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2.4 Primary barriers including certified biological safety cabinets are required for aerosol-generating manipulations of agents assigned to Biosafety Level 2 and should be used for tasks that pose a splash risk to personnel.

2.5 An autoclave must be accessible for decontamination of infectious waste generated in BSL-2 facilities.

2.6 All BSL-2 facilities must be maintained under negative pressure relative to corridors and adjacent public areas, and must have exhaust air that is not re-circulated.

2.7 Special practices required for work with Biosafety Level 2 agents include decontamination of all infectious material prior to disposal and implementation of an accident/incident plan that details exposure follow-up procedures and methods to clean up spills.

2.8 Biosafety Level 2+ (BSL-2+) is a combination of BSL-2 facility containment requirements with the utilization of BSL-3 practice requirements that includes the preparation of a laboratory operations manual and restricted laboratory access. BSL-2+ is required at the University of Pittsburgh for work with lentiviral agents, such as HIV and SIV, and recombinant DNA work with certain lentiviral-based vectors. See the Lentiviral Usage SOP for more information on the requirements for BSL-2+.

3. Biosafety Level 3 (BSL-3)

3.1 Infectious agents handled at Biosafety Level 3 are high-risk, viable microorganisms associated with human diseases that are potentially lethal, and are hazardous through exposures resulting from autoinoculation, ingestion, mucous membrane exposure, and particularly through inhalation.

3.2 Biosafety Level 3 practices and techniques include all standard microbiological practices used for Biosafety Levels 1 and 2 in addition to limiting laboratory access to only those personnel required for the program and who have been trained in potential hazards of and control measures for the specific agent.

3.2.1 Required training for all personnel working in BSL-3/ABSL-3 facilities at the University shall consist of successful completion of 1) an online self-study training course with accompanying quizzes; 2) a live training session to address critical facility specific BSL-3/ABSL-3 work practices, safety and emergency response information; and 3) mentored observation of demonstration of proficiency in facility and/or activity-specific procedures.

3.3 Operational procedures for BSL-3 activity must be prepared, documented, and maintained in an operating Manual approved by the Biohazards Committee and DLAR Senior Executive or designee, and additionally approved and signed by a Biosafety Officer. It is the responsibility of the Principal Investigator of the BSL-3/ABSL-3 facility to develop

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and maintain this Manual. Copies of the Manual will be kept by the Principal Investigator, facility director (if different from the PI), EH&S, and if animals are utilized, the Division of Laboratory Animal Resources (DLAR). At a minimum, the Manual must contain the following components:

- Approval Page signed by Principal Investigator, EH&S Biosafety Officer, and, if animals are utilized, the DLAR Director
- User Acknowledgement Sheet
- Emergency Contact Numbers
- List of agents used in the facility and locations of use and storage
- Facility entrance requirements
- List of training requirements and records of training for all current personnel
- List of medical surveillance requirements for personnel and proof that personnel have met current requirements
- Standard Operating Procedures and BSL-3 work practices (e.g., agent handling, PPE, waste handling and disposal)
- Emergency procedures (e.g., spill, fire, personal injury)
- Autoclave verification program
- SDSs for hazardous chemicals and infectious materials
- Annual reverification procedures and reports of activities for same
- Other items as deemed necessary by the Biohazards Committee

3.4 Appropriate personal protective equipment is required for all manipulations of agents assigned to Biosafety Level 3 including at a minimum, appropriate lab clothing, liquid barrier gloves, respiratory protection, and safety glasses.

3.5 All personnel authorized and trained to enter BSL-3 laboratories must be enrolled in the University's Respiratory Protection Program and the University's Occupational Health Screening program for BSL-3 workers.

3.6 All manipulations of infectious agents in a BSL-3 facility are performed in certified biological safety cabinets.

3.7 An autoclave must be available for decontamination of infectious waste and all other materials before removal from the BSL-3 containment area.

3.8 A spill cleanup kit containing materials to contain, disinfect, and clean up laboratory spills must be available in the BSL-3 containment area.

3.9 The University has adopted design guidelines and specific commissioning criteria for BSL-3 facilities. Contact EH&S for more information.

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4. Biosafety Level 4 (BSL-4)

Infectious agents handled at Biosafety Level 4 are extremely high-risk, viable microorganisms associated with dangerous and exotic life-threatening human diseases. Because of the lack of appropriate facilities and restriction by law, experiments involving agents that require Biosafety Level 4 containment facilities, and/or experiments involving nonindigenous pathogens with importation, possession or use prohibitions or restrictions (as defined by Federal regulation or administrative policies) are not permitted to be undertaken on the premises of the University of Pittsburgh.