

Basic Laboratory Design for Biosafety Level 3 Laboratories

The Biosafety Officer (in collaboration with the Institutional Biosafety Committee) must approve the location and design of any BSL-3 facility, and has final authority to authorize the commencement of BSL-3 work.

The Biosafety Level-3 facility design and operational procedures must be documented. The facility must be tested for verification that the design and operational parameters have been met prior to operation. It is essential that the facility meets the required predetermined standards before putting the biocontainment facility into service.

1. GENERAL

- A. The laboratory must consist of an anteroom and laboratory rooms.
- B. The facility must have gas-impermeable walls, ceilings, and floors. Air gaps under doors are acceptable for directional airflow. If the door gaps are sealed, the laboratory suite must not leak gaseous decontamination materials.
- C. Air balance must be set so air from low hazard rooms flows into rooms with higher hazards, and entry into the laboratory requires passage through two doors.
- D. The laboratory must consist of high-quality room construction with special consideration given to joints, finishes, and penetrations.
- E. All shutoffs (steam, water, natural gas) must be external to containment.
- F. All tall and/or heavy fixtures and equipment (e.g., biological safety cabinets, autoclaves, freezers, incubators, etc.) must be fitted with a seismic anchoring system/device engineered to withstand earthquake stresses equal to 7.0 on the Richter scale.
- G. The laboratory must be designed for ease of maintenance, so that access to critical mechanical equipment (ventilation ducts, fans, piping, etc.) is outside containment. Access panels are only allowed in some retrofits, and in those cases, the panels must be piano-type hinged and gasketed with gas-tight gaskets.
- H. There should be a room for large equipment decontamination. The room should be capable of being sealed for decontamination with gaseous paraformaldehyde and must have a connection to the HVAC exhaust system.
- I. Consideration should be given to providing a separate equipment room (to isolate heat load and high hazard equipment like centrifuges) within the laboratory.
- J. Consideration should be given to providing a shared prep room within the laboratory.
- K. There should be provisions for a comfortable temperature compensating for the heat load from equipment and the gowning requirements for personnel in the laboratory. The temperature is lower for comfort, usually 68°F.
- L. CO₂ and other specialty gases must be plumbed from outside the laboratory into containment.
- M. Work surfaces, floors, walls, and ceilings must be designed, constructed, and finished to facilitate easy cleaning and decontamination.
- N. The facility must pass third-party inspection and tests to verify that design and operational parameters have been met. This should be done by a third party.
- O. The laboratory must be located away from public areas and corridors used by laboratory personnel who do not work in the BSL-3 laboratory.
- P. The laboratory must be separated from unrestricted traffic.

- Q. The laboratory should be located away from regions that could impact directional airflow or differential pressure maintenance (elevators, exterior doors, laboratories with variable air volume systems or night set-backs, exterior walls with high wind or temperature fluctuations).
- R. An intercom or hands-free telephone must be located in each room and must be connected to a location that has personnel available for emergency response at all times work is being performed in a BSL-3 laboratory.

2. Anteroom

- A. The anteroom must consist of two doors for access to the laboratory.
- B. Anteroom doors should be interlocked or alarmed so only one door may be opened at a time, or placed sufficiently apart so that one person cannot open both doors at the same time. A manual override should be provided for emergency exit.
- C. The anteroom, if functioning exclusively as a clean change room, must have ventilation separate from the laboratory's in order to maintain the containment envelope in the event of a ventilation failure.
- D. The anteroom must be large enough to provide for storage of clean gowns, laboratory coats, or uniforms that must be donned before entry and be removed before leaving the suite. The anteroom must also provide space for a log book, wall calendar, and a laundry hamper.
- E. The anteroom should be designed such that turbulent air currents formed when opening doors are minimized, i.e., doors are perpendicular to each other, anteroom is of sufficient size.
- F. The anteroom must have communication capabilities installed.
- G. Space must be provided on or near the door for the conspicuous posting of the biohazard warning symbol, a list of personnel authorized to enter the area, and access rules.

