

## Acutely Toxic Solids and Liquids

### STANDARD OPERATING PROCEDURE (SOP)

**Type of SOP:**     Process     Hazardous Chemical     Hazardous Class

All personnel who are subject to these SOP requirements must review a completed SOP and sign the associated training record. Completed SOPs must be kept with the UC Davis Laboratory Safety Manual or be otherwise readily accessible to laboratory personnel. Electronic access is acceptable. SOPs must be reviewed, and revised where needed, as described in the [UC Davis Laboratory Safety Manual](#). Note that not all hazardous chemicals are appropriately addressed in a single control-banded SOP, and some chemicals are subject to several control-banded SOPs. The unique properties of each chemical must be considered before including it into a control band.

---

Date SOP Written:	<u>12/29/15</u>	Approval Date:	<u>Click here to enter a date.</u>
SOP Prepared by:	<u>Akiva Shalit-Kaneh</u>		
	<u>CLSC SOP Task Force</u>		
SOP Reviewed and Approved by (name/signature):	<u>REQUIRED - Insert Approver's Name &amp; Signature</u>		
Department:	<u>Plant Biology</u>		
Principal Investigator/ Laboratory Supervisor:	<u>Stacey Harmer</u>	Phone:	<u>530-752-8101</u>
Lab Manager/ Safety Coordinator:	<u>Akiva Shalit-Kaneh</u>	Phone:	<u>530-752-8102</u>
Emergency Contact(s):	<u>EH&amp;S (safety specialist helpline)</u>	Phone:	<u>530-752-1493</u>
	<u>Fire Department</u>		<u>911</u>
Location(s) covered by SOP:	Building: <u>LSA</u>	Lab	
	Room #(s): <u>2123, 2119, 2115, 2110, 2124</u>	Phone:	<u>530-752-8102</u>

---

#### 1. HAZARD OVERVIEW

There is a broad spectrum of Acutely Toxic solid and liquid materials. For these materials, a single short-term exposure at low concentrations can cause serious illness or death. Recognition of the hazards associated with the transportation, operation, storage, and disposal of these materials is essential.

## 2. HAZARDOUS CHEMICAL(S)/CLASS OF HAZARDOUS CHEMICAL(S)

An Acutely Toxic Material is a chemical falling within any of the following categories:

- A. 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.
- B. 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.
- C. 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.

Acutely Toxic Materials can be identified using the Globally Harmonized System Hazard Codes H300 (Fatal if swallowed), H310 (Fatal in contact with skin) and H330 (Fatal if inhaled). A few examples of common Acutely Toxic Materials used at the UC Davis campus include, but are not limited to, the following:

1. Sodium Azide
2. Mercaptoethanol
3. Cyanide salts
4. Mercury compounds
5. Isocyanates

**Sodium Azide** - may be harmful if inhaled. May cause respiratory tract irritation. May be fatal if absorbed through skin. May cause skin irritation. May cause eye irritation. May be fatal if swallowed. May react with metal spatulas and metal lab equipment to form shock sensitive salts. Reacts with lead, copper, silver, gold and metal halides to form heavy metal azides which are explosive.

**Mercaptoethanol** - Combustible liquid. Toxic if swallowed or if inhaled. Fatal in contact with skin. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye damage. May cause damage to organs (Liver, Heart) through prolonged or repeated exposure if swallowed. Very toxic to aquatic life with long lasting effects

**Bromoacetic Acid** - Fatal if swallowed or in contact with skin. Causes severe skin burns and eye damage. Causes serious eye damage. Toxic if inhaled. May cause allergy or asthma symptoms or breathing difficulties if inhaled. Very toxic to aquatic life with long lasting effects.

**Hygromycin B** - Fatal if swallowed, in contact with skin or if inhaled. Causes serious eye damage. May cause allergy or asthma symptoms or breathing difficulties if inhaled.

