

SOP 11. Standard Operating Procedure for Acutely Toxic Gases

I. General Statement of Coverage

Standard operating procedures (SOP) are intended to provide you with general guidance on how to safely work with a specific class of chemical or hazard. This SOP is generic in nature. It addresses the use and handling of substances by hazard class only. In some instances multiple SOPs may be applicable for a specific chemical (i.e., both the SOPs for flammable liquids and carcinogens would apply to benzene). Some common acutely toxic gases include: Carbon Monoxide, Anhydrous Hydrogen Fluoride, Fluorine, Hydrogen Cyanide, Cyanogen, Arsine, Boron Trifluoride, Chlorine, Ozone (see SOP 13), Phosgene, and Phosphine. Using and storing certain chemicals may require prior approval. Some of these compounds include, but are not limited to: toxic or corrosive gases such as: Fluorine, Chlorine, Phosgene, Arsine, Anhydrous Hydrofluoric Acid, Carbon Monoxide, Hydrogen Sulfide, unstable Boron Hydrides; highly reactive or explosive chemicals such as: Polynitrated Compounds, unstable Organic Peroxides, Heavy Metal Azides or Acetylides; or highly toxic materials such as: Cholinesterase Inhibitors, some Pesticides or Magic Methyl and related chemicals.

II. Hazard Assessment

A Job Hazard Assessment should be performed for work involving acutely or highly toxic materials and should address the issues of proper use and handling, education of laboratory workers concerning the health risks posed by reproductive toxins, the demarcation of designated areas, chemical toxicity, storage, disposal, and required PPE. See Section 21 and Form 4 of Section 25 of the Chemical Hygiene Plan.

III. Resources

A. Available Training

Chemistry 685

EHS/Chemistry Lab Safety Course

B. Text and Literature References

Department of Chemistry Safety Handbook

C. CHP Appendix III (Section 23.3) Chemical Information Tables

Table 12. Toxic Metals and Metal Compounds

Table 13. Definition of High Degree of Acute Toxicity

Table 14. Acutely Toxic Chemicals

IV. Chemical Storage

A. Special Storage

1. Acutely toxic gases must be stored in a designated area. Ventilation of the stored cylinders is recommended and must be approved by the CHO and the Division of Environmental Health and Safety.
2. Continuous monitoring devices that will alert staff of a release of the acutely toxic gas is strongly recommended.

B. Gas Cylinders

Gas cylinders must be secured while in use or in storage (empty or full). They should be stored with the valve cap secured. Refer to SOP #7-Compressed Gases.

V. **Personal Protective and Emergency Equipment**

A. **Eye and Face Protection**

Refer to the Eye Protection Policy, Appendix IIB (Section 23.2). At a minimum, safety glasses with permanently attached top and side shields must be worn in the laboratory. These glasses, however, do NOT protect against splash hazards. When performing a hazardous activity, a face shield must be worn in addition to the safety glasses OR switch to chemical splash goggles (with shielded ventilation ports). Face shields are available from the Safety Office (free of charge).

B. **Gloves**

Appropriate gloves should be worn when handling hazardous materials. The selection of glove materials should be made from Appendix II, Part A (Section 23.2) of this document. If this chart is insufficient, please see the Safety Coordinator/CHO.

C. **Protective Clothing**

Lab coats, closed toed shoes and long sleeved clothing should be worn when handling hazardous materials. Additional protective clothing, such as aprons or full-length arm protection, should be worn if the possibility of skin contact is likely.

D. **Hearing Protection**

The use of hearing protection requires monitoring and training. See the Safety Coordinator/CHO for details.

E. **Respirators**

The use of respirators require medical certification, fit testing, and training. See the Safety Coordinator/CHO for details.

F. **Eye Wash**

Where the eyes or body of any person may be exposed to hazardous materials suitable facilities for quick drenching or flushing of the eyes and body shall be provided within, or near, the work area for immediate emergency use. Bottle type eyewash stations are not acceptable.

G. **Safety Showers**

A safety shower should be available and functioning as specified by ANSI Z358.1.

H. **Fire Extinguishers**

All laboratories must contain at least one Carbon Dioxide (Type B-C) or Dry Chemical (Type A-B-C) fire extinguisher. Additional fire extinguishers are located near exits and/or stairwells in each building. Special Class D fire extinguishers (for certain metal fires) are available from the Safety Office.

VI. **Controls**

A. **Designated Areas**

1. The acrylic laboratory door sign must be updated to include the type and approximate amount of the acutely toxic gas in use or storage.
2. All locations within the laboratory (or the laboratory door itself) where acute toxins are handled should have posted with designated area caution signs. This includes all fume hoods and bench tops where the toxins are handled.
3. Training must be provided by the laboratory supervisor on the proper handling and storage techniques, waste disposal, and spill response involving each acutely toxic gas used. This training must be documented.

