# General Use Standard Operating Procedure (SOP)

# Biological Toxins

**Health Hazard

Globally Harmonized System pictogram Indicating a chemical is an health hazard, such as a carcinogen.** **Acute Toxicity

Globally Harmonized System pictogram Indicating a chemical is an acute toxicity hazard.**

*Globally Harmonized System Hazard Class: Health Hazard or Acute Toxicity*

*Examples: Pertussis toxin, Lipopolysaccharide, Diphtheria toxin, Cholera toxin*

**Note**: This SOP is intended to provide general guidance on how to safely work with biological toxins and only addresses safety issues specific to biological toxins. Other hazard classes may also apply. Review Safety Data Sheets (SDS) and refer to other general use SOPs relevant to the chemical you are working with. Contact the Principal Investigator/ Laboratory Supervisor or the WSU Chemical Hygiene Officer for questions concerning the applicability of any item listed in this SOP (OEHS: 313-577-1200).

**If the chemical of interest is a particularly hazardous substance or a high risk chemical a lab specific SOP is required.**

## Hazard Description

Biological toxins are hazardous substances produced by microorganisms, animals, insects, and plants that can be harmful when inhaled, ingested, injected, or absorbed. Depending on the toxin and amount and route of exposure, health effects can range from minor (skin or eye irritation, headache, nausea) to severe (respiratory distress, muscle weakness, seizures, death). Toxins with a mammalian LD50 ≤100 μg/kg body weight, called “acute toxins”, pose the greatest risk. They are highly toxic in minute quantities, have no established safe exposure limits, and there is limited toxicological data applicable to human exposures. Laboratory exposure risks are primarily from accidental injection, absorption through skin or mucous membranes, inhalation, and ingestion. Most acute toxins are stable proteins (or carbohydrates) requiring rigorous inactivation of contaminated surfaces, objects, and waste. Note that the health effects and lethal dose in humans for many biological toxins are not well known, and therefore should be treated with a high level of caution.

## Control of Hazards – General

* Conduct a hazard assessment to identify proper use and handling techniques, fire safety, storage, and waste disposal issues specific to the chemical being used.
* Note CDC/USDA Select Toxins require Institutional Biosafety Committee (IBC) approval for use.
* If possible, do not work with toxins in solid or powder form. If it is necessary to purchase it in powder or solid form, purchase pre-weighed toxin in the minimum quantity needed to perform work.
* When opening packages of biological toxins shipped to the lab, use a functional and certified fume hood or biosafety cabinet.
* Conduct literature search and review for the specific biological toxin. Review resource information such as from the Federal Select Agent Program. Assess the lethal dose (LD50) and health effects of each toxin.
* Develop a written laboratory-specific SOP for the toxin being used.
* Provide and document hazardous chemical training and specific toxin SOP training to personnel working with biological toxins and any other personnel authorized or required to be in the laboratory during toxin work. This should include but is not limited to reviewing the SDS, training on the physical hazards of the chemicals, symptoms of exposure, appropriate work practices, and use of PPE.
* Use good microbiological laboratory techniques.
* Do not work alone when working with biological toxins.
* Verify your experimental set-up and procedure prior to use.
* Before starting work, prepare a fresh solution of the appropriate chemical used for inactivation of the biological toxin, if applicable. Refer to SDS and other reference material, such as CDC Biosafety in Microbiological and Biomedical Laboratories, for specific information.
* Line work area with absorbent, leak-proof bench pads. Change daily.
* For toxins supplied in glass ampules, wrap a paper towel around the top of the ampule when snapping the ampule open to protect against cuts.
* For toxins supplied in septum sealed vials, use a hands-free device to stabilize the vial to avoid an accidental needle stick when resuspending.
* Use in the smallest practical quantities for work being done.
* Change gloves at least every 2 hours, or immediately after contamination, and wash hands at time of glove change.
* Re-suspend the toxin carefully and slowly, rinsing down the walls of the tube in the process.
* Toxin should be removed from the BSC or 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 or at the end of each day.
* Until thoroughly decontaminated, the fume hood or BSC 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.

## Engineering/Ventilation Controls

* Designate a certified BSC, fume hood, glove box or other approved containment for work with a biological toxin. Do not use a laminar flow hood or cabinet for toxin work. Consider the properties of the specific toxin and procedures when selecting a containment device.
* When toxins are in use, post a warning sign in the area (e.g. WARNING! PERTUSSIS TOXIN WORK AREA – TOXIC).
* In-line HEPA filters are required if vacuum lines are used with toxin.
* If centrifuging materials containing toxin, centrifuge safety cups or sealed rotors must be used and the outside surfaces routinely decontaminated. Open the sealed cups or rotors inside BSC or fume hood.
* Limit the use of glassware (no glass Pasteur pipettes).
* Sharps with engineering controls (i.e. self-sheathing) must be used. Have a sharps container next to the work area for quick and easy disposal.