3. Floors

- A. Floors must be impermeable to liquids, monolithic/seamless, or have welded seams.
- B. Floors must be coved up the wall.
- C. Floors must be easily cleaned, with chemical-resistant flooring (vinyl, or epoxy with fiberglass reinforcement) with a slip-resistant, smooth, hard finish.
- D. For monolithic floors, either a 100-mm-high, readily cleanable, integrally coved sheet flooring base, or a readily cleanable, 100-mm-high, vinyl or rubber base should be used.
- E. For epoxy floors, if silicone sealants are used for penetrations, the silicone must be applied after the epoxy has been installed.

4. Walls

- A. Suite walls should be full height extending to the structural deck above.
- B. Walls must be durable, washable, and resistant to detergents/disinfectants (masonry, gypsum board, fiberglass-reinforced plastic, etc.).
- C. Walls must be painted with durable glossy acrylic or epoxy paint.
- D. For epoxy paint, if silicone sealants are used for penetrations, the silicone must be applied after the epoxy has been installed.

- E. Wall/ceiling penetrations should be kept to a minimum and sealed with non-rigid, non-shrinking, silicone or latex sealant; for fire rated walls, apply sealant before fire stopping.
- F. Corner guards and bumper rails must be provided to protect wall surfaces in high-traffic/impact areas.
- G. A “pass-through” (for supplies, product, or equipment) requires approval of the Biosafety Officer.

5. Ceiling

- A. The ceiling must be washable and resistant to detergents/disinfectants.
- B. The ceiling must be painted with durable glossy acrylic or epoxy paint; for epoxy, if silicone sealants are used, the silicone must be applied after the epoxy.
- C. The ceiling must be of monolithic construction (i.e., gypsum board, not removable tiles).
- D. The ceiling must be high enough over Class II A2 biological safety cabinets (BSCs) to allow for a canopy/thimble connection or the opening of canopy/thimble door(s).
- E. Ceiling height should be at least 10 feet to allow for 14 inches of clearance above BSCs.
- F. Light fixtures must be surface or independently mounted.
- G. If recessed lighting must be used because of ceiling height in a renovation, lighting penetrations are gasketed.

6. Offices and Eating Areas

- A. Eating and drinking is prohibited in BSL-3 laboratories. Formal offices should not be included in the laboratory suite.

7. Doors

- A. Doors must be self-closing and lockable.
- B. Doors should open inward (dependent on Fire Marshall requirements) or slide open. If sliders are used, they must be made of safety glass, and a trackless design should be considered. Note: Opening sliding doors causes less turbulence than standard doors. Pocket doors must not be used.
- C. Door between anteroom and corridor must have door sweep for pest control.
- D. Doors inside the suite should allow for an approximately 3/4-inch clearance underneath the door for directional airflow.
- E. Door openings should be sized to allow the passage of large equipment.
- F. Wall-door frame connection should be made airtight at time of frame installation.
- G. Doors and frames must be of solid finish construction, have required fire ratings, and include panic-hardware, hardware appropriate for high-use, and kick plates.

8. Windows

- A. Windows (safety glass, permanently closed, sealed with silicone or latex sealant) should be installed so that the interior of the adjacent room, except change rooms and restrooms, is visible.
- B. Windows must not allow viewing from public areas.
- C. Interior sills must be sloped away from windows for ease of cleaning/minimize dust collection.

9. Eyewash/Safety Shower

- A. An emergency eyewash must be located in each BSL-3 room.
- B. A combination emergency eyewash/safety shower unit must be located in near proximity to places if personnel are exposed to splash hazards (determined during programming).
- C. Emergency eyewash and emergency eyewash/safety shower units must be sited and installed in accordance with Section 5162 of 8 CCR.

