



## Highly Toxic Chemicals

***Principal Investigator (PI) Approval is Required Prior to Performing this Procedure***

### Description

*This standard operating procedure outlines the handling and use of highly toxic chemicals. 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 highly toxic chemicals.*

A substance with a high degree of acute or chronic toxicity is considered a chemical falling within any of the following categories:

1. A chemical with a median lethal dose (LD50) of 50 mg or less per Kg of body weight when administered orally to albino rats weighing between 200 and 300 gm each.
2. A chemical with a median lethal dose (LD50) of 200 mg or less per Kg of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between 2 and 3 Kg each.
3. A chemical that has a median lethal concentration (LC50) in air of 200 ppm by volume or less of gas or vapor, or 2 mg per liter or less of mist, fume, or dust, when administered by continuous inhalation for 1 hour (or less if death occurs within 1 hour) to albino rats weighing between 200 and 300 gm each.

### Potential Hazards

Highly toxic substances are known to cause severe illness and sometimes death upon exposure. Highly toxic powders may aerosolize and pose an inhalation hazard. Similarly, highly toxic liquids may evaporate and be subsequently inhaled. Highly toxic substances may also be absorbed through the skin and/or mucous membranes and cause local or systemic effects.

**Check the Safety Data Sheet (SDS) of the material for exposure limits to determine inhalation hazards, and for skin warnings to determine skin hazards. The SDS will also provide information on other hazards such as flammable, corrosive, etc. Follow other SOPs as appropriate.**

### Engineering Controls

- **Fume hood:** All manipulation of highly toxic chemicals should be carried out in a fume hood. If vapors or aerosols (toxic powders and liquid suspensions) are generated, it must be handled in a chemical fume hood, exhausted biological safety cabinet with negative pressure ductwork, or other exhausted enclosure. If the use of a fume hood proves impractical refer to the section on special ventilation.
- **Glove (dry) box:** Certain highly toxic chemicals must be handled in a glove box rather than a fume hood. The Principal Investigator, Lab Director or Manager will determine if this is required.

- **Eyewash:** Where the eyes or body of any person may be exposed to highly toxic chemicals, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use. Bottle type eyewash stations are not acceptable.

A safety or drench shower should be available in a nearby location where the highly toxic chemicals are used.

Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of highly toxic chemicals which pose this risk should occur in a fume hood with the sash in the lowest feasible position. Portable shields, which provide protection to all laboratory occupants, are acceptable.

Manipulation of highly toxic chemicals outside of a fume hood may require special ventilation controls in order to minimize exposure to the material. Fume hoods provide the best protection against exposure to highly toxic chemicals in the laboratory and are the preferred ventilation control device. Where possible handle highly toxic chemicals in a fume hood. If the use of a fume hood proves impractical attempt to work in a glove box or in an isolated area on the laboratory bench top.

If available and appropriate, consider using a biological safety cabinet. The biological safety cabinet is designed to remove aerosolized highly toxic chemicals before the air is discharged into the environment. Highly toxic chemicals that are volatile must not be used in a biological safety cabinet unless the cabinet is vented to the outdoors.

### **Work Practice Controls**

Laboratories using highly toxic chemicals must use a “Designated Area” identifier to identify areas where the highly toxic chemical work is taking place. This can be accomplished using postings on the laboratory door, signs near the area where the highly toxic chemical is used, or labels around the physical area where the highly toxic chemical is used (for example: labeled tape). Other means of designating highly toxic chemical areas must be approved by OSEH. Labels or signs used to identify highly toxic chemical areas must indicate the highly toxic chemical being used in addition to the words “Designated Area”.

Laboratories with designated areas may require specific work practices to reduce the risk of exposure to laboratory employees. Examples of these restrictions may be:

- Work logs indicating who, when, and how much of a highly toxic chemical was used in a designated area
- Restricted access areas of work
- Special laboratory specific signs or labels (in addition to Designated Area identifier signs) indicating warnings or work practices to be followed

Designated area locations, applicable work practices, and information regarding general handling of specific highly toxic chemicals must be communicated to laboratory employees through laboratory-specific training provided by the Principal Investigator prior to beginning work with highly toxic chemicals.

