Section 7 Bio-Safety Laboratories

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A. Scope

The majority of the criteria presented in this chapter are taken from *Biosafety in Microbiological and Biomedical Laboratories (BMBL), 5th Edition*, authored by the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH). The criteria presented in this chapter are for general-use Biosafety Containment Levels 1, 2, and 3 for biological research laboratories. If vertebrate animals are involved in research with bio-hazardous materials, requirements of animal biosafety laboratories (ABSL), also provided in the BMBL, will apply as well. Furthermore, this chapter does not include Appendix G and Q of the NIH Guidelines for Recombinant DNA research which apply if recombinant DNA research will be performed in the laboratory.

B. Basic Laboratory Design for Bio-Safety Level 1

- 1. Each laboratory should have doors to control access.
- 2. Each laboratory must have a sink for hand washing.
- 3. The laboratories should be designed for easy cleaning.
 - a) Carpets and rugs shall not be used.
 - b) Spaces between furniture and equipment should be accessible for cleaning.
 - c) Furniture must be covered with a non-porous material for easy cleaning.
- 4. Laboratory Furniture must be capable of supporting anticipated loads and uses.
- 5. Bench tops shall be impervious to water, and resistant to acids, alkalis, organic solvents and moderate heat.
- 6. Approved methods for decontamination of infectious or regulated laboratory wastes shall be available (e.g., autoclave, chemical disinfection or other decontamination procedure approved by the University Biosafety Officer (BSO) or designee).
- 7. Windows shall be fixed and not operable unless existing condition requires them to open for ventilation. If operable, they must be fitted with screens.

C. Basic Laboratory Design for Bio-Safety Level 2

In addition to the requirements for a BSL 1 laboratory, the following are required:

- 1. Doors should be self-closing and have locks in accordance with institutional policies.
- 2. The sink for hand washing should be located near the exit door.
- 3. Vacuum lines should be protected with High Efficiency Particulate Air (HEPA) filters. The preferred location of the HEPA filter is in the lab so as to minimize

contamination of vacuum lines. If managed by lab ensure system design supports this approach.

- 4. An eyewash station must be readily available. See Chapter 4 for design details.
- 5. An approved method for decontaminating all laboratory wastes should be available in the facility. Optimize location to minimize travel distance for users.

D. Basic Laboratory Design for Bio-Safety Level 3

In addition to the requirements for a BSL 2 laboratory, the following are required.

- 1. The lab must be separated from areas that are open to unrestricted traffic flow within the building.
- 2. Doors must be self-closing and have locks in accordance with institutional policies.
- 3. Security systems shall be used to control access to the laboratory.
- 4. Access is restricted to entry by a series of two self-closing doors. The space between the two sets of doors can be used as an anteroom.
- 5. The sink for hand washing must be hands-free or automatically operated, and should be located near exit door.
- 6. Floors must be slip resistant, impervious to liquids, and resistant to chemicals. Consider the installation of seamless, sealed, resilient or poured floors, with integral cove base.
- 7. Walls should be constructed to produce a sealed smooth finish that can be easily cleaned and decontaminated.
- 8. Ceilings should be constructed, sealed, and finished in the same manner as walls.
- 9. All windows must be sealed.
- 10. Vacuum lines must be protected with High Efficiency Particulate Air (HEPA) filters. The preferred location of the HEPA filter is in the lab so as to minimize contamination of vacuum lines. If managed by lab ensure system design supports this approach.
- 11. An eyewash station must be readily available in the laboratory.

