



BSL-2 Laboratory Overview

Purpose

The purpose of this document is to assist laboratory managers, supervisors, and principal investigators (PIs) in conducting safe and compliant research in biosafety level 2 (BSL-2) laboratories. This document will outline basic requirements and responsibilities set forth by governmental regulation, official guidance documents, and university policy.

Responsibilities

Laboratory managers, supervisors, and principal investigators are responsible for maintaining safe and compliant laboratory spaces as well as ensuring all applicable local, state, and federal regulations are observed.

The UMBC Department of Environmental Safety and Health (ESH) is responsible for assisting laboratory managers, supervisors, and principal investigators maintain a safe and compliant laboratory through the implementation of laboratory safety focused programs including but not limited to: hazardous waste collection, respiratory protection, biosafety cabinet (BSC) recertification, fume hood inspections, emergency shower/eyewash station inspections, door sign generation, SOP review, and laboratory safety audits.

The UMBC Office of Research Protections and Compliance is responsible for assisting laboratories maintain compliance through administrative review of laboratory processes, procedures, and permitting.

Biosafety Level 2 Laboratories

Biosafety levels (BSL) denote specific combinations of laboratory equipment, practices, and laboratory design that are used to achieve certain levels of physical containment. Biosafety level 2 (BSL-2) containment is typically used for agents that pose a moderate hazard to laboratory personnel (e.g. Human cells, blood, RG-2 material). Lower risk agents in high concentrations or that have a high potential for aerosol production may also require BSL-2 containment based on a thorough risk assessment. Basic characteristics of BSL-2 laboratories are as follows:

Standard & Special Practices

- Standard microbiological and laboratory safety practices are followed.
- A safety manual specific to the facility is prepared or adopted.
- The laboratory supervisor enforces the institutional policies that control safety in and access to the laboratory.
- Laboratory personnel are provided medical surveillance as needed, and offered available immunizations for agents handled or potentially present in the laboratory. Laboratory workers handling human blood, blood products, or potentially infectious materials as defined by 29 CFR 1910.1030 can receive Hepatitis B vaccination free of charge through Retriever Integrated Health.
- Sharps should be avoided in the BSL-2 laboratory when possible. Policies/SOPs for the safe handling of sharps, such as needles, scalpels, pipettes, and broken glassware should be developed, implemented, and followed.
- Properly maintained BSCs or other physical containment devices are used, when possible, whenever procedures with a potential for creating infectious aerosols or splashes are conducted or high concentrations or large volumes of infectious agents are used. BSCs must be installed so that fluctuations of the room air supply and exhaust do not interfere with proper operation. BSCs should be located away from doors, windows that can be opened, heavily traveled laboratory areas, and other possible airflow disruptions. BSCs should be certified annually and whenever the unit is moved.
- Materials may be centrifuged in the open laboratory only when using sealed rotors or centrifuge safety cups with loading and unloading of the rotors and centrifuge safety cups in the BSC or another containment device
- Laboratory equipment is routinely disinfected.
- A method for decontaminating all laboratory waste is available.
- Large spills or safety incidents that may result in exposure to infectious materials are immediately reported as outlined in the UMBC Biosafety Manual.
- Animals and plants not associated with the work being performed are not permitted in the laboratory.

Safety Equipment

- Protective laboratory coats, gowns, or uniforms designed for laboratory use are worn while working with hazardous materials and removed before leaving for non-laboratory areas. Protective clothing is disposed of appropriately or deposited for laundering by the institution. Laboratory clothing is not taken home.
- Protective gloves appropriate for the hazards identified during the risk assessment are used during manipulations.

- Eye protection and face protection (e.g., safety glasses, goggles, mask, face shield, or other splatter guard) are used for manipulations or activities that may result in splashes or sprays of infectious or other hazardous materials. Eye protection and face protection are disposed of with other contaminated laboratory waste or decontaminated after use.
- Respiratory protection may be required as determined by risk assessment.

Facilities

- Self closing doors that can be secured (locked). Access to the laboratory is controlled when work is being conducted.
- The laboratory door sign is in accordance with the UMBC Biosafety Manual. Door signs should include the universal biohazard symbol, name of biohazardous agent(s), Containment level, emergency contact name and phone number, as well as entry and exit requirements (e.g., PPE, handwashing, sign out). Additional door sign information can be found on safety.umbc.edu.
- Sink is present with adequate soap and towels for hand washing.
- An eyewash station is readily available in the laboratory.
- Autoclave or other means for adequate disinfection is readily available.
- Hard, non-porous flooring that is easily decontaminated (no carpet or rugs)
- Chairs are covered with a non-porous material that can be easily decontaminated.
- Screens are placed on laboratory windows that open to the exterior.
- Vacuum lines are protected with liquid disinfectant traps and in-line HEPA Filters or an equivalent.

Training

The laboratory manager, supervisor, or PI is responsible for ensuring that laboratory personnel receive appropriate standard training as well as laboratory specific training regarding their duties, potential hazards, manipulations of infectious agents, necessary precautions to minimize exposures, hazard/exposure evaluation procedures, and that appropriate records are maintained. The laboratory supervisor is responsible for ensuring that laboratory personnel demonstrate proficiency in standard microbiological practices and techniques for working with agents requiring BSL-2 containment.