10. Shower — Entry/Exit

- A. A shower may be required in ABSL-3 laboratories, insectaries, or with certain agents. The need for a shower will be determined during programming.
- B. When required, the entry/exit shower must be pass-through in design so that traffic flows in one direction, and dirty clothing/personal protective equipment (PPE) must not contaminate clean clothing, people, or equipment.

11. Plumbing

- A. All penetrations must be perpendicular to the surface and must be sealed to be gas-tight.
- B. Penetrations must be sealed with nonrigid, nonshrinking, silicone or latex sealant; for fire-rated walls, apply sealant before fire stopping.
- C. All pipes into the BSL-3 laboratories should be secured to prevent movement.
- D. Fixtures must be resistant to corrosion of bleach and other disinfectants.
- E. Back-flow prevention devices must be installed on all faucets (including industrial water).
- F. 6-inch P-traps should be installed if significant changes in pressure could occur.
- G. All pipes must be identified by use of labels and tags.
- H. Water supply control should be located outside the containment area.
- I. Plumbing should discharge directly to a sanitary sewer.

12. Sinks

- A. Handwashing sinks must be located in each room near the exit.
- B. Sinks must be hands-free. Infrared sensors are preferable, but may not be suitable for all laboratories. In cases where infrared sensors cannot be used, knee-operated sinks are preferable to foot-operated.
- C. Each sink must have chemical-resistant traps (for disinfectants), a coved backsplash, and a hot-cold water, pre-mixing faucet.
- D. Each handwashing sink must be accompanied by a paper-towel dispenser and a hands-free soap dispenser mounted within easy reach.

13. Autoclave

- A. Pass-through to the anteroom or support room outside containment.
- B. Autoclave must be equipped with interlocked doors.
- C. Decontamination cycles should be determined during programming; gravity and liquid cycles are typical.
- D. Appropriate autoclave size should be determined prior to purchase.
- E. The body of the autoclave must be located outside containment to provide easy access for maintenance.
- F. Sufficient space adjacent to the contaminated (input) door must be present for waste collection.
- G. Control panels should be located internal and external to containment.

- H. Bioseals or other equivalent means should be used to create a seal at the wall.
- I. The floor under the autoclave must be monolithic, seamless, or heat-sealed, coved, and water-tight.
- J. Floor penetrations, if essential, must have a water and gas-tight seal at the monolithic floor.
- K. The walls and hard ceiling must have epoxy paint.
- L. Exposed pipes should be insulated.
- M. The autoclave should be seismically anchored.
- N. Fire sprinkler heads, if in the canopy, should be rated higher than the steam temperature.
- O. A curbed corrosion-resistant basin should be installed to prevent leakage.
- P. A canopy hood is provided over the exit door of the autoclave to contain heat and steam.
- Q. The installation must be signed off by a professional engineer.
- R. The autoclave room must have a minimum of 10 air changes per hour.

N. Life Safety

- A. Fire alarms must be clearly audible above ambient noise levels (low-frequency alarms for animal facilities).
- B. A wall-mounted ABC Dry Chemical fire extinguisher must be mounted near the exit door of the anteroom.
- C. Laboratory-safe refrigerators or metal flammable cabinets must be used to store flammable/combustible materials.

15. Alarms

- A. Alarms must be provided for:
 - 1. Fire hazard
 - 2. Ventilation failure
 - 3. Differential pressures below 0.05" wg
 - 4. -80°C ultra-cold freezers
 - 5. intrusion detection systems
- B. Alarms must be connected to the building control system and to campus public safety department.
- C. Alarms must be audible and visible throughout the laboratory.
- D. Alarms should be differentiated from each other so that each can be easily identified.
- E. Alarms should be on UPS power.