**3-1,1-dimethylurea**: Suspected of causing cancer, Harmful if swallowed, Very toxic to aquatic life with long lasting effects Inhalation: May cause irritation of nose and throat. EYES: Irritation. SKIN: Moderately irritating to skin.

**Diethyl pyrocarbonate (DEPC)** - Combustible liquid. Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.

**Rifampicin** - Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.

Sulfadiazine - Harmful if swallowed. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation.

DL-Dithiothreitol (DTT) - Harmful if swallowed. Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation.

Amonium Persulfate - May intensify fire; oxidiser. Harmful if swallowed or in contact with skin. Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. May cause respiratory irritation. Harmful to aquatic life with long lasting effects.

REQUIRED - List (or attach) the applicable chemical(s) for your laboratory, and describe important properties and signs/symptoms of exposure.

### 3. ENGINEERING/VENTILATION CONTROLS

The following is a general plan for all Acutely Toxic Materials:

- A. Use containment devices (*e.g.*, chemical fume hoods, glove boxes, etc.) when:
  - i. Using volatile and/or semi-volatile substances;
  - ii. Manipulating substances that may generate aerosols; and
  - iii. Performing laboratory procedures that may result in an uncontrolled release.
- B. Use high-efficiency particulate air (HEPA) filters, carbon filters, or scrubber systems with containment devices to protect effluent and vacuum lines, pumps, and the environment whenever feasible.
- C. Ventilated containment should be used to weigh out solid chemicals (*e.g.*, certified laboratory chemical fume hood). Alternatively, the tare method can be used to prevent inhalation of the chemical. While working in a fume hood, the chemical is added to a pre-weighed container. The container is then sealed and can be re-weighed outside of the fume hood. If a chemical needs to be added or removed, this manipulation is carried out in the fume hood. In this manner, all open chemical handling is conducted in the fume hood.

If you must use Acutely Toxic Materials without engineering or ventilation controls, you must contact the Chemical Hygiene Officer or [healthandsafety@ucdavis.edu](mailto:healthandsafety@ucdavis.edu) for an exposure assessment.

When handling reproductive toxins in the lab use the chemical fume hood in room 2123. If weighing is necessary use the tare method described above in 3.c.

REQUIRED - Insert descriptions of the lab-specific ventilation controls and equipment safety features utilized to reduce the risk of Acutely Toxic chemical exposures.

### 4. ADMINISTRATIVE CONTROLS

The following elements are required:

1. Complete the [UC Laboratory Safety Fundamentals](#) (or approved equivalent) training prior to working in the laboratory;
2. Complete laboratory-specific safety orientation and training on laboratory-specific safety equipment, procedures, and techniques to be used, including any applicable laboratory-specific Laboratory Safety Plan(s), prior to receiving unescorted access to the laboratory;

3. Demonstrate competency to perform the procedures to the Principal Investigator (PI), Laboratory Supervisor, laboratory-specific Safety Officer, and/or trainer;
4. Be familiar with the location and content of any applicable Safety Data Sheets (SDSs) for the chemicals to be used (online SDSs can be accessed from [UC SDS](#));
5. Implement good laboratory practices, including good workspace hygiene;
6. Inspect all equipment and experimental setups prior to use;
7. Follow best practices for the movement, handling, and storage of hazardous chemicals (see Chapters 5 and 6 of [Prudent Practices in the Laboratory](#) for more detail). An appropriate spill cleanup kit must be located in the laboratory. Chemical and hazardous waste storage must follow an appropriate segregation scheme and include appropriate labeling. Hazardous chemical waste must be properly labelled, stored in closed containers, in secondary containment, and in a designated location;
8. Do not deviate from the instructions described in this SOP without prior discussion and approval from the PI and/or Laboratory Supervisor.
9. Notify the PI and/or Laboratory Supervisor of any accidents, incidents, near-misses, or upset condition (*e.g.*, unexpected rise or drop in temperature, color or phase change, evolution of gas) involving Acutely Toxic Materials described in this SOP; and
10. Abide by the laboratory-specific working alone SOP, if applicable.

