UC RIVERSIDE | Environmental Health & Safety

ACUTELY TOXIC CHEMICAL HAZARDS PROGRAM - External

CONTENTS

INTRODUCTION

Acutely toxic chemicals have adverse effects upon a single exposure, or multiple exposures in a short period of time. This document outlines the hazards of working with acutely toxic materials, and risk minimization for working with acutely toxic chemicals.

OBJECTIVES

The objectives of this program are to ensure that researchers working with acutely toxic materials are aware of the hazards and are working in ways to minimize risks to themselves and their environment.

RESPONSIBILITIES

Environmental Health and Safety

EH&S is responsible for the management of the campus' chemical inventory, including acutely toxic materials, and for the generation of reports based on the inventory data. EH&S provides guidance for working safely with chemical hazards, and works with laboratories to verify that all requirements of working with acutely toxic chemicals, as outlined by this acutely toxic chemical hazard program, are met.

Principal Investigators (PIs)

The PI is responsible for maintaining safety protocols in their laboratory spaces. This involves making sure their laboratory personnel are properly trained for hazards that may be present in the laboratory, and that training is documented. The PI is also responsible for making sure that all safety precautions are being upheld in their laboratory space, including use of Standard Operating Procedures (SOPs) and adherence to the Personal Protective Equipment (PPE) policy. The PI ensures that the inventory in their space is regularly managed, and annually certifies that their inventory in RSS Chemicals is accurate. While a PI may delegate tasks related to safety to members of their laboratory, the ultimate responsibility of safety in the space remains with the PI.

Laboratory Personnel

Laboratory Personnel are individuals who work in the laboratory. Laboratory personnel are required to follow all safety protocols in the laboratory as outlined by the PI, including following SOPs and wearing required PPE. Any changes to established procedures or amounts should be approved by the PI before making the change.

RECOGNIZING ACUTELY TOXIC CHEMICALS

Acutely toxic chemicals are defined by OSHA based on their LD_{50} or LC_{50}. Acutely toxic chemicals will usually be identified with the toxic skull and crossbones pictogram shown below. The

- H300: Fatal if swallowed (Acute toxicity, oral – Category 1, 2)
- H301: Toxic if swallowed (Acute toxicity, oral – Category 3)
- H310: Fatal in contact with skin (Acute toxicity, dermal – Category 1, 2)
- H311: Toxic in Contact with skin (Acute toxicity, dermal – Category 3)
- H330: Fatal if inhaled (Acute toxicity, inhalation – Category 1, 2)
- H331: Toxic if inhaled (Acute toxicity, inhalation – Category 3)

These H-codes may be combined if a material is acutely toxic by more than one route, such as "H300+H310: Fatal if swallowed or in contact with skin."

Some acutely toxic materials will include the GHS symbol for health hazard shown below. This symbol is not specific to acutely toxic materials and includes other health hazards. The material is acutely toxic if this symbol is present along with the following H-codes:

- H304: May be fatal if swallowed and enters airways (Aspiration Hazard – Category 1)
- H370: Causes damage to organs (Specific target organ toxicity, single exposure – Category 1)
- H372: Causes damage to organs through prolonged or repeated exposure (Specific target organ toxicity, repeated exposure – Category 1)

Figure 1: Example SDS Section 2, showing label elements used for acutely toxic materials

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 2), H300
Acute toxicity, Inhalation (Category 2), H330
Acute toxicity, Dermal (Category 1), H310
Skin corrosion (Category 1A), H314
Serious eye damage (Category 1), H318
Acute aquatic toxicity (Category 3), H402

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram 

Signal word: Danger

Hazard statement(s)

H300 + H310 + H330	Fatal if swallowed, in contact with skin or if inhaled
H314	Causes severe skin burns and eye damage.
H402	Harmful to aquatic life.

