Biological Toxins

Standard Operating Procedure

Revision Date: 5/06/25

Laboratory Director (LD) Approval is Required Prior to Performing this Procedure

# Description [Provide additional information as it pertains to your research protocol]

This standard operating procedure (SOP) outlines the handling and use of Biological Toxins. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling Biological Toxins. *All laboratory workers must read and understand the*[*Laboratory Emergencies SOP*](https://ehs.umich.edu/wp-content/uploads/2022/05/LaboratoryEmergencyProceduresSOP.docx)*prior to commencing any work in a laboratory.*

All lab members working with wild-type diphtheria toxin (DT) **must** have received Td booster vaccinations within the last 5 years. In addition, available vaccinations for any toxins, e.g., pertussis toxin, tetanus toxin, **must** be offered to all lab members working with those materials.

Under the CDC regulations, certain listed toxins are exempt from the Select Agent registration provided that the LD does not at any time possess more than the following aggregate amount of toxin. Laboratories using quantities of toxins below federally established thresholds are required to follow the procedures outlined this standard operating procedure. LDs in possession of any of the toxins listed below, **must** complete the [EHS Toxin Declaration Form](https://ehs.umich.edu/wp-content/uploads/2025/05/ToxinDeclarationForm_Apr2025.pdf).

\*The Institutional Biosafety Committee (IBC) approves work with biological toxins. Ensure that work with all toxins is included in your IBC. Toxin work must also be approved by the IBC before the IACUC Animal Protocol will be approved.

## Exempt Select Agent Toxins

The following select agent toxins and the exempt amount that can be used:

**NOTE**: If a Laboratory Director (LD) seeks to possess more toxin than the exempt quantity, prior approval from the Responsible Official (RO) and the Federal Select Agent Program **must** be obtained before acquiring the material.

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| CAS # | HHS Toxin | Amount |
| 1393-62-0 | Abrin | 100 mg |
| multiple | Botulinum neurotoxins  | 1 mg |
| N/A | Short, paralytic alpha conotoxins | 100 mg |
| 2270-40-8 | Diacetoxyscirpenol (DAS) | 10,000 mg |
| 9009-86-3 | Ricin | 1,000 mg |
| 35523-89-8 | Saxitoxin | 500 mg |
| multiple | Staphylococcal enterotoxins (Subtypes A, B,C, D and E) | 100 mg |
| 21259-20-1 | T–2 toxin | 10,000 mg |
| 4368-28-9 | Tetrodotoxin | 500 mg |

## Non-Select Agent Toxins

The following non-select agent toxins and their LD50 values include:

| CAS # | Toxin | LD50 (µg/kg) |
| --- | --- | --- |
| N/A | Aerolysin | 7.0 |
| 12778-32-4 | β-bungarotoxin | 14.0 |
| 58205-95-1 | Caeruleotoxin | 53 |
| 72270-31-6 | Cereolysin | 40-80 |
| 9012-63-9 | Cholera toxin | 250 |
| N/A | Clostridium difficile enterotoxin A | 0.5 |
| N/A | Clostridium difficile cytotoxin B | 220 |
| N/A | Clostridium perfringens kappa toxin | 1,500 |
| N/A | Clostridium perfringens perfringolysin O | 13-16 |
| N/A | Clostridium perfringens enterotoxin | 81 |
| N/A | Clostridium perfringens beta toxin | 0.4 |
| N/A | Clostridium perfringens delta toxin | 5 |
| N/A | Clostridium perfringens epsilon toxin | 0.1 |
| 9007-40-3 | Crotoxin | 82 |
| 92092-36-9 | Diphtheria toxin | 0.1 |
| 72270-41-8 | Listeriolysin | 3-12 |
| 1406-83-3 | Leucocidin | 50 |
| 65988-88-7 | Modeccin | 1-10 |
| N/A | Nematocyst toxins | 33-70 |
| 37223-96-4 | Notexin | 25 |
| 70323-44-3 | Pertussis toxin | 15 |
| N/A | Pneumolysin | 1.5 |
| N/A | Pseudomonas aeruginosa toxin A | 3 |
| N/A | Shiga toxin | 20 |
| N/A | Shigella dysenteriae neurotoxin | 1.3 |
| 98072-47-0 | Streptolysin O | 8 |
| 87502-32-7 | Streptolysin S | 25 |
| 52019-39-3 | Taipoxin | 2 |
| 676570-37-9 | Tetanus toxin | 0.001 |
| 83590-17-4 | Viscumin | 2.4-80 |
| 91933-11-8 | Volkensin | 1.4 |
| N/A | Yersinia pestis murine toxin | 10 |

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

# Engineering Controls [Provide additional information as it pertains to your research protocol]

Engineering control measures includes room design, ventilation systems, and lab and emergency response equipment.