Additional guidelines:

- Keep containers closed as much as possible.
- Use in the smallest practical quantities for the experiment being performed.
- For powders, whenever possible, order the material in liquid form or purchase in pre-weighed amounts, preferably in a sealed vial with a septum so that the diluent can be injected directly into the vial.

- For powders, determine a means for decontaminating the work area. Daily HEPA vacuuming or wet cleaning methods (with a compatible solvent) are required for any work that may generate aerosols. Note that HEPA vacuuming is not recommended for reactive materials, as they may react with other materials collected in the vacuum, or with components of the vacuum itself.
- If weighing dry powders and the balance cannot be located in a fume hood or BSC, tare a container then add the material to the container in a hood and seal the container before returning to the balance to weigh the powder.
- Change gloves regularly (at least every two hours) and wash hands at the time of the glove change.
- If using a HEPA vacuum to clean powdered residues, change the filter inside a chemical fume hood or biological safety cabinet. If the HEPA vacuum may be used for incompatible materials, maintain a log of vacuum use so that collection of incompatible materials can be avoided.

### **Personal Protective Equipment**

Lab coats, closed toed shoes and long sleeved clothing must be worn when handling highly toxic chemicals. Additional protective clothing like Tyvek suits and/or gowns (or other air-tight non-woven textile) should be worn if the possibility of skin contact is likely, especially if the arms, torso, and other body parts may be exposed to dry particles and liquid suspensions.

Eye protection in the form of safety glasses must be worn at all times when handling highly toxic chemicals. Ordinary (street) prescription glasses do not provide adequate protection. (Contrary to popular opinion these glasses cannot pass the rigorous test for industrial safety glasses.) Adequate safety glasses must meet the requirements of ANSI Z.87. 1 and must be equipped with side shields. Safety glasses with side shields do not provide adequate protection from splashes, therefore, when the potential for splash hazard exists, other eye protection like goggles and/or face protection must be worn.

Gloves must be worn when handling highly toxic chemicals. Disposable nitrile gloves provide adequate protection against accidental hand contact with small quantities of most laboratory chemicals. However, the handling of some highly toxic chemicals will require specific chemical resistant gloves. Many toxic liquids, including acetone and methylene chloride, easily penetrate common laboratory gloves. If glove contact is anticipated, check the glove compatibility charts on EHS's [Glove Use webpage](#) to select an appropriate glove. Lab workers should review the SDS for the highly toxic agent to select the proper glove.

### **Transportation and Storage**

- Transport liquids in unbreakable secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier. Wear all PPE appropriate to the chemicals being transported.
- If the toxic liquid is also flammable, follow transportation and storage guidelines for flammables.
- Avoid storing on the floor.
- Dry powders must be in sealed shatter-resistant containers and/or a secondary container during transportation.
- If the material may be flammable, reactive, or explosive, keep away from heat and open flame.
- Keep chemicals away from any incompatible materials.

## Waste Disposal

All materials contaminated with highly toxic chemicals must be disposed of as a hazardous waste. Wherever possible, attempt to design research in a manner that reduces the quantity of waste generated.

Because most spent, unused and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. ***Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers.*** Contact EHS at (313) 593-0921 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to EHS's [Hazardous Waste Webpage](#) for more information.

## Exposures/Unintended Contact



***If the employee is in need of emergency medical attention, call 911 immediately.***



Always check the SDS for specific instructions for the chemicals you are working with. Be prepared to provide emergency personnel with a copy of the SDS so that medical personnel are aware of the material(s) involved and can take precautions to protect themselves.

For an actual chemical exposure/injury, flush exposed eyes or skin with water for at least 15 minutes, then seek medical attention.