Some of the more common acutely toxic chemicals used on campus include:

2-Mercaptoethanol	Acute toxicity, Oral (Category 3), H301 Acute toxicity, Inhalation (Category 3), H331 Acute toxicity, Dermal (Category 2), H310
4-Dimethylaminopyridine	Acute toxicity, Oral (Category 3), H301 Acute toxicity, Inhalation (Category 3), H331 Acute toxicity, Dermal (Category 2), H310
Acetic anhydride	Acute toxicity, Inhalation (Category 2), H330
Di-tert-butyl dicarbonate	Acute toxicity, Inhalation (Category 1), H330
Ethidium bromide	Acute toxicity, Inhalation (Category 2), H330
Nitric acid, fuming, Solution in Dinitrogen trioxide	Acute toxicity, Inhalation (Category 1), H330 Acute toxicity, Dermal (Category 3), H311
N-Lauroylsarcosine sodium salt	Acute toxicity, Inhalation (Category 2), H330
Potassium dichromate	Acute toxicity, Oral (Category 3), H301 Acute toxicity, Inhalation (Category 2), H330
Sodium azide	Acute toxicity, Oral (Category 2), H300 Acute toxicity, Inhalation (Category 2), H330 Acute toxicity, Dermal (Category 1), H310
Sodium fluoride	Acute toxicity, Oral (Category 3), H301

For information on how to search your RSS Chemicals online inventory for acutely toxic chemicals, review the Inventory Management section of this document.

BEFORE WORKING WITH ACUTELY TOXIC MATERIALS

Before working with acutely toxic materials, you should be aware of the hazards, and the appropriate protocols for safely working with the materials. These will include:

- Read and understand this guidance document and the material's safety data sheet (SDS) in order to be fully aware of all hazards present and how to safely work with the material.
- Create, review and sign a lab specific standard operating procedure (SOP) for work with acutely toxic materials. A starting template with generic information is supplied in Appendix A.
- Receive procedure specific training from your PI and/or supervisor that addresses unique lab protocols, your lab's acutely toxic chemicals SOP, the location of safety equipment, and proper emergency procedures.
- Before conducting the actual procedure, always perform a dry run (without the acutely toxic material) to identify and resolve possible safety hazards.
- Whenever possible, work with these materials should not occur when campus is closed or outside of normal campus hours (8am-5pm Monday-Friday).
- Always implement the "buddy system" and work alongside someone also trained in the hazards, use, and emergency procedures of acutely toxic materials.

MITIGATING THE RISKS FROM ACUTELY TOXIC CHEMICALS

A written, comprehensive project-specific risk assessment should be undertaken when working with acutely toxic chemicals.

General risk mitigation measures are as follows:

Elimination/Substitution

- Substitute less hazardous chemicals whenever possible. Conduct a literature review to determine if there are viable replacements that are safer to handle and store.

Engineering Controls

- Storage
    - Keep containers tightly sealed and in a dry, well-ventilated place. Opened containers must be carefully resealed and kept upright to prevent leakage. Ensure that manufacturer's labels and warnings remain intact.
    - Whenever possible, use secondary containment, such as trays, to conduct your experiment in and for storage of particularly hazardous substances.
    - Acutely toxic chemicals should be stored by themselves in clearly marked trays or containers indicating what the hazard is i.e., "Acutely Toxic," "Poison", etc.
- Usage/Handling
    - Do not work with acutely toxic chemicals outside of a fume hood, glove box or ventilated enclosure.
    - Fume hood sash should be kept at the lowest possible height where you can comfortably work, but fume hood sash coverage is maximized. Using the fume hood at the safe sticker height meets airflow requirements, but does not provide additional splash protection.
    - At the end of the work, thoroughly inspect work area for any residual material and clean.

Administrative Controls

- Follow all general safe chemical handling practices as described in the Chemical Hygiene Plan.
- Conduct a thorough literature search, including review of Safety Data Sheets, to establish a thorough understanding of the properties of the acutely toxic materials to be handled, with particular consideration given to the procedures and tasks to be conducted.
- Develop a thorough SOP based on EH&S template (see Appendix A), and include all specific information about the chemical you are using and procedures you are following.
- The scale of work is critical. It should be done at the smallest scale possible (e.g., mmole) and scaled up only with the input and authorization of the Principal Investigator/Supervisor. Maximum reaction quantities should be explicitly documented in the SOP.
- Know what actions to take in the event of an emergency. Ensure that an appropriate fire extinguisher and properly functioning safety shower are readily available.
- Maintain standard lab safety training for all personnel, including Lab Safety Fundamentals, Fire Extinguishers, and Hazardous Materials and Waste Management
- All lab members, not just those working directly with acutely toxic materials, should be made aware of the hazards and emergency procedures in case of a spill, exposure, or fire.
- Notify everyone in the lab when you are working with acutely toxic materials.
- Never work alone with acutely toxic materials, use the buddy system and pair inexperienced/learning lab members with those more experienced with safely handling acutely toxic materials.

