

Biosafety Level 3 (BL3)

NIH Guidelines for Research Involving Recombinant or Synthetic Nucleic Acid Molecules

(Appendix G-II-C) - April 2019



Biosafety Level 3 (BL3)

Biosafety Level 3 is applicable to clinical, diagnostic, teaching, research, or production facilities in which work is conducted with indigenous or exotic agents which may cause serious or potentially lethal disease as a result of exposure by the inhalation route. Laboratory personnel have specific training in handling pathogenic and potentially lethal agents and are supervised by competent scientists who are experienced in working with these agents. All procedures involving the manipulation of infectious material are conducted within biological safety cabinets or other physical containment devices or by personnel wearing appropriate personal protective clothing and devices. The laboratory has special engineering and design features. It is recognized, however, that many existing facilities may not have all the facility safeguards recommended for BL3 (e.g., access zone, sealed penetrations, and directional airflow, etc.). In these circumstances, acceptable safety may be achieved for routine or repetitive operations (e.g., diagnostic procedures involving the propagation of an agent for identification, typing, and susceptibility testing) in laboratories where facility features satisfy BL2 recommendations provided the recommended "Standard Microbiological Practices," "Special Practices," and "Containment Equipment" for BL3 are rigorously followed. The decision to implement this modification of BL3 recommendations should be made only by the Principal Investigator.

Appendix G-II-C-1. Standard Microbiological Practices (BL3)

- a. Work surfaces are decontaminated at least once a day and after any spill of viable material.
- b. All contaminated liquid or solid wastes are decontaminated before disposal.
- c. Mechanical pipetting devices are used; mouth pipetting is prohibited.
- d. Eating, drinking, smoking, storing food, and applying cosmetics are not permitted in the work area.
- e. Persons wash their hands: (i) after handling materials involving organisms containing recombinant or synthetic nucleic acid molecules, and handling animals, and (ii) when exiting the laboratory.
- f. All procedures are performed carefully to minimize the creation of aerosols.
- g. Persons under 16 years of age shall not enter the laboratory.
- h. If experiments involving other organisms which require lower levels of containment are to be conducted in the same laboratory concurrently with experiments requiring BL3 level physical containment, they shall be conducted in accordance with all BL3 level laboratory practices.

Appendix G-II-C-2. Special Practices (BL3)

- a. Laboratory doors are kept closed when experiments are in progress.



- b.** Contaminated materials that are to be decontaminated at a site away from the laboratory are placed in a durable leak-proof container which is closed before being removed from the laboratory.
- c.** The Principal Investigator controls access to the laboratory and restricts access to persons whose presence is required for program or support purposes. The Principal Investigator has the final responsibility for assessing each circumstance and determining who may enter or work in the laboratory.
- d.** The Principal Investigator establishes policies and procedures whereby only persons who have been advised of the potential biohazard, who meet any specific entry requirements (e.g., immunization), and who comply with all entry and exit procedures entering the laboratory or animal rooms.
- e.** When organisms containing recombinant or synthetic nucleic acid molecules or experimental animals are present in the laboratory or containment module, a hazard warning sign incorporating the universal biosafety symbol is posted on all laboratory and animal room access doors. The hazard warning sign identifies the agent, lists the name and telephone number of the Principal Investigator or other responsible person(s), and indicates any special requirements for entering the laboratory such as the need for immunizations, respirators, or other personal protective measures.
- f.** All activities involving organisms containing recombinant or synthetic nucleic acid molecules are conducted in biological safety cabinets or other physical containment devices within the containment module. No work in open vessels is conducted on the open bench.
- g.** The work surfaces of biological safety cabinets and other containment equipment are decontaminated when work with organisms containing recombinant or synthetic nucleic acid molecules is finished. Plastic-backed paper toweling used on non-perforated work surfaces within biological safety cabinets facilitates clean-up.
- h.** An insect and rodent program is in effect.
- i.** Laboratory clothing that protects street clothing (e.g., solid front or wrap-around gowns, scrub suits, coveralls) is worn in the laboratory. Laboratory clothing is not worn outside the laboratory, and it is decontaminated prior to laundering or disposal.
- j.** Special care is taken to avoid skin contamination with contaminated materials; gloves should be worn when handling infected animals and when skin contact with infectious materials is unavoidable.
- k.** Molded surgical masks or respirators are worn in rooms containing experimental animals.
- l.** Animals and plants not related to the work being conducted are not permitted in the laboratory.
- m.** Laboratory animals held in a BL3 area shall be housed in partial-containment caging systems, such as Horsfall units (see [Appendix G-III-K](#), *Footnotes and References of Appendix G*), open cages placed in ventilated enclosures, solid-wall and -bottom cages covered by filter bonnets or solid-wall and -bottom cages placed on holding racks equipped with ultraviolet in radiation lamps and reflectors.