- All individuals working in BSL-2 laboratories are required to complete the following standard trainings:
 - UMBC Laboratory Safety (provided by CITI and Webnet)
 - Biosafety Complete or modified Training Series (provided by CITI)
 - Hazard Communication Part 1 & 2 (provided by CITI and Webnet)

- NIH Recombinant DNA Guidelines (as needed, provided by CITI)
- Bloodborne Pathogens (Provided by CITI and Webnet, required if working with blood or other potentially infectious materials, must be repeated annually)
- Hazcom1 and Hazcom 2 (Offered Through CITI and Webnet)
- RCRA Hazardous Waste Awareness (Offered Through Webnet)

CITI is self serviced and can be accessed by any UMBC community member. Webnet requires registration that can be created by facility managers or UMBC ESH. Visit <https://safety.umbc.edu/training/> for additional information.

- Laboratory specific training should be provided to laboratory personnel by the laboratory manager, supervisor, or PI based upon an in depth risk assessment.
 - Laboratory specific training can include: proper BSC operation, disinfection procedures, emergency procedures, proper equipment usage, donning/doffing PPE, hazard mitigation, and laboratory specific standard operating procedures (SOPs).
 - Only individuals that have completed laboratory specific training and have adequate experience should be authorized to handle BSL-2 material.

Standard Operating Procedures (SOPs)

SOPs benefit laboratories by reducing errors, increasing efficiencies, and creating a safer work environment. SOPs clarify processes performed in the laboratory and enable users to more easily identify safety issues and possible solutions.

- BSL-2 laboratories should develop or adopt SOPs pertaining to the specific research conducted. SOPs can include but are not limited to: Spill cleanup, material handling and receiving, emergency operations, equipment usage, equipment servicing, procedural actions, material disinfection, equipment cleaning, sharps handling, etc.

Reporting

Spills or accidents occurring in BSL-2 laboratories resulting in an overt exposure must be immediately reported to the PI, ESH, ORPC, and possibly the NIH. The NIH Guidelines state that "...any significant problems, violations of the NIH Guidelines, or any significant research-related accidents and illnesses" must be reported to NIH. Detailed reporting procedures can be found in the UMBC Biosafety Manual. It is important to report any spill, accident, or near miss as this can assist in preventing these occurrences in the future.

Administrative Review

The UMBC Institutional Biosafety Committee (IBC) regularly reviews protocols pertaining to any research or teaching on UMBC campus that involves recombinant DNA, synthetic DNA, transgenic animals, and biohazardous material. IBC approval or registration is **required** for any research, regardless of funding, and teaching labs that involve any of the following:

- Biohazardous material
 - Includes but is not limited to: bacterium, fungi, algae, potentially infectious agents and select agents (as defined in 42 CFR Part 73).
- Non-exempt experiments as defined in the *NIH Guidelines* Section III-A to Section III-E
- Human tissues, fluids, cell lines, and exempt recombinant DNA
 - IRB approval may be required as well
- Animals, animal fluids and animal cell lines (including transgenic animals)
 - IACUC approval may be required as well

Please note that IBC registration is required even if your recombinant DNA research is considered exempt.

Visit <https://research.umbc.edu/umbc-institutional-biosafety-committee-overview/> for more information on protocol submission or contact the Office of Research Protections (ORPC) at 5-2737 or compliance@umbc.edu for questions or assistance.

Blood, Blood products, and Other Potentially Infectious Material

Laboratories working with blood, blood products, or other potentially infectious material as defined by OSHA 29 CFR 1910.1030 are required to abide by BSL-2 containment guidelines as well as observe the following:

- Create or adopt an Exposure Control Plan that conforms with 29 CFR 1910.1030, the UMBC Exposure Control Plan can be found on safety.umbc.edu
- Complete Bloodborne Pathogens (BBP) training. This training must be repeated annually. BBP training is offered through both CITI and Webnet.
- Receive a Hepatitis B vaccination free of charge from Retriever Integrated Health or submit a Hepatitis B Vaccination Declination Form found on safety.umbc.edu prior to handling material.

BSL-2 Enhanced/BSL-2+

Work conducted at BSL2+ usually involves work with biological agents that would normally be conducted at BSL2; however, the work may involve certain conditions which would necessitate an increased amount of precautions. This level of containment necessitates all of the same requirements of BSL-2 laboratories as well as:

- Prohibiting the use of sharps.
- Substituting non-glass containers for glass containers.
- Conducting all procedures within a certified BSC or using other appropriate methods as defined by risk assessment.
- Utilizing additional PPE such as: Double gloves, disposable gowns/tyvek suits, respiratory protection
- Additional in depth laboratory specific training on all approved procedures.
- Medical surveillance as dictated by risk assessment.

A thorough risk assessment must be performed prior to any proposed BSL-2 Enhanced/BSL-2+ work. IBC registration or approval will be necessary prior to starting work.

Reference materials

Biosafety in Microbiological and Biomedical Laboratories (most current edition)

NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules.

29 CFR 1910.1030 (OSHA Bloodborne Pathogens)

UMBC Biosafety Manual

UMBC Exposure Control Plan