

CHAPTER 18

GUIDELINES FOR WORK WITH TOXINS OF BIOLOGICAL ORIGIN

In recognition of the growing number of microbiological and biomedical laboratories working with toxins of biological origin, the following is provided as a guideline for working with these toxins. The material below is adapted from the Biological Defense Safety Program, Technical Safety Requirements (DA Pamphlet 385-69)⁽¹⁾ and Appendix A of the OSHA standard "Occupational Exposure to Hazardous Chemicals in Laboratories"⁽²⁾ Principal Investigators are encouraged to utilize the references listed below and to consult with subject matter experts before using any toxin, to ensure that appropriate facilities, containment equipment, policies and procedures, personnel training programs and medical surveillance protocols specific to the toxin and the laboratory are in place.

General

The laboratory facilities, equipment, and procedures appropriate for work with toxins of biological origin must reflect the intrinsic level of hazard posed by a particular toxin as well as the potential risks inherent in the operations performed. If both toxins and infectious agents are used, both must be considered when containment equipment is selected and policies and procedures are written. If animals are used, animal safety practices must also be considered.

Standard Practices

Standard practices listed under BSL 2 and BSL 3 (pages 20 and 27) should be reviewed and incorporated as appropriate into protocols for work with toxins.

Special Practices

Special practices listed under BSL 2 and BSL 3 (pages 21 and 28) should be reviewed and incorporated as appropriate into protocols for work with toxins.

1. Each laboratory should develop a chemical hygiene plan specific to the toxin(s) used in that laboratory. The chemical hygiene plan should 1) identify the hazards that will be encountered in normal use of the toxin, and those that could be encountered in case of a spill or other accident, and 2) specify the policies and practices to be used to minimize risks (e.g., containment and personal protective equipment, management of spills, management of accidental exposures, medical surveillance).⁽³⁾
2. Training specific to the toxin(s) used should be required and documented for all laboratory personnel working with toxins, before starting work with the toxin and at intervals thereafter.

3. An inventory control system should be in place.
3. Toxins should be stored in locked storage rooms, cabinets, or freezers when not in use.
4. Access to areas containing toxins should be restricted to those whose work assignments require access.
5. Preparation of primary containers of toxin stock solutions and manipulations of primary containers of dry forms of toxins should be conducted in a chemical fume hood, a glove box, or a biological safety cabinet or equivalent containment system approved by the safety officer. HEPA and/or charcoal filtration of the exhaust air may be required, depending on the toxin.
6. The user should verify inward airflow of the hood or biological safety cabinet before initiating work.
7. All work should be done within the operationally effective zone of the hood or biological safety cabinet.
8. When toxins are in use, the room should be posted to indicate "Toxins in Use-Authorized Personnel Only." Any special entry requirements should be posted on the entrance(s) to the room. Only personnel whose presence is required should be permitted in the room while toxins are in use.
9. All high risk operations should be conducted with two knowledgeable individuals present. Each must be familiar with the applicable procedures, maintain visual contact with the other, and be ready to assist in the event of an accident.
10. Before containers are removed from the hood, cabinet, or glove box, the exterior of the closed primary container should be decontaminated and placed in a clean secondary container. Toxins should be transported only in leak/spill-proof secondary containers.
11. Contaminated and potentially contaminated protective clothing and equipment should be decontaminated using methods known to be effective against the toxin before removal from the laboratory for disposal, cleaning or repair. If decontamination is not possible/practical, materials (e.g., used gloves) should be disposed of as toxic waste. Materials contaminated with infectious agents as well as toxins should also be autoclaved or otherwise rendered non-infectious before leaving the laboratory.
12. The interior of the hood, glove box, or cabinet should be decontaminated periodically, for example, at the end of a series of related experiments. Until decontaminated, the hood, box, or cabinet should be posted to indicate that toxins are in use, and access to the equipment and apparatus restricted to necessary, authorized personnel.

Safety Equipment

The safety equipment guidelines listed under BSL 2 and BSL 3 (see Section III) should be reviewed and incorporated as appropriate into protocols for work with toxins.

1. When using an open-fronted fume hood or biological safety cabinet, protective clothing, including gloves and a disposable long-sleeved body covering (gown, laboratory coat, smock, coverall, or similar garment) should be worn so that hands and arms are completely covered.
2. Eye protection should be worn if an open-fronted containment system is used.
3. Other protective equipment may be required, depending on the characteristics of the toxin and the containment system. For example, use additional respiratory protection if aerosols may be generated and it is not possible to use containment equipment or other engineering controls.
4. When handling dry forms of toxins that are electrostatic:
 - a. Do not wear gloves (such as latex) that help to generate static electricity
 - b. Use glove bag within a hood or biological safety cabinet, a glove box, or a class III biological safety cabinet.
5. When handling toxins that are percutaneous hazards (irritants, necrotic to tissue, or extremely toxic from dermal exposure), select gloves that are known to be impervious to the toxin.
6. Consider both toxin and diluent when selecting gloves and other protective clothing.
7. If infectious agents and toxins are used together in an experimental system, consider both when selecting protective clothing and equipment.

Laboratory Facilities

Laboratory facility recommendations listed under BSL 2 and BSL 3 (See Section III) and OSHA standards⁽⁴⁾ should be reviewed and incorporated as appropriate into protocols for work with toxins. When vacuum lines are used with systems containing toxins, they should be protected with a HEPA filter to prevent entry of toxins into the lines. Sink drains should be similarly protected when water aspirators are used.

References

1. Department of the Army, DOD. 32 CFR Parts 626, 627 - Biological Defense Safety Program.
2. United States Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910 - Occupational Safety and Health Standards.
3. United States Department of Labor, Occupational Safety and Health Administration. 29 CFR Part 1910. (2)
4. United States Department Occupational Safety and Health Administration. 29 CFR Part 1910. (2)

Additional References

American Industrial Hygiene Association - Biosafety Reference Manual. Heinsohn P.A.; Jacobs R.R.; Concoy B.A. (eds.). American Industrial Hygiene Association, Fairfax. 1995.

National Research Council. Prudent Practices in the Laboratory: Handling and Disposal of Chemicals. National Academy Press, Washington D.C. 1995.
CRC handbook of Toxicology. Derelanko M.J., Hollinger M.A. (eds.). CRC Press, Boca Raton 1995.

Ellenhorn's Medical Toxicology: Diagnosis and Treatment of Human Poisoning. Ellenhorn M.J., Schonwald S., Ordog G., Wasserberger J., Williams and Wilkins, Baltimore 1997.