16. Vacuum System/Pump

- A. Vacuum lines are protected with liquid disinfectant traps and HEPA filters, or their equivalent. Filters must be replaced as needed. An alternative is to use portable vacuum pumps (also properly protected with traps and HEPA filters).
- B. If an individual vacuum pump is used, it should be located in the laboratory. Noise and maintenance issues should be addressed.
- C. Self-contained, portable autoclavable vacuum systems are preferred.

17. Electrical

- A. Emergency power must be provided for:
- B. HVAC (including controls)
- C. Alarms

- D. Emergency lighting
- E. Biological safety cabinets
- F. Storage freezers
- G. Incubators
- H. UPS power should be provided to alarms, and when possible, to biological safety cabinets.
- I. An independent circuit should be provided for each biological safety cabinet.
- J. Wall/ceiling penetrations should be kept to a minimum and must be sealed with nonrigid, nonshrinking, silicone or latex sealant; for fire-rated walls, apply sealant before fire stopping.
- K. Junction boxes should be cast and/or sealed airtight (e.g. closed cell foam compatible with gaseous paraformaldehyde).
- L. Light fixtures are surface- or pendent-mounted.
- M. Circuit breakers are located outside containment and are labeled.

18. Heating, Ventilation, and Air Conditioning (HVAC) Systems

- A. In most cases, the HVAC system should be Constant Air Volume (CAV). Variable Air Volume (VAV) is not recommended.
- B. Electronic direct digital controls are used to manage the system.
- C. Recirculation of exhaust air must not be allowed.
- D. A dedicated exhaust system is required.
- E. The outside exhaust must be dispersed away from occupied areas and air intakes, or the exhaust must be HEPA-filtered. Recommend locating the exhaust stacks on the roof and discharging upward at a velocity greater than 3,000 fpm.
- F. An exhaust HEPA is required (see HEPA filter section).
- G. The need for a redundant exhaust fan should be determined by users, in order to allow continuing work.
- H. Air supply and exhaust system capacity must be $\geq 125\%$ of the laboratory's requirements to provide for future adaptability and flexibility.
- I. The HVAC system must create directional airflow drawing air from rooms/areas of low hazard into rooms/areas of higher hazard.
- J. Inward directional airflow must be maintained by providing 15% more flow of exhaust airflow than supply air (USDA) (minimum 200 cfm – Jennette, 2000), and sufficient to maintain the differential pressure between rooms in 0.05 – 0.20" Wg range.
- K. The air balance must accommodate biological safety cabinet canopy/thimble connection or Class II type B2 cabinet exhaust requirements.
- L. Inward directional airflow must be able to be verified before entry. Install a device(s) to indicate/confirm directional airflow into the laboratory (e.g., 0 – 0.20" Wg magnehelic gauges, digital differential pressure monitors, or both).
- M. The BSL-3 lab must not become positively pressured if the exhaust system fails. Whenever possible, electrically interlock the supply and exhaust fans.
- N. Exhaust ductwork must not be positively pressurized.
- O. Supply and exhaust dampers should be gas-tight and closable from outside the facility to facilitate decontamination with gaseous paraformaldehyde.
- P. Local visual and audible ventilation system failure alarms are required for laboratory personnel.
- Q. Air supply diffusers must be located so that airflow at the biological safety cabinet face is unaffected (laminar diffusers preferred).

- R. Ductwork should be located external to the laboratory; if exposed in the laboratory, ductwork is clear of walls to allow for cleaning, maintenance, and leak testing.
- S. Ductwork should be gas-tight 316 stainless steel up to the HEPA filter (if present).
- T. All ducts must be constructed in a leak-tight manner with seams and joints usually welded airtight. The Biosafety Officer will determine if exhaust ductwork is to be welded.
- U. If the exhaust ductwork is welded, recommend welded joints for all connections except for the damper(s) (use flange and bolt connections for quick change-out in the future).
- V. Coil units (for supplemental cooling) should not impact cleaning or provide a breach of containment.
- W. Limit elbows whenever possible to reduce the amount of background noise generated.

