General Use Standard Operating Procedure (SOP)

Acutely Toxic Chemicals

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*Globally Harmonized System Hazard Class and Category(s): Acute Toxicity Oral and Dermal*

#### Examples: Organolead compounds (e.g. Tetraethyllead), Organomercury compounds (e.g dimethyl mercury), hydrofluoric acid, Cyanide salts (potassium and sodium), hydrogen cyanide, phosgene, sodium azide

**Note**: This SOP is intended to provide general guidance on how to safely work with acutely toxic chemicals and only addresses safety issues specific to acutely toxic chemicals. 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. In addition to the lab specific SOP, labs who intend to use highly toxic dermal and inhalation acute toxins (GHS category 01) must obtain approval from Wayne State University Chemical Safety Committee, prior to begin any research.

# Hazard Description

* Acutely toxic chemicals pose significant adverse health effects (including the possibility of death) following oral or dermal administration of a single dose of a substance, or multiple doses given within 24 hours, or an inhalation exposure of 4 hours. The analysis is based on the LD50 (median lethal dose by oral or dermal exposure) and LC50 (median lethal inhalation concentration) for a four-hour exposure. The LD50 and LC50 represent the dose or concentration, respectively, at which 50 percent of the test animals (and, presumptively, humans) will be expected to die.
* The route of exposure that causes the adverse effect may be inhalation, absorption (through skin, eyes, or mucous membranes), or ingestion, depending on the chemical.
	+ Some have the potential to penetrate gloves.
* Effects of contact or inhalation may be delayed.
* May decompose upon heating to produce corrosive and/or toxic fumes.

# 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.
* Eliminate or substitute for a less hazardous chemical if possible.
* Purchase and use the smallest quantity practical, at the lowest concentration of acutely toxic chemicals that will meet your research needs.
* When possible, order the material in liquid form OR in pre-weighed amounts, in a sealed septum-top vial, so that diluent can be injected directly into the vial.
* Do not handle acutely toxic chemicals when working alone.
* Designate a specific work area for particularly hazardous toxins and label it (e.g. WARNING! SODIUM CYANIDE WORK AREA – HIGHLY TOXIC).
* Line work area with absorbent, leak-proof bench pads. Change daily or after each use.
* If possible, equipment used for procedures involving acute toxins should be suitably isolated from the general laboratory environment.
* After each use decontaminate the immediate work area and equipment used to prevent accumulation of residual acute toxins.
* After leaving designated area, remove PPE and wash hands thoroughly prior to begin any other work.
* Once a project with acute toxins is completed, thoroughly decontaminate the designated work area, instruments and utensils used prior to returning to normal laboratory work.
* Vacuum pumps used for procedures involving acute toxins should be protected from contamination by installing two collection flasks in series along with an in-line hydroscopic filter.
* Plan work to avoid contact with gloves. ***Change gloves immediately if contaminated.***
* Change gloves at least every 2 hours and wash hands at time of glove change.
* Some acute toxins have the potential to penetrate gloves. Review the chemical specific SDS to identify ideal glove material to use.
* Verify your experimental set-up and procedure prior to use.

# Engineering/Ventilation Controls

* Use a chemical fume hood or other locally exhausted ventilation ducted to the outside with acute toxins if:
	+ Vapors and/or aerosols generated during the experiment or
	+ Work involves open containers of dry powder, or
	+ Work involves open or pressurized manipulations of suspensions or solutions.
* Certain acutely toxic chemicals must be handled in a glove box rather than a fume hood.

# 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.
	+ For dermal acute toxins, additional protective clothing (e.g. over sleeves, apron) should be used in addition to the lab coat.
* Appropriate chemical‐resistant gloves.
* Glove selection must be done after a risk assessment and referring to the SDS recommendations. Double gloving with nitrile gloves may be adequate to handle small quantities of none dermal acute toxins. However, for best protection use the the glove material recommended in the chemical specific SDS.
	+ 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.
* Respirators.
	+ Use of acute inhalation toxins may require respiratory protection. Refer to Section 8 “Exposure controls/personal protection” of SDS to select the appropriate respirator based on the type of chemical use. Some respirators require special training and fit testing. Contact OEHS respiratory protection program prior to using respirators, including an N95 mask.

# Special Handling Procedures and Storage Requirements

* Transport in a sealed, shatter-resistant container. Use a secondary container if the container is not shatter resistant.
* Keep toxics away from any incompatible materials.
* Store non-flammable acutely toxic chemicals within secondary containment.
* Chemicals that require refrigeration should be stored within secondary containment.
* Store flammable acutely toxic chemicals within flammable storage cabinet.
* Store acute inhalation toxins in a vented chemical cabinet or well ventilated area.
* Use an anti-static gun if powder sticks to sides of vial, etc.
* Store liquid acute toxins in secondary containers and always below eye level.
* Keep segregated from incompatible chemicals.
* Store the highly toxic (lethal, GHS category 1 and 2) acute toxins in a secured storage area. preferably within a locked cabinet in a room with restricted access.

# Decontamination Procedures

* Wet-clean using a compatible solvent or a solution of detergent and water to minimize air dispersion.

OR

* HEPA vacuum daily.

# Waste Disposal

* Acutely toxic chemicals intended for disposal are considered hazardous wastes.
* Unused or unopened chemicals designated by EPA as P-list or U-list are considered hazardous waste.
* Empty containers that previously contained a P-listed chemical such as sodium azide or cyanide salts are regulated as a hazardous waste. These containers must be disposed of through OEHS as hazardous waste.
* Empty containers of most other liquid or solid chemicals that are not on the P-list can be triple rinsed, defaced, and discarded as regular trash or glass waste as appropriate.

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](https://research.wayne.edu/oehs/forms/chem-waste) for waste containers, labels, and waste collection. Also, refer to the [OEHS Hazardous Waste Management web page](http://research.wayne.edu/oehs/hazardous/index.php) and [WSU Chemical Hygiene Plan](http://research.wayne.edu/oehs/pdf/chemical-hygiene-plan.pdf) 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 [OEHS chemical spill response guidelines](http://research.wayne.edu/oehs/chemical/spills), [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. Eliminate all sources of ignition.
	3. Increase ventilation in area of spill (turn on fume hood and open sash, open windows). Vent vapors to outside of building only.
	4. 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).
	5. Choose appropriate personal protective equipment (e.g. goggles, face shield, chemical resistant gloves, lab coat or apron).
	6. 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.
	7. For solid spills: Use a scoop and brush or other suitable non-combustible items to collect spilled material. Minimize dust generation.
	8. For liquid spills: Cover the liquid with appropriate non-combustible absorbent material (NO paper towel), working from the spill's outer edges toward the center.
	9. Collect spill cleanup materials using a scoop or other suitable items and place in a tightly closed hazardous waste container.
	10. After spilled material is removed, decontaminate surfaces with water or other appropriate solvent.
	11. Place all contaminated materials, including contaminated items such as gloves, in the hazardous waste container.
	12. Label waste container with completed hazardous waste tag (available from OEHS).
	13. 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) and Hazard Communication
* [Fire Safety](https://risk.wayne.edu/fire-safety).
1. **Laboratory Specific Safety Training:**
* [Laboratory-Specific Safety Training](https://research.wayne.edu/oehs/docs/lab-safety-training-checklist.doc) checklist
* 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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