Personal Protective Equipment

- **Eye Protection**: Safety glasses/goggles are required at all times when working in a lab. When working with acutely toxic materials, risks from a small exposure are high, therefore, splash goggles should be used to provide a seal around the eye area for additional protection. An additional full face shield may be appropriate if there is higher risk of a chemical splash.
- **Hand Protection**: Gloves must be worn when handling these materials. Manufacturer recommendations may be found in Section 8 of the Safety Data Sheet (SDS). Make sure that the glove material you are using will protect you in the event that there is contact with the acutely toxic material.
- **Body Protection**: Full length pants and closed toe shoes are required in all lab spaces. A lab coat is required when working with chemicals. Consider a chemical resistant apron when working with larger quantities of toxic materials.

Waste Handling

- Proper planning and segregation is critical to making sure that your lab is safe during accumulation and storage of hazardous waste, and the EH&S Hazardous Waste team is safe while handling hazardous waste.
- All waste must be handled through WASTe. It is critical for waste to be appropriately labeled as soon as one drop of waste is generated, to reduce risk of accidentally adding incompatible materials into the container.
- Do not reuse empty containers that have contained acutely toxic chemicals. Empty containers can be disposed of through EH&S as hazardous waste. The empty containers must be capped at all times.
- Review the specific chemical SDS for specific waste practices.

EMERGENCY PROCEDURES

Review the SDS of any acutely toxic materials you are using for substance specific spill cleanup and exposure recommendations. In general:

Small Spills

1. If anyone is exposed at all, remove all affected clothing and rinse exposed skin/eyes for at least 15 minutes in a nearby emergency shower/eyewash.
2. Small spills inside a chemical fume hood or glove box can be cleaned up by laboratory staff if they fully understand the hazards and are confident in their ability to clean up the spill safely.
3. Alternatively, if the spill is small, nobody was injured, and there is no chance for the situation to worsen, vacate the lab and contact EH&S at 951-827-5528 (M-F 8am-5pm, except holidays). If after normal campus hours (M-F 8am-5pm), call **911** or UCPD at 951-827-5222.

Large Spills

1. Life Safety First!
    a. Remove all affected clothing and rinse exposed skin/eyes for at least 15 minutes in a nearby emergency shower/eyewash.
2. Evacuate the immediate area.
3. Pull the nearest fire or chemical alarm in the hallway as you vacate the building.
4. Call **911** or UCPD at 951-827-5222 from a safe location to notify emergency personnel of the issue.
5. Remain on-site and available for emergency personnel.

Exposure

Any exposures should be treated promptly with first aid followed by medical treatment. Acutely toxic chemicals can be deadly on single exposure, so quick action is critical. The following steps by the exposed party should be taken while someone else in the lab calls 911 or UCPD at 951-827-5222 for emergency response.

Skin: If skin contact occurs, and/or skin or clothing are on fire, immediately drench in the safety shower with copious amounts of water for no less than 15 minutes to remove any remaining contaminants. If possible to do so without further injury, remove any remaining jewelry or clothing.

Eye: Rinse thoroughly with plenty of water using an eyewash station for at least 15 minutes, occasionally lifting the upper and lower eyelids. Remove contact lenses if possible.

Inhalation: Move to fresh air and seek medical attention.