19. HEPA Filters

- A. HEPA filters must be "bag-in, bag-out," and the housing must accommodate gas decontamination and filter testing (gas-tight dampers and housing).
- B. HEPA filter housings must be no more than five-feet high in order to facilitate filter change-out.
- C. When HEPA filters are installed, a magnehelic gauge or other pressure-monitoring device must be installed, with the display placed in the most accessible location that is practical, to measure pressure drop across the filters.
- D. A HEPA may be required on the autoclave exhaust, ultracentrifuge vent, and sewer vent.
- E. HEPA filters should comply with DOE-STD-3020-97 (or latest edition).
- F. Arrangements must be made to permit periodic leak testing of exhaust system HEPA filters. The system should comply with ASME AG-1.

20. Laboratory Furniture and Casework

- A. Laboratory furniture and casework must be sturdy, and capable of supporting anticipated loading and uses.
- B. Laboratory furniture and casework must be spaced so that areas around and under benches, cabinets, and equipment must be accessible for cleaning.
- C. Benchtops should be impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
- D. Benchtops should have marine/drip edging for spill control.
- E. Modular, mobile casework should be used for future flexibility.
- F. Laboratory furniture and casework should be designed with ergonomic considerations (e.g., adjustable work-surface heights, selection of biological safety cabinets, adequate knee clearances for seated work, adequate toe clearances for standing work, wall cabinet heights, etc.).
- G. Fixed casework, if used, must be sealed/caulked to the walls on installation to facilitate cleaning and prevent harborage for vermin.
- H. Fixed casework, if used, should be installed before the coved flooring so that the coving can extend up toe-kicks.
- I. Closed cabinets rather than open shelving should be used for storage.
- J. In BSL-2 and 3 laboratories, chairs and other furniture should be covered with a nonfabric material that can be easily decontaminated.

- K. Tall or movable cabinets/shelves should be seismically anchored.
- L. Cabinets/shelves should have angled tops or be built up to the ceiling to facilitate cleaning.

21. Security

- A. Access controls should be provided to record entry and exit times and dates.
- B. Palm scan, proximity card, keypad entry with codes unique to each worker, cardkey, or equivalent, should be used.
- C. Access to mechanical and support areas must be limited.
- D. Security measures must meet the requirements of the Select Agent Regulations if the facility is to be used for select agent work or storage.
- E. Security measures must equal or exceed the guidance set forth in Appendix F of the latest version of the CDC-NIH's Biosafety in Microbiological and Biomedical Laboratories. Note: USDA has specific security requirements; refer to USDA Security Policies and Procedures for Biosafety Level-3 Facilities, DM 9610-001.

22. Communications

- A. An intercom or hands-free telephone must be located in each room and must be connected to a location that has personnel available for emergency response at all times work is being performed in a BSL-3 laboratory.
- B. Wall/ceiling penetrations must be kept to a minimum and must be sealed with nonrigid, nonshrinking, silicone or latex sealant; for fire-rated walls, apply sealant before fire stopping.

23. Commissioning

- A. Commissioning should be performed by a third party in the presence of the Biosafety Officer.
- B. The Biosafety Officer will furnish checklists for the containment features to be evaluated, dependent on the facility design. Initially, the facility must pass a series of inspections and tests to meet standards that have been predeveloped, authorized, and specified in the design and construction documents before biohazardous agents are used in the facility. These are in addition to the desired outcomes by the commissioning team identified prior to initiation of construction activities.
- C. A properly designed and constructed biocontainment facility, including its structural and mechanical safety systems, must meet predetermined performance criteria and be operational upon completion of construction. The integrity of the critical components of the biological containment systems shall be verified by the testing and certification requirements listed below.
- D. Certification of the facility, including structural components and safety systems, must be included as part of the overall commissioning processes normally undertaken to verify that the design and construction meet applicable standards, and that the facility can operate in accordance with the design intent.
- E. Commissioning testing must also be performed without degradation to the facility or mechanical system that is being tested.
- F. All equipment and materials should be tested/evaluated prior to installation; duplicate testing is recommended.
- G. BSCs must be certified in accordance with NSF 49 after the BSC is anchored in its final location.