B. **Chemical Fume Hoods**

1. Manipulation of acutely toxic gases should be carried out in a fume hood. If the use of a fume hood proves impractical refer to the section on special ventilation.
2. All areas where acutely toxic gases are stored or manipulated must be labeled as a designated area.

C. **Glove Boxes**

Certain materials should be handled in a glove box rather than a fume hood. Consult the Division of Environmental Health and Safety or the Laboratory Supervisor. Refer to SOP 14 on the use of Dry Boxes.

D. **Safety Shielding**

Safety shielding is required any time there is a risk of explosion, splash hazard or a highly exothermic reaction. All manipulations of reactive 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.

E. **Special Ventilation**

1. Manipulation of acutely toxic gases outside of a fume hood requires special ventilation controls in order to minimize exposure to the material. Fume hoods provide the best protection against exposure to toxins in the laboratory and are the preferred ventilation control device. When possible, handle acutely toxic gases in a fume hood. If the use of a fume hood proves impractical, local ventilation systems must be used.
2. If your research does not permit the handling of acute toxins in a fume hood or glove box, contact the CHO or the Division of Environmental Health and Safety.
3. All areas where acutely toxic gases are manipulated must be labeled as a designated area.

F. **Vacuum Protection**

1. Evacuated glassware can implode and eject flying glass, and splattered chemicals. Vacuum work involving hazardous materials must be conducted in a fume hood, glove box or isolated in an acceptable manner.
2. Mechanical vacuum pumps and the "House Vacuum System" must be protected using cold traps and, where appropriate, filtered to prevent particulate release. See the article on cold traps in the Department Safety Handbook under "Compressed Gases." The exhaust for the pumps should be vented into an exhaust hood.

G. **Signs and Labels**

1. Doorways: All OSHA Select Carcinogens, Reproductive Toxins, Highly (Acutely) Toxic materials, and NFPA Level 4 Flammable Liquids (Section 23.3, Tables 10-15) must be indicated on the acrylic door sign.
2. Containers: All hazardous materials must be clearly labeled with the correct chemical name.

H. **Utilities**

In Evans and Celeste Labs, utility shut-off valves are located in pipe chases just outside of the laboratories. In Newman/Wolfrom, the valves are located above the ceiling in the hallways. Look for the ceiling tiles with the green dots.

I. **Fire Protection**

Older buildings, such as Evans and Johnston Labs, do not have sprinkler suppression systems. This could be a consideration for storing or using large quantities of hazardous materials.

VII. **Specific Procedures**

Refer to the MSDS or other sources of information to become familiar with the properties of the particular substances including: chemical and physical properties, health hazard information, symptoms of over-exposure, etc.

VIII. **Emergency Procedures**

A. **Notification**

Refer to the “Emergency Response” section of the Department Safety Handbook for generic emergency response procedures. Specific emergency procedures should be developed for each group or laboratory. The procedures should address as a minimum the following:

1. Who to contact: (University police at 292-2121 or 292-2525, and Division of Environmental Health and Safety at 292-1284 during normal working hours, and the Principal Investigator of the laboratory including evening phone number).
2. The location of all safety equipment (showers, spill equipment, eye wash, fire extinguishers, etc.).
3. The location and quantity of acutely toxic gases in the laboratory.
4. The method used to alert personnel in nearby areas of potential hazards.
5. Special first aid treatment required by the type of chemicals handled in the laboratory

B. **Spill Response**

The release of a highly toxic gas requires immediate evacuation. Close the lab door behind you and notify surrounding personnel. Pull the fire alarm to evacuate the building and call 911 to report the emergency. **DO NOT ATTEMPT TO RESCUE ANYONE WHO MAY BE OVERCOME BY A HAZARDOUS GAS. DO NOT ATTEMPT TO OPEN WINDOWS IN THE LABORATORY.**

IX. **Decontamination and Waste Disposal**

A. **Decontamination Procedures**

1. Personnel: Wash hands and arms with soap and water immediately after handling any chemicals.
2. Area: Carefully clean work area after use.
3. Equipment:

B. **Waste Disposal**

All materials contaminated with acute toxins must be disposed of as hazardous waste. See the Department Safety Handbook for more information.

X. **Approvals**

Some hazardous materials require special handling or prior approvals. See Sections 18 and 20 of this document.

XI. SOP Prepared by _____ Date _____

Reviewed by _____ Date _____