For Acutely Toxic Materials, the following are also required:

11. Work surfaces should be protected (*e.g.*, disposable absorbent bench paper, aluminum foil, etc.) and must be decontaminated after each use.

REQUIRED - Insert the laboratory-specific restrictions on maximum quantities to be used and stored.

Sodium azide powder should be purchased in the smallest practical amount. Make stock solutions of 10%, if possible to minimize potential accidents. Whenever handling pure sodium azide powder or concentrated solutions of 10% or more that may require assistance in case of a spill or accident, it is recommended that a second trained individual be present in the lab or in the vicinity.

**Conditions for safe storage:** Store in secondary containment with “Acute Toxin” label on the primary container, secondary containment and the storage location. Keep containers tightly closed in a dry, cool, and well-ventilated place. Do not store on metal shelves or use metal items (spatulas) to handle sodium azide. Store away from metals, acids, carbon disulfide, bromine, chromyl chloride, sulfuric acid, nitric acid, hydrazine and dimethyl sulfate.

Mercapthoethanol - Precautions for safe handling Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Recommended storage temperature 2 - 8 °C.

Hygromycin B - Precautions for safe handling Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Recommended storage temperature: 2 - 8 °C Keep in a dry place.

Bromoacetic Acid - Precautions for safe handling Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. hygroscopic Air sensitive. Light sensitive. Handle and store under inert gas. Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

DEPC - Handle under argon. Store under argon. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Recommended storage temperature 2 - 8 °C Over time, pressure may increase causing containers to burst Handle and open container with care. Moisture sensitive.

DTT - Keep container tightly closed in a dry and well-ventilated place. Recommended storage temperature 2 - 8 °C

Rifampicin - Keep container tightly closed in a dry and well-ventilated place. Recommended storage temperature: -20 °C Product is sensitive to light and moisture. Store under inert gas. Keep in a dry place.

Sulfadiazine - Keep container tightly closed in a dry and well-ventilated place.

Ammonium Persulfate (APS) - Keep container tightly closed in a dry and well-ventilated place. Moisture sensitive. Keep in a dry place.

REQUIRED - Insert descriptions of any special handling or storage requirements.

INSERT IF APPLICABLE - Describe any additional administrative controls (*e.g.*, restrictions on procedure/work equipment/work locations/unattended operations). Include any chemical-specific administrative controls (*e.g.*, peroxide formers).

## 5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

At a minimum, long pants (covered legs) and closed toe/closed heel shoes (covered feet) are required to enter a laboratory or technical area where hazardous chemicals are used or stored.

In addition to the minimum attire required upon entering a laboratory, the following PPE is required for work with Acutely Toxic Materials:

- A. Eye Protection: Eye protection is required for all work with Acutely Toxic Materials.
  - i. At a minimum ANSI Z87.1-compliant safety glasses are necessary.
  - ii. Splash goggles may be substituted for safety glasses, and are required for processes where splashes are foreseeable or when generating aerosols.
  - iii. Ordinary prescription glasses will NOT provide adequate protection unless they also meet the Z87.1 standard and have compliant side shields.
- B. Body Protection: At a minimum a chemically-compatible laboratory coat that fully extends to the wrist is necessary.

- i. If a risk of fire exists, a flame-resistant laboratory coat that is NFPA 2112-compliant should be worn.
  - ii. For chemicals that are corrosive and/or toxic by skin contact/absorption additional protective clothing (*e.g.*, face shield, chemically-resistant apron, disposable sleeves, etc.) are required where splashes or skin contact is foreseeable.
- C. Hand Protection: When hand protection is needed for the activities described in this SOP define the type of glove to be used based on: A) the chemical(s) being used, B) the anticipated chemical contact (*e.g.*, incidental, immersion, etc.), C) the manufacturers' permeation/compatibility data, and D) whether a combination of different gloves is needed for any specific procedural step or task.

For all acutely Toxic materials wear a lab coat, eye protection and gloves.