- H. All HEPA filters must be tested to meet NSF 49 after installation.
- I. Integrity of seals must be demonstrated by visual inspection.
- J. Integrity of epoxy coatings may be tested using ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers.
- K. The autoclave installation must be found to be proper as attested by the sign-off of a Professional Engineer.
- L. The autoclave must be tested to verify that it meets specified standards:
 - 1. Thermometers are calibrated
 - 2. Clocks and timers are calibrated
 - 3. Biological indicators are used to verify the autoclave's effectiveness
- M. The operation of backflow preventers must be verified
- N. The ventilation system must be tested by:
 - 1. Ventilation ductwork and HEPA housings must pass pressure-decay testing under ASHRAE SMACNA Standard 126-2000 (Method of Testing HVAC Air Ducts)
 - 2. Measurements of airflow at each supply and exhaust diffuser
 - 3. Smoke testing to visually verify limited turbulence at face of BSC
 - 4. Smoke testing to visually verify airflow from areas of low hazard to areas of higher hazard
 - 5. Verification that air system failure alarms (exhaust, supply, room pressure) function and annunciate properly
 - 6. Air balance report must be provided to and verified by the Biosafety Officer
- O. Additional environmental protection (e.g., personnel showers, HEPA filtration of exhaust air, containment of other piped services, and the provision of effluent decontamination) should be considered if recommended by the agent summary statement, as determined by risk assessment, the site conditions, or other applicable federal, state, or local regulations.

24. BMBL Requirements

A. Biosafety Level 1

- 1. A door
- 2. A sink for hand washing
- 3. Designed for easy cleaning.
- 4. Benchtops impervious to water and resistant to acids, alkalis, organic solvents, moderate heat, and chemicals used to decontaminate.
- 5. Laboratory furniture capable of supporting anticipated loading and uses
- 6. Accessible spaces between and under benches, cabinets, and equipment
- 7. Windows fitted with fly screens (if they can be opened).

B. Biosafety Level 2

- 1. BSL-1 requirements and good practices
- 2. Lockable, self-closing, fire-rated door that opens inward
- 3. Located away from public areas
- 4. Appropriately installed biological safety cabinets
- 5. Readily available eyewash station that complies with the requirements of Chapter 4 of this Guide
- 6. Adequate illumination for all activities
- 7. Consideration of inward flow of air without recirculation to spaces outside of the laboratory
- 8. Seismically anchored autoclaves.

9. Good Practice for BSL-2 includes:
 - a. Floors with a slip-resistant, smooth, hard finish; are liquid-tight or monolithic/seamless or have welded seams; and that have a wall coved up 4-inches, or a cove-base installed to create a water-tight seal to the floor
 - b. Walls that are durable, washable, and resistant to detergents/disinfectants (use durable glossy acrylic or epoxy paint or equivalent)
 - c. Protection of exposed corners and walls from damage by carts
 - d. Wall/ceiling penetrations kept to a minimum and sealed with fire-retardant material
 - e. Douse shower unit in near proximity. The safety shower/eyewash must comply with the requirements of Chapter 4 of this Guide
 - f. Floor drain for autoclave
 - g. A canopy hood located over each end of the autoclave.