## Personal Protective Equipment

In addition to proper street clothing (long pants or equivalent that cover legs and ankles, close-toed non-perforated shoes that completely cover the feet), wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks:

* Safety glasses (If splash potential exists, use goggles + face shield instead)
* Lab coat.
  + Hazard assessment of procedures may indicate the need for a flame-resistant lab coat, such as Nomex.
* Appropriate chemical‐resistant gloves.
  + Refer to Section 8 “Exposure controls/personal protection” of SDS or a glove selection guide (e.g. [Ansell Chemical Protection Guide](https://www.ansellguardianpartner.com/chemical/home#hp)) to identify appropriate glove type.

## Special Handling Procedures and Storage Requirements

* Designate toxin storage area in a locked container (freezer, refrigerator, cabinet or other container) in a secure location.
* Store and transport toxin in a minimum of 2 layers of sturdy, leak-proof non-breakable containers (e.g. plastic container with sealing lid as a secondary container).

## Decontamination Procedures

* Determine the appropriate chemical and/or physical inactivation method(s) for the specific toxin. Exposure to strong bleach or sodium hydroxide for a minimum of 30 minutes is generally sufficient. Note: autoclaving is not an effective method for low molecular weight toxins (e.g. marine toxins or mycotoxins). Refer to SDS and other reference material, such as CDC Biosafety in Microbiological and Biomedical Laboratories, for specific information.
* Ensure supplies for inactivation of toxin are available. Note: disinfecting solutions and products may not inactivate biological toxins.
* Spills must be cleaned immediately by properly protected and trained staff.
* For liquid spills, cover spill with absorbent materials and inactivate by applying the appropriate chemical inactivating agent starting at the perimeter and working toward the center, allowing prescribed contact time before clean up. Clean the spill area with inactivating agent, allowing prescribed contact time, then soap and water.
* For powder spills inside fume hood or biosafety cabinet, cover with absorbent materials that have been wetted with a compatible buffer or inactivating agent, in order to prevent air dispersal. Apply the appropriate chemical inactivating agent starting at the perimeter and working toward the center, allowing prescribed contact time before clean up. Clean the spill area with inactivating agent, allowing prescribed contact time, then soap and water.
* For powder spills outside of a containment device, personnel should be instructed to leave the laboratory and entrance should be restricted. Contact OEHS for clean-up.

## Waste Disposal

Unused biological toxins, toxin waste and materials contaminated with biological toxins must be collected and disposed of as hazardous waste. Consult OEHS to determine if it should be collected as chemical or biohazardous waste. Waste may need to be chemically inactivated prior to disposal.

Do not dispose of waste by dumping down a drain or discarding in regular trash containers, unless authorized in writing by OEHS. Submit requests to OEHS for waste containers, labels, and waste collection. Also, refer to the OEHS Hazardous Waste Management web page and WSU Chemical Hygiene Plan for more information.

# Spill procedures

1. **Spills**

For hazardous material spills or releases which have impacted the environment (via the storm drain, soil, or air outside the building) or which cannot be cleaned up by local personnel due to size of spill, hazard level, or hazards are unknown:

* 1. Call WSU Police (313) 577-2222. Available 24 hours a day, 7 days a week.
  2. Evacuate the spill area
  3. Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering.
  4. Remain in the vicinity until emergency personnel arrive and provide them with information on the chemicals involved.

For additional information regarding spill response procedures, refer to the [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) and [American Chemical Society (ACS) guide for chemical spill response](https://www.acs.org/content/acs/en/about/governance/committees/chemicalsafety/publications/guide-for-chemical-spill-response.html).

1. **Small Spills**

In the event of a minor spill or release that can be safely cleaned up by local personnel using readily available equipment (e.g. absorbent materials) and appropriate PPE:

* 1. Alert personnel in the immediate area of spill and restrict access.
  2. Review the SDS for the spilled material, or use your knowledge, to assess the hazards and to determine the appropriate level of protection.
     1. **DO NOT** clean up spills requiring respiratory protection. Contact OEHS for help (313-577-1200).
  3. Choose appropriate personal protective equipment (e.g. goggles, face shield, chemical resistant gloves, lab coat or apron).
  4. Protect floor drains, sinks or other potential avenues of environmental release as much as possible. Make a dike around the outside edges of the spill using absorbent materials.
  5. For solid spills: Cover solid material with wetted paper towels to minimize dust generation.
  6. For liquid spills: Cover the liquid with paper towels, working from the spill's outer edges toward the center.
  7. Collect spill cleanup materials using a scoop or other suitable items and place in a plastic bag.
  8. After spilled material is removed, decontaminate surfaces with an appropriate disinfectant. Refer to Safety Data Sheet, product information, or other references to determine appropriate disinfectant.
  9. Place all contaminated materials, including contaminated items such as gloves, in the plastic bag. Once all clean-up material has been collected, tie the bag closed. Once all clean-up material has been collected, tie the bag closed and place in a sealable hazardous waste container.
  10. Label waste container with completed hazardous waste tag (available from OEHS).
  11. Submit online [waste pickup request](https://research.wayne.edu/oehs/hazardous/chemical-waste.php) to OEHS.