For Sodium Azide - Handle with nitrile gloves. Double-gloving is recommended when working with pure sodium azide or sodium azide solutions greater than 5%. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands

safety glasses or goggles (goggles for Mercapthoethanol). Face shield is also recommended.

For Sodium Azide - Flame resistant lab coat

For Hygromycin B wear glasses and face shield.

REQUIRED - Insert descriptions of PPE and hygiene practices used with each process, hazardous chemical(s), or hazardous chemical class, including any specialized PPE needed for a procedural step/task.

## 6. SPILL AND EMERGENCY PROCEDURES

Follow the guidance for chemical spill cleanup from [SafetyNet #13](#) and/or the [UC Davis Laboratory Safety Manual](#), unless specialized cleanup procedures are described below. Emergency procedure instructions for the UC Davis campus and UCD Medical Center are contained in the [UC Davis Laboratory Safety Manual](#) and the [Emergency Response Guide](#) (which must be posted in the laboratory). All other locations must describe detailed emergency procedure instructions below.

For spills of solid materials, DO NOT dry sweep.

For spill clean up refer to safetyNet #13, if you do not feel confident with the task ask other lab members for assistance. The Harmer lab spill kit is located in the cabinet beneath the sink to the left of the chemical fume hood in room 2123.

**Sodium Azide Spill** – Do not use water for clean up!!! Sodium azide is a water-reactive poison. Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (*e.g.*, use caution tape, barriers, etc.).

**Small (<1 L)** – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled, spill kit is located under the sink to the

left of the chemical fume hood room 2123. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

**Large (>1 L) – Dial 911 or EH&S 530-752-1493.**

Sodium azide is a water-reactive poison. Wearing proper PPE, decontaminate equipment and bench tops using 70-75% ethanol. Dispose of the used sodium azide and disposables contaminated with sodium azide as hazardous waste. Drain disposal of sodium azide solutions is not permitted.

REQUIRED - Insert descriptions of any specialized spill clean up procedures for hazardous chemicals used in this SOP (*e.g.*, hydrofluoric acid, pyrophorics, phenol, etc.). Additional details of lab-specific spill cleanup should be provided if applicable.

INSERT IF APPLICABLE - Descriptions of any specialized emergency procedures for locations outside of the UC Davis main campus and the UCD Medical Center campus.

## 7. WASTE MANAGEMENT AND DECONTAMINATION

Hazardous waste must be managed according to [Safety Net #8](#) using the appropriate [label](#). In general, hazardous waste must be removed from your laboratory within 9 months of the accumulation start date; refer to the [timeline for waste disposal](#). Hazardous waste pick up requests must be [completed online](#).

For liquid waste use liquid waste container in the chemical fume hood room 2123. For solid waste such as tips and tubes use double bagged solid waste bag also in the chemical fume hood, if such a container is not present or full contact the lab's safety officer. Waste container will be properly labeled and collected by EH&S. REQUIRED - Insert descriptions of laboratory-specific information on the waste streams generated, storage location, and any special handling/storage requirements.

Decontamination procedures vary depending on the material being handled. The toxicity of some materials can be neutralized with other reagents. All surfaces and equipment should be wiped with the appropriate cleaning agent following dispensing or handling to prevent accumulation of Acutely Toxic chemical residue. Decontaminate vacuum pumps or other contaminated equipment before removing them from the designated area or before resuming normal laboratory work in the area.

Carefully inspect work areas to make sure no hazardous materials remain. Clean contaminated work areas with an appropriate cleaning agent, and dispose of cleaning materials properly. Be sure all ignition sources are secured before beginning clean up with flammable liquids.

Sodium azide is a water-reactive poison. Wearing proper PPE, decontaminate equipment and bench tops using 70-75% ethanol. Dispose of the used sodium azide and disposables contaminated with sodium azide as hazardous waste. Drain disposal of sodium azide solutions is not permitted.