Report all work related accidents, injuries, illnesses or exposures to WorkConnections within 24 hours by completing and submitting the [Illness and Injury Report Form](#). Follow the directions on the WorkConnections website [Forms Instructions](#) to obtain proper medical treatment and follow-up.

Complete the [EHS Laboratory Incident and Near-Miss Report](#) form.

### Health Care Providers

Medical consultations and examinations for employees are provided via:

#### Concentra Medical Center

17500 Federal Drive, Ste. 750  
Allen Park, MI  
Phone: 313-982-1376  
MON – FRI: 8:00am – 5:00pm

#### Concentra Medical Center (After Hours and Non-Emergency)

11700 Metro Airport Center Drive, Ste. 104  
Romulus, MI  
Phone: 734-955-7000  
24 hours – 7 days a week

#### Henry Ford Medical Center-Fairlane -- *University students (non-life threatening conditions)*

19401 Hubbard Drive  
Dearborn, MI 48126  
Phone: 313-928-8278

Click [here](#) for more information.

## Spill Procedure

Please refer to SDSs for specific guidelines for responding to spills. If uncertain, contact your lab director or manager for assistance. The following spill procedures may not apply to all highly toxic chemicals.

### Additional Spill Procedures:

A **minor (small) chemical spill** is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel. A **major/large chemical spill** requires active assistance from emergency personnel.

- When a spill occurs, ***personal safety should always come first.***
- Alert and clear everyone in the immediate area where the spill occurred.

### Spill Response Steps:

#### MINOR CHEMICAL SPILL

- Alert people in immediate area of spill.
- If spilled material is flammable, turn off ignition and heat sources. Don't light Bunsen burners or turn on other switches.
- Open outside windows, if possible.
- Wear appropriate personal protective equipment.
- Avoid breathing vapors from spill.
- Confine spill to as small an area as possible.
- **Do not wash spill down the drain.**
- Use appropriate spill kits/sorbents to neutralize corrosives and/or absorb spill. Collect contaminated materials and residues and place in container.
- For spills of dry powders in a chemical fume hood or other enclosure, or very small spills outside a chemical fume hood, wipe up the powder using a cloth dampened with a suitable solvent, (determined in advance) or wet the powder with a suitable solvent and then wipe with a dry cloth. Consider using electrostatic microfiber cleaning cloths, especially if the powder is likely to carry an electrostatic charge. Alternately (or in addition), a HEPA vacuum (preferably with electrostatic-charge-neutralization features) may be used for cleaning the spill (but do not use the vacuum for cleaning incompatible materials). Minimize the fume hood or enclosure opening during this process. Place all clean-up materials into a white plastic bucket and affix a completed hazardous waste label.
- Clean spill area with water.
- EHS at (313) 593-0921 to schedule a pickup.

#### MAJOR CHEMICAL SPILL

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate.
- If spilled material is flammable, turn off ignition and heat sources. Don't light bunsen burners or turn on other switches.
- **Call Public Safety at (313) 593-5333 or 911 from a campus phone immediately for assistance.**

- Close doors to affected area.
- Post warnings to keep people from entering the area.
- Have person available that has knowledge of incident and laboratory to assist emergency personnel.

#### Additional Spill Links:

- [Chemical Spill Control Information](#)

Report all emergencies, suspicious activity, injuries, spills, and fires to Public Safety by calling at (313) 593-5333 or 911 from a campus phone. Register with the University of Michigan-Dearborn [Emergency Alert System](#).

#### Training of personnel

All personnel are required to complete the [Comprehensive Laboratory Safety](#) session (BLS009 or equivalent). Furthermore, all personnel shall read and fully adhere to this SOP when handling highly toxic chemicals.

#### Certification

I have read and understand the above SOP. I agree to contact my Supervisor or Lab manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Principal Investigator \_\_\_\_\_

Revision Date \_\_\_\_\_