- 12. A fully ducted supply and exhaust air ventilation system is required. This system must provide sustained directional airflow from "clean" areas toward potentially contaminated areas. The system shall be designed so that under failure conditions, the airflow will not be reversed. In addition, the system must provide the following:
 - a) Laboratory personnel must be able to verify direction of air flow by means of a visual monitoring device at the laboratory entry. Audible alarms should be considered to notify personnel of air flow disruption.
 - b) Exhaust air must not re-circulate to any other areas of the building and the exhaust system should be dedicated to serve only the BSL-3.
 - c) Exhaust air including that of the anteroom must be HEPA filtered through a BIBO.
 - i. BIBO unit must be designed to facilitate decontamination with our inhouse unit. For a schematic drawing of port locations and details see Figure A at the end of this chapter.
 - ii. Access to BIBO filter housings must be designed to allow scanning of the filters. If the BIBO unit is designed to have 2 banks of filters, side by side, access to both sides must be provided. A scanning rack should be included on larger models.
- 13. All Class II A2 BSCs shall have a thimble connection.
- 14. An approved method for decontaminating all laboratory wastes should be available in the facility, preferably within the laboratory.
- 15. Equipment that may produce infectious aerosols must be contained in devices that exhaust air through HEPA filtration before discharge into the laboratory. The HEPA filters should be tested and/or replaced annually.
- 16. Consider means of decontaminating large pieces of equipment before removal from the laboratory.
- 17. Enhanced design features may be required based upon specific research planned or funding conditions for the BSL3 in question. The enhancements may include one or more of the following; an anteroom for clean storage of equipment and supplies with dress-in, shower-out capabilities; gas tight dampers to facilitate laboratory isolation; laboratory effluent decontamination; advanced access control devices such as biometrics, fan redundancy, emergency power for HVAC, and specific room finishes.
- 18. The BSL-3 facility must be commissioned to include visual inspection and performance testing to verify that design and operational parameters have been met before research may begin. Facility performance must be re-verified and documented at least annually.

E. Biological Safety Cabinets

- 1. Review EH&S website at <u>http://www.ehs.washington.edu/fsobiocab/</u> for information concerning BSC selection, location, procurement, and certification.
- 2. Locate the biological safety cabinets (BSC) away from doors, operable windows, high-traffic, ventilation diffusers and other possible airflow disruptions; use a guideline of six feet of separation.
- 3. Provide a minimum of six feet of clearance between BSCs installed directly opposite another.
- 4. Do NOT plumb the BSCs with natural gas.
- 5. Design Biological Safety Cabinets (BSC) to be installed as follows:
 - a. Class II, Type A2 BSC may need to be connected to the general exhaust system via a thimble connection depending on chemical use. This determination is best made through discussions with EH&S early in the design process. If required, the thimble will be provided by the BSC manufacturer and installed per manufacturer's instructions and exhausted per Figure B at the end of this chapter.
 - b. Class II Type B2 BSC shall be directly (hard) connected to a dedicated exhaust system.
 - c. Class II Type B BSCs shall be interlocked with the exhaust fan so they shut down and alarm in the event of an exhaust fan/system failure.
 - d. Class II Type B BSC exhaust shall be provided with a gas-tight valve that is accessible from the front or side of the cabinet; the purpose of this valve is to facilitate decontamination of the BSC.
- 6. Provide each Class II Type B BSC with a dedicated exhaust system unless an alternative design is demonstrated to provide the precise control necessary for cabinets to stay in tight tolerance limits.
- 7. Provide each Class II Type B BSC with a bypass system for exhausting the room when the BCS fan is turned off; turning the BSC fan off saves filter life and the bypass facilitates decontamination of the BSC.
- 8. Thimble connection exhaust airflow shall be 120-125% of the BSC manufacturer's exhaust specification.
- 9. Provide at least ten inches of clearance above a recirculating Class II A2 BSC; this is to facilitate decontamination of the exhaust HEPA filter.
- 10. Provide at least four inches of clearance behind and on the non-utility side, and six inches clearance on the utility side of the cabinet.

- 11. Provide a NEMA 5-20 (20-amp) receptacle located high so that unit may be easily unplugged for servicing.
- 12. Specify BSC to be seismically anchored per manufacturer recommendations and include seismic braces and other necessary components in the purchase.
- 13. Biosafety cabinets must be certified by University EH&S technicians prior to substantial completion and use. This should be scheduled directly with the EH&S technician at least 2 weeks prior to required certification date.

F. Bag In/Bag Out Unit Detail