Laboratory work with biological toxins should be performed in either a designated area or room with controlled access and at pre-determined bench areas. When toxins are in use, a sign should be clearly posted outside the room or area stating “Toxins in Use – Authorized Personnel Only.” For more information about signs, see the [Door Signs and Labels Requirements](https://ehs.umich.edu/forms/research-and-clinical/%27) section of this document.

## Biological Safety Cabinets and Chemical Fume Hoods

Work with dry toxins should be performed inside a biosafety cabinet (BSC) or chemical fume hood.

Animal administration must take place in a biosafety cabinet with double gloves.

Necropsy must be performed inside a biosafety cabinet.

## Emergency Equipment

In addition, a hand-washing sink **must** be readily available to all locations where toxins are used; and an emergency shower and eyewash station or eyewash/drench hose combination unit is recommended.

## Sharps

Standard sharps should not be used with biological toxins. If it is absolutely necessary to use sharps with toxins, sharps with engineering controls (i.e. self-sheathing) should be used.

Used needles **must** be disposed of in an approved sharps container immediately after use. Used needles should not be set on the bench, sheared, bent, or re-capped prior to disposal.

For more information about using sharps, refer to the Environment, Health & Safety (EHS) Web site [Use of Sharps](https://ehs.umich.edu/research-clinical/equipment-tools/use-of-sharps/) Web page.)

## Restraint Devices

Restraint devices and practices should be used to reduce the risk of exposure during animal manipulation and administration should take place inside a certified BSC or chemical fume hood.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

* Re-suspend the toxin by careful and slow titration, rinsing down the walls of the tube in the process.
* Toxin should be removed from the BSC or chemical fume hood only after the exterior of the closed primary container has been decontaminated (with a solution appropriate for specific toxin) and placed in a clean secondary container.
* The interior of the BSC or hood should be decontaminated periodically, for example, at the end of a series of related experiments.
* Until thoroughly decontaminated, the BSC or chemical fume hood should be posted to indicate that toxins remain in use, and access should remain restricted.
* Remove and dispose or decontaminate protective clothing and wash hands with soap and water before leaving the work area.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

At a minimum, lab personnel **must** wear safety glasses, suitable laboratory PPE to protect hands and arms (such as lab coats, smocks, or coveralls), and disposable gloves when working at an open-fronted BSC or chemical fume hood.

When handling toxins that are percutaneous hazards (irritants, necrotic to tissue, or extremely toxic by dermal exposure), select [gloves](https://ehs.umich.edu/research-clinical/planning-safe-research/glove-compatibility-chart/) that are known to be impervious to the toxin. Consider both the toxin and the diluent when selecting gloves or other protective clothing. If infectious agents and toxins are used in an experimental system, consider both when selecting protective clothing and equipment. Respiratory protection may be required if aerosols may be generated and it is not possible to use containment equipment or other engineering controls.

Double gloves must be worn for animal administration.

# Security [Provide additional information as it pertains to your research protocol]

* Toxins should be stored within a locked freezer, refrigerator or cabinet when not in use. Freezers, refrigerators, cabinets, and other containers where stocks of select agents are stored must be locked when they are not in direct view of the workers (e.g., when located in unattended storage areas).
* An inventory control system should be in place.
* Access to areas containing toxins should be restricted to those whose work assignments require access.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Toxin containers **must** be labeled with the toxin name and hazard warnings.
* Toxins should be transported only in leak-proof secondary containers.
* When toxins are stored in the lab, containers should be sealed, legibly labeled and secured to ensure restricted access.
* Use spill trays in BSCs, chemical fume hoods, or glove boxes for work with toxins, especially in solution.
* Refrigerators and other storage containers containing biological toxins should be labeled with contact information for trained, responsible laboratory staff.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Before disposal, destroy select agent biological toxins by using appropriate chemical or physical agents, i.e. sodium hypochlorite and / or sodium hydroxide solution or by autoclave.

# BSC/Chemical Fume Hood Failure [Provide additional information as it pertains to your research protocol]

Close or cover all toxin containers. Shut down operations, close hood sash, and evacuate room. Contact your maintenance provider to repair the BSC or chemical fume hood.

# Training of Personnel

All personnel are required to complete the ***General Laboratory Safety Training*** session (**BLS025w** *or equivalent*) via the [EHS My LINC](http://ehs.umich.edu/education/). Web page. Furthermore, all personnel shall read and fully adhere to this SOP when handling these toxins.

Personnel **must** have training as to the symptoms of toxin exposure, post-exposure management, spill cleanup and decontamination, proper use of engineering and work practice controls, personal protective equipment and security requirements. Additional training is required for Select Agent Toxin use.

# Certification

I have read and understand the above SOP. I have received approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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| Laboratory Director | Revision Date |

### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| --- | --- |
| Date | Revision |
| 09-13-18 | EHS name and logo were added, updated the formatting, and revised the content under Exposure/Unintended Content (AKJ). |
| 03-04-19 | Reviewed and updated. |
| 09-12-23  | Reviewed and updated (IWT).  |