**2-Mercaptoethanol** - Laboratory work surfaces and equipment shall be decontaminated at the conclusion of each procedure and at the end of each day. Use a soapy, wet paper towel to clean the affected areas and dispose of the paper towel as hazardous waste.

Hygromycin B and Bromoacetic acid- same as 2-Mercaptoethanol.

REQUIRED - Insert descriptions of decontamination procedures for equipment, glassware, and controlled areas (*e.g.*, glove boxes, restricted access hoods, perchloric/hot acid fume hoods, or designated portions of the laboratory).

Upon completion of work with Acutely Toxic Materials and/or decontamination of equipment, remove gloves and/or PPE to wash hands and arms with soap and water. Additionally, upon leaving a designated Acutely Toxic Materials work area remove all PPE worn and wash hands, forearms, face and neck as needed. Contaminated clothing or PPE should not be worn outside the lab. Soiled lab coats should be sent for professional laundering. Grossly contaminated clothing/PPE and disposable gloves must not be reused.

#### **8. DESIGNATED AREA**

Designated area(s) are required for the use and storage of Acutely Toxic Materials. Such areas must be clearly marked with signs that identify the chemical hazard and include an appropriate warning; for example: DANGER! ACUTELY TOXIC MATERIAL WORK AREA!

The designated area for working with Acute toxins is the chemical fume hood in room 2123.

Acute toxins are kept in different locations in the lab and are labeled as such.

REQUIRED - Insert description(s) of the designated area(s) for Acutely Toxic Materials in your laboratory, which is required for Acutely Toxic Materials. The entire laboratory, a portion of the laboratory, a fume hood, etc. can be designated.

#### **9. DETAILED PROTOCOL**

When using Acute toxins use gloves (two sets for Sodium Azide) a lab coat (Flame proof sor Sodium azide) and safety glasses (Goggles for 2-Mercaptoethanol). Work with the substance in the chemical fume hood, if needed aliquote carefully into a new container and label that container with all the hazard information provided on the original container. If weighing is necessary use the tare method described above in 3.c. Dispose of all waste, liquid or solid in the appropriate waste container located in the chemical fume hood. In case of a spill refer to safety net #13, in case of contamination of glass ware or other equipment clean with paper towels and 70% ethanol for Sodium azide not water! For other chemicals use water and soap. Dispose of paper towels in double bags and have them collected by EH&S.

REQUIRED - Insert or attach detailed laboratory-specific procedures for the process, hazardous chemical(s), or hazard class. You may also include any relevant supporting resources (*e.g.*, SafetyNets, journal citations, etc.) that are applicable.



### TEMPLATE REVISION HISTORY

Version	Date Approved	Author	Revision Notes:
<b>1.0</b>	<b>12/1/14</b>	<b>CLSC Task Force</b>	<b>New template</b>
<b>1.1</b>	<b>4/16/15</b>	<b>Chris Jakober</b>	<b>Changed SDS link, language related to soiled PPE</b>

### LAB-SPECIFIC REVISION HISTORY

Version	Date Approved	Author	Revision Notes:

**Documentation of Standard Operating Procedure Training**

*(Signature of all users is required)*

- ✓ Prior to using **Acutely Toxic Solids and Liquids**, laboratory personnel must be trained on the hazards described in this SOP, how to protect themselves from these hazards, and emergency procedures.
- ✓ Ready access to this SOP and to a Safety Data Sheet for each hazardous material described in the SOP must be made available.
- ✓ The Principal Investigator (PI), or the Laboratory Supervisor if the activity does not involve a PI, must ensure that their laboratory personnel have attended appropriate laboratory safety training or refresher training within the last three years.
- ✓ Training must be repeated following **any** revision to the content of this SOP. Training must be documented. This training sheet is provided as one option; other forms of training documentation (including electronic) are acceptable but records must be accessible and immediately available upon request.

**Designated Trainer:** *(signature is required)*

I have read and acknowledge the contents, requirements, and responsibilities outlined in this SOP:

Name	Signature	Trainer Initials	Date