Note: Conventional caging systems may be used provided that all personnel wear appropriate personal protective devices. These protective devices shall include at a minimum wrap-around gowns, head covers, gloves, shoe covers, and respirators. All personnel shall shower on exit from areas where these devices are required.

- n. All wastes from laboratories and animal rooms are appropriately decontaminated before disposal. For research involving mammalian-transmissible HPAI H5N1 virus, liquid effluents should be chemically disinfected or heat-treated, or collected and processed in a central effluent decontamination system. Decontamination of shower and toilet effluents is not required, provided appropriate practices and procedures are in place for primary containment of mammalian-transmissible HPAI H5N1 virus. Animal tissues, carcasses, and bedding originating from the animal room must be decontaminated by an effective and validated method (e.g., use of an autoclave) preferably before leaving the containment barrier. If waste must be transported, special practices should be developed for transport of infectious materials to designated alternate location(s) within the facility.
- o. Vacuum lines are protected with high efficiency particulate air/HEPA filters and liquid disinfectant traps.
- p. Hypodermic needles and syringes are used only for parenteral injection and aspiration of fluids from laboratory animals and diaphragm bottles. Only needle locking syringes or disposable syringe-needle units (i.e., needle is integral to the syringe) are used for the injection or aspiration of fluids containing organisms that contain recombinant or synthetic nucleic acid molecules. Extreme caution should be used when handling needles and syringes to avoid autoinoculation and the generation of aerosols during use and disposal. Needles should not be bent, sheared, replaced in the needle sheath or guard, or removed from the syringe following use. The needle and syringe should be promptly placed in a puncture-resistant container and decontaminated, preferably by autoclaving, before discard or reuse.
- q. Spills and accidents which result in overt or potential exposures to organisms containing recombinant or synthetic nucleic acid molecules are immediately reported to the Biological Safety Officer, Institutional Biosafety Committee, and NIH OSP. Reports to NIH OSP shall be sent to the Office of Science Policy, National Institutes of Health, preferably by e-mail to: NIHGuidelines@od.nih.gov (Contact information: 6705 Rockledge Drive, Suite 750, MSC 7985, Bethesda, MD 20892-7985 (20817 for non-USPS mail), 301-496-9838, 301-496-9839 (fax)). Contact information is also available on the OSP website (www.osp.od.nih.gov). Appropriate medical evaluation, surveillance, and treatment are provided and written records are maintained.
- r. Baseline serum samples for all laboratory and other at-risk personnel should be collected and stored in accordance with institutional policy and at least for the time period in which the personnel continues to work with the agent at biosafety level 3 containment. Such samples must be collected and stored for laboratory and other at-risk personnel who will work with mammalian-transmissible HPAI H5N1 virus. Additional serum specimens may be collected periodically depending on the agents handled or the function of the laboratory.
- s. A biosafety manual is prepared or adopted. Personnel are advised of special hazards and are required to read and follow the instructions on practices and procedures.