# Emergency Procedures

**\*\*If medical attention required, call WSU police (313-577-2222) immediately\*\***

* **Fire Extinguishers** – Refer to section 5 of the SDS for chemical specific firefighting measures. Both ABC dry powder and carbon dioxide extinguishers are appropriate for most fires.
* **Eyewash/Safety Showers** – Depending on the chemical hazard type, an ANSI approved eyewash station and safety shower may be required, easily accessed, and available within 10 seconds travel time for emergency use. Instruct personnel on the locations of eyewashes and safety showers, and how to activate them, prior to an emergency. Refer to [MIOSHA Fact Sheet: Eyewashes and Safety Showers](https://www.michigan.gov/documents/lara/lara_miosha_cet0199_628109_7.doc) to determine if an eyewash/safety shower is required for your specific chemical.

Please note: Additional hazards present in the laboratory may require that an eyewash or safety shower be present. This emergency equipment is required for treating exposures to workplace hazards such as chemical splashes, biological agents, welding sparks, metal shavings, or fine particulates like dust, dirt and sand.

1. **Health Threatening Emergencies**
   1. **Fire, explosion, health threatening hazardous material spill or release, compressed gas leak, or valve failure.**
      1. Call WSU Police (313) 577-2222.
      2. Alert people in the vicinity and activate the local alarm systems.
      3. Evacuate the area and go to your Emergency Assembly Point.
      4. Remain nearby to advise emergency responders.
      5. Once personal safety is established, call OEHS at (313) 577-1200.

Note: For compressed gas leaks, shut off gas supply only if this can be done safely, without risk to personnel.

* 1. **Injuries and Exposures:** 
     1. Remove the injured/exposed individual from the area, unless it is unsafe to do so because of the medical condition of the victim or the potential hazard to rescuers.
     2. Call WSU Police (313) 577-2222.
     3. Administer first aid as appropriate.
        1. Eye contact: Promptly flush eyes with copious amounts of water for a prolonged period (at least 15 minutes). Seek medical attention.
        2. Ingestion: Seek medical attention IMMEDIATELY. See first aid section of chemical Safety Data Sheet.
        3. Skin contact: Remove any contaminated clothing. IMMEDIATELY flush contamination from skin using the nearest emergency shower for a minimum of 15 minutes. Seek medical attention.
        4. Inhalation: Get to a source of fresh air. Seek medical attention.
     4. Call OEHS (313) 577-1200, to report the exposure and complete [Report of Injury](https://risk.wayne.edu/files/rofi.pdf) form.
     5. Bring to the hospital copies of the Safety Data Sheets for all chemicals to which the victim was exposed.

1. **Non-Health Threatening Emergencies**
   1. **Injuries and Exposures**

For injuries and exposures that are not considered serious or a medical emergency, visit:

Henry Ford Occupational Health – Harbortown

3300 East Jefferson, Suite 100

Detroit MI 48207

(313) 656-1618

Monday – Friday 8:00 AM to 6:30 PM

If Henry Ford Occupational Health Center is closed or for serious injuries, visit:

Henry Ford Hospital – Emergency Room

2799 W. Grand Blvd.

Detroit MI 48202

(313) 916-8742

OR

Detroit Receiving Hospital - Emergency Room

4201 St. Antoine St, Detroit, MI 48201

Phone: (313) 745-3000

# Minimum Training Requirements

1. **General Training:**

* Online through the [Collaborative Institutional Training Initiative (CITI)](https://about.citiprogram.org/en/homepage/).
  + Laboratory Safety Training (general lab & chemical safety issues)
  + Hazard Communication
* [Fire Safety](https://risk.wayne.edu/fire-safety).

1. **Laboratory Specific Safety Training:**

* [Laboratory-Specific Safety Training checklist](https://research.wayne.edu/oehs/lab-safety/lab-safety-training-checklist.docx)
* Review of SDS for chemicals involved in process/experiment.
* Review of this SOP.
* Review [WSU Hazardous Waste Management](https://research.wayne.edu/oehs/hazardous/chemical-waste) guidelines.
* Other: \_\_\_\_\_\_\_\_\_

# Laboratory Personnel Review

Prior to initiating work, lab personnel using these types of chemicals must complete the table below confirming that they have read and understood the above SOP and the associated hazards.

| **Name** | **Signature** | **Date** |
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