C. Biosafety Level 3

1. BLS-2 requirements and good practices
2. The laboratory is separated from areas that are open to unrestricted traffic flow within the building, and access to the laboratory is restricted. Passage through a series of two self-closing doors is the basic requirement for entry into the laboratory from access corridors. Doors must be lockable. A clothes-changing room may be included in the passage way.
3. Each laboratory room contains a sink for handwashing. The sink is hands-free or automatically operated, and is located near the room exit door.
4. The interior surfaces of walls, floors, and ceilings of areas where BSL-3 agents are handled are constructed for easy cleaning and decontamination. Seams, if present, must be sealed. Walls, ceilings, and floors should be smooth, impermeable to liquids, and resistant to the chemicals and disinfectants normally used in the laboratory. Floors should be monolithic and slip-resistant. Consideration should be given to the use of coved floor coverings. Penetrations in floors, walls, and ceiling surfaces are sealed. Openings such as those around ducts and the spaces between doors and frames are capable of being sealed to facilitate decontamination.
5. Benchtops are impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and those chemicals used to decontaminate the work surfaces and equipment.
6. Laboratory furniture is capable of supporting anticipated loading and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning. Chairs and other furniture used in laboratory work should be covered with a non-fabric material that can be easily decontaminated.
7. All windows in the laboratory are closed and sealed.
8. A method for decontaminating all laboratory wastes is available in the facility and utilized, preferably within the laboratory (i.e., autoclave, chemical disinfection, incineration, or other approved decontamination methods). Consideration should be given to means of decontaminating

equipment. If waste is transported out of the laboratory, it should be properly sealed and not transported in public corridors.

9. Biological safety cabinets are required and are located away from doors, from room supply louvers, and from heavily traveled laboratory areas.
10. A ducted exhaust air ventilation system is provided. This system creates directional airflow, which draws air into the laboratory from "clean" areas and toward "contaminated" areas. The exhaust air is not recirculated to any other area of the building. Filtration and other treatments of the exhaust air are not required, but may be considered based on site requirements and specific agent manipulations and use conditions. The outside exhaust must be dispersed away from occupied areas and air intakes, or the exhaust must be HEPA-filtered. Laboratory personnel must verify that the direction of the airflow (into the laboratory) is proper. It is recommended that a visual monitoring device that indicates and confirms directional inward airflow be provided at the laboratory entry. Consideration should be given to installing an HVAC control system to prevent sustained positive pressurization of the laboratory. Audible alarms should be considered to notify personnel of HVAC system failures.
11. HEPA-filtered exhaust air from a Class II biological safety cabinet (BSC) can be recirculated into the laboratory if the cabinet is tested and certified at least annually. When exhaust air from Class II BSCs is to be discharged to the outside through the building exhaust air system, the cabinets must be connected in a manner that avoids any interference with the air balance of the cabinets or the building exhaust system (e.g., an air gap between the cabinet exhaust and the exhaust duct). When Class III BSCs are used, they should be directly connected to the exhaust system. If Class III BSCs are connected to the supply system, it is done in a manner that prevents positive pressurization of the cabinets
12. Continuous flow centrifuges or other equipment that may produce aerosols are contained in devices that exhaust air through HEPA filters before discharge into the laboratory. These HEPA systems are tested at least annually. Alternatively, the exhaust from such equipment may be vented to the outside if it is dispersed away from occupied areas and air intakes.
13. Vacuum lines are protected with liquid disinfectant traps and HEPA filters, or their equivalent. Filters must be replaced as needed. An alternative is to use portable vacuum pumps (also properly protected with traps and filters).
14. An eyewash station is readily available inside the laboratory.
15. Illumination is adequate for all activities, avoiding reflections and glare that could impede vision.
16. The Biosafety Level-3 facility design and operational procedures must be documented. The facility must be tested for verification that the design and operational parameters have been met prior to operation. Facilities should be re-verified, at least annually, against these procedures as modified by operational experience.
17. Additional environmental protection (e.g., personnel showers, HEPA filtration of exhaust air, containment of other piped services, and the provision of effluent decontamination) should be considered if

recommended by the agent summary statement, as determined by risk assessment, the site conditions, or other applicable federal, state, or local regulations.

18. Laboratory separated from areas that are open to unrestricted traffic flow within the building, and access to the laboratory is restricted.