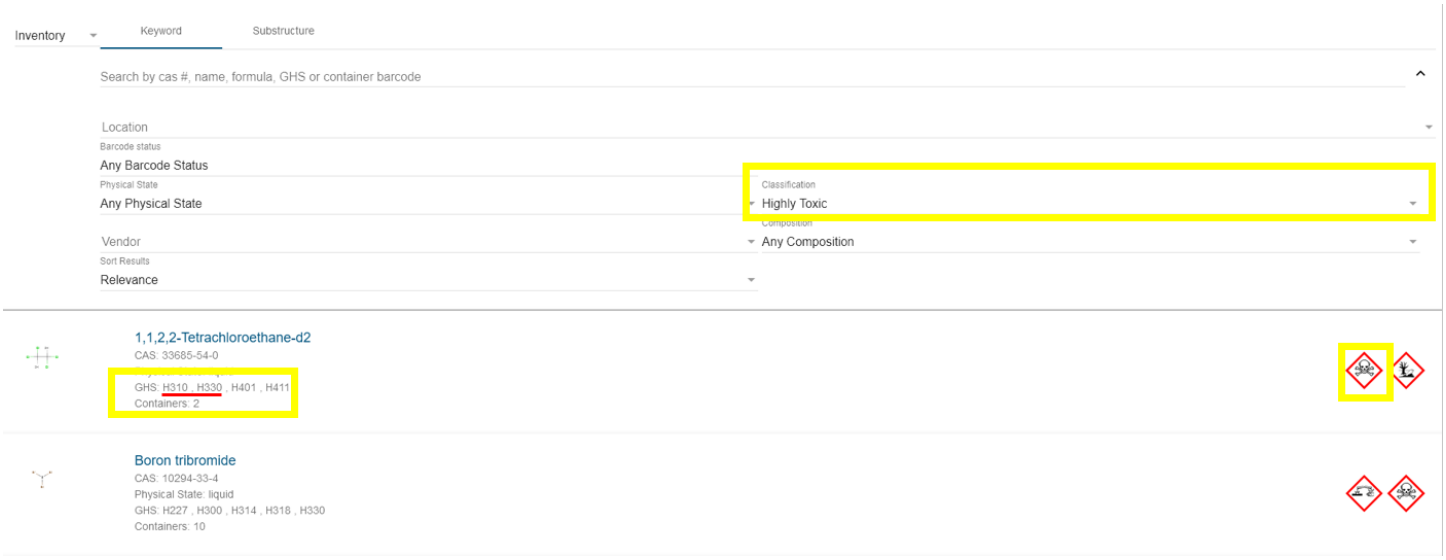
Ingestion: Do NOT induce vomiting unless directed otherwise by the SDS. Never give anything by mouth to an unconscious person. Rinse mouth with water. Seek medical attention.

INVENTORY MANAGEMENT

Inventory updates are the responsibility of the laboratory that purchases them. Having an updated inventory allows for accurate response in hazardous situations, particularly in spaces with acutely toxic materials. To reduce risk, it is recommended to minimize ordering and keep only a few months stock of acutely toxic chemicals.

To review your chemical inventory for acutely toxic chemicals, from your RSS Chemicals page click "Search Chemicals." Click the down arrow on the right to open an advanced search and select the classification for "Highly Toxic." To find the acutely toxic materials in this list, look for the skull and crossbones GHS symbol, along with one of the Acutely Toxic H-Codes listed in the section "Recognizing Acutely Toxic Chemicals" of this document. Review any chemicals in this section, including an extensive review of the supplier specific SDS for the chemical in question.

Figure 2: RSS Chemicals advanced search for acutely toxic chemicals



Verify that the form of chemical you have stored is accurately reflected in the inventory. You might have material supplied in a diluted form with lesser hazards or different protections required. Adjusting your inventory to accurately reflect the correct hazardous material better communicates risks in your lab space. If you need assistance in reassigning or reclassifying chemicals in your inventory, contact ehslaboratory@ucr.edu.

ACUTELY TOXIC CHEMICAL SOP

A generic SOP created by EH&S is available in Appendix A, which covers the basic safety requirements of handling acutely toxic chemicals in a laboratory setting. One requirement of the SOP is defining the largest allowed quantity without PI approval, to keep reaction size low. While it is understood that the requirements of a research laboratory may require varied and changing processes, it is strongly encouraged, whenever possible, to outline specific processes in detail when working with hazardous substances. SOP should be signed by the PI, along with anyone in the laboratory using or handling acutely toxic materials in any way. SOPs should be reviewed and updated as needed by the PI every three years.