Alternative Selection of Containment Equipment (BL3)



Experimental procedures involving a host-vector system that provides a one-step higher level of biological containment than that specified may be conducted in the BL3 laboratory using containment equipment specified for the BL2 level of physical containment. Experimental procedures involving a host-vector system that provides a one-step lower level of biological containment than that specified may be conducted in the BL3 laboratory using containment equipment specified for the BL4 level of physical containment. Alternative combination of containment safeguards are shown in [Appendix G-Table 1, Possible Alternate Combinations of Physical and Biological Containment Safeguards](#).

Appendix G-II-C-3. Containment Equipment (BL3)

- a. Biological safety cabinets (Class I, II, or III) (see [Appendix G-III-L, Footnotes and References of Appendix G](#)) or other appropriate combinations of personal protective or physical containment devices (e.g., special protective clothing, masks, gloves, respirators, centrifuge safety cups, sealed centrifuge rotors, and containment caging for animals) are used for all activities with organisms containing recombinant or synthetic nucleic acid molecules which pose a threat of aerosol exposure. These include: manipulation of cultures and of those clinical or environmental materials which may be a source of aerosols; the aerosol challenge of experimental animals; the harvesting of infected tissues or fluids from experimental animals and embryonate eggs; and the necropsy of experimental animals.

Appendix G-II-C-4. Laboratory Facilities (BL3)

- a. The laboratory is separated from areas which are open to unrestricted traffic flow within the building. Passage through two sets of doors is the basic requirement for entry into the laboratory from access corridors or other contiguous areas. Physical separation of the high containment laboratory from access corridors or other laboratories or activities may be provided by a double-doored clothes change room (showers may be included), airlock, or other access facility which requires passage through two sets of doors before entering the laboratory.
- b. The interior surfaces of walls, floors, and ceilings are water resistant so that they can be easily cleaned. Penetrations in these surfaces are sealed or capable of being sealed to facilitate decontaminating the area.
- c. Bench tops are impervious to water and resistant to acids, alkalis, organic solvents, and moderate heat.
- d. Laboratory furniture is sturdy and spaces between benches, cabinets, and equipment are accessible for cleaning.
- e. Each laboratory contains a sink for hand washing. The sink is foot, elbow, or automatically operated and is located near the laboratory exit door.
- f. Windows in the laboratory are closed and sealed.
- g. Access doors to the laboratory or containment module are self-closing.
- h. An autoclave for decontaminating laboratory wastes is available preferably within the laboratory.
- i. A ducted exhaust air ventilation system is provided. This system creates directional airflow that draws air into the laboratory from uncontaminated spaces surrounding the laboratory. The



exhaust air is not recirculated to any other area of the building, is discharged to the outside, and is dispersed away from the occupied areas and air intakes. Personnel shall verify that the direction of the airflow (into the laboratory) is proper. The exhaust air from the laboratory room may be discharged to the outside without being filtered or otherwise treated unless research is being conducted with mammalian-transmissible HPAI H5N1 virus. For research with mammalian-transmissible HPAI H5N1 virus, exhaust air must be HEPA filtered and there must be sealed ductwork from the containment barrier to the filter. In addition, the air handling system shall be designed such that under failure conditions, the airflow will not be reversed and periodic verification, with annual verification of the HEPA filters, shall be performed. Finally, backup power shall be available for critical controls and instrumentation necessary to maintain containment.

- j. The high efficiency particulate air/HEPA filtered exhaust air from Class I or Class II biological safety cabinets is discharged directly to the outside or through the building exhaust system. Exhaust air from Class I or II biological safety cabinets may be recirculated within the laboratory if the cabinet is tested and certified at least every twelve months. If the HEPA-filtered exhaust air from Class I or II biological safety cabinets is to be discharged to the outside through the building exhaust air system, it is connected to this system in a manner (e.g., thimble unit connection (see [Appendix G-III-L, Footnotes and References of Appendix G](#))) that avoids any interference with the air balance of the cabinets or building exhaust system.

