

## 10. Hazardous Gases

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). If you have questions concerning the applicability of any items listed in this procedure, contact Vanderbilt Environmental Health and Safety (615-322-2057) or the Principal Investigator of your laboratory. Specific written procedures are the responsibility of the principal investigator.

If compliance with all the requirements of this standard operating procedure is not possible, the principal investigator must develop a written procedure that will be used in its place. This alternate procedure must provide the same level of protection as the SOP it replaces. Vanderbilt Environmental Health and Safety is available to provide guidance during the development of alternate procedures.

A list of highly toxic gases is included in Appendix C of the chemical hygiene plan guidelines.

### Training:

All Vanderbilt employees who work with hazardous chemicals must be apprised of the hazards of chemicals present in their work area. This training must be provided before initial assignment and before new exposure situations. Before a lab worker may begin work with Hazardous Gases they must be trained on the lab specific Standard Operating Procedure for these materials.

In addition, each lab worker needs to be trained in regard to the harmful effect of the gas, the protective measures that must be taken when working with the gas, the first aid measures to apply if exposed to the gas, and measure to be taken to assure the gas does not leak or escape so that people can be exposed.

### Securing of gas cylinders:

Cylinders of compressed gases must be handled as high-energy sources. When storing or moving a cylinder, have the cap securely in place to protect the stem. Use suitable racks, straps, chains or stands to support cylinders. Do not store cylinders or lecture bottles with the regulator in place. If the regulator fails, the entire content of the gas cylinder may be discharged.

### Decontamination procedures:

Wash hands and arms with soap and water immediately after handling hazardous gases (particularly corrosive ones). Some gases, particularly hydrogen fluoride, should also be treated immediately with special neutralization or decontamination solutions. However, many of these should be administered by trained medical personnel only. Refer to the MSDS or contact VEHS for direction on decontamination procedures and special provisions.

### Designated area:

All locations within the laboratory where highly toxic, carcinogenic or reproductive hazards are handled should be demarcated with designated area caution tape. Areas that should be designated include all fume hoods, sinks and bench tops where the highly toxic, carcinogenic or reproductive hazards are handled. An entire laboratory may be considered a designated area if the PI determines the need for such chemicals to be handled in the entire laboratory. A lab worker may designate an area only during the time the chemical is used and then remove the designated area

sign/tape. Only lab workers trained on the particular hazards found in a designated area should work in that area

**Emergency procedure:**

Emergency procedures, which address response actions to fires, explosions, spills, injury to staff, or the development of sign and symptom of overexposure, must be developed. The procedures should address as a minimum the following:

- Who to contact: University police, Vanderbilt Environmental Health and Safety, and the Principal investigator of the laboratory including evening phone number.
- The location of all safety equipment (showers, eye wash, fire extinguishers, etc.)
- The method used to alert personnel in nearby areas of potential hazards.
- Special first aid treatment required by the type of highly toxic material(s) handled in the laboratory. (Student Health Clinic or Occupational Health Clinic should be consulted for first aid procedures.)

**Eye protection:**

Eye protection in the form of safety glasses must be worn at all times when handling hazardous gases. Ordinary (street) prescription glasses do not provide adequate protection and cannot pass the rigorous test for industrial safety glasses. Adequate safety glasses must meet the requirements of the Practice for Occupational and Educational Eye and Face Protection (ANSI Z.87. 1 1989) and must be equipped with side shields. When handling certain corrosive gases, protective gloves should be worn.

**Eyewash:**

Where the eyes or body of any person may be exposed to hazardous gases, 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.

**Glove (dry) box:**

Not applicable

**Gloves:**

Gloves should be worn when handling hazardous gases, particularly corrosive ones. Nitrile gloves provide adequate protection against accidental hand contact with small quantities of most laboratory chemicals. However, when larger quantities are handled or regular contact is involved more protective gloves should be used.

**Hazard assessment:**

Hazard assessment should focus on the education of employees concerning the health risk posed by hazardous gases, on proper use and handling procedures, the demarcation of designated areas, and emergency evacuation and notification procedures in the event of a spill.

**Lab hood:**

Not applicable

**Labels:**

**Containers:** All hazardous gases must be clearly labeled with the correct chemical name. Handwritten labels are acceptable; chemical formulas and structural formulas or abbreviations are not acceptable.

**Notification:**

You should notify Vanderbilt Environmental Health and Safety prior to the initial use of highly toxic gases. Notification is also required following significant changes in procedures or the quantity of materials used.

**Protective apparel:**

Appropriate lab attire (lab coats, closed-toe shoes and long-sleeved clothing) should be worn when handling hazardous gases, particularly corrosive ones. Additional protective clothing should be worn if the possibility of skin contact is likely.

**Safety shielding:**

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

**Safety shower:**

A safety shower should be available in a nearby location where the corrosive gases are used.

**Signs:**

**Doorways:** The hazard identification sign must demarcate where highly toxic gases are stored or used.

**Special storage and monitoring:**

Highly toxic gases must be stored in a designated area. Special ventilation of the stored cylinders is required and must be approved by Vanderbilt Environmental Health and Safety. Continuous monitoring devices, which will alert staff of a release of the highly toxic gas is required. The Chemical Safety Committee must approve any exemptions. The quantity of a highly toxic gas that may be stored in a laboratory will be determined on a case-by-case basis by VEHS.

**Special ventilation:**

Manipulation of hazardous gases outside of a fume hood will require special ventilation controls in order to minimize exposure to the material and/or the evolution of hazardous conditions. Fume hoods provide the best protection against exposure to highly toxic gases in the laboratory or the evolution of hazardous conditions and are the preferred ventilation control device. Always attempt to handle hazardous gases in a fume hood. If your research does not permit the handling of hazardous gases in your fume hood you must contact Vanderbilt Environmental Health and Safety to review the adequacy of all special ventilation.

**Spill response:**

In the event of a major release of gas alert personnel in the area that a gas release has occurred. Vacate the laboratory immediately and call for assistance.

- Vanderbilt University Police Department 1-1911 or 322-2745.  
Remain on the scene, but at a safe distance, to receive and direct safety personnel when they arrive.

**Vacuum protection:**

Not applicable

**Waste disposal:**

All empty or partially filled hazardous gas cylinders should be returned to the supplier. If the supplier does not accept empty or partially filled cylinders, contact Vanderbilt Environmental Health and Safety concerning disposal.