



# Pressure and Vacuum Systems

## Description

*This standard operating procedure outlines hazards and controls when working with systems under pressure or vacuum. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when working with systems under pressure or vacuum.*

## Potential Hazards

Experiments carried out at pressures above one atmosphere can lead to explosion from equipment failure. Systems under vacuum pose a potential for flying glass, exposure to toxic chemicals contained in the vacuum system and fire from solvent release.

Exposure to cryogenic liquids poses a hazard with vacuum lines that require cold traps between the pumps and the vacuum line. Cold traps need to be checked frequently to make sure they do not become plugged with frozen material. Cold traps in a reduced-pressure system should be taped or placed in a metal can filled with vermiculite.

## Engineering Controls

- Make sure the container you are using will withstand the pressure/vacuum and set up the operation to minimize the hazards of a container failure.
- Whenever possible, metal reactors with glass liners should be used instead of sealed glass tubes.
- Use suitable shielding to prevent injury from flying glass or from corrosive or toxic reactants.
- Glass tubes with high-pressure sealers should be no more than three-quarters full.
- For vacuum filtering applications, use a heavy walled filtering flask conforming to ASTM E1406. Coated glass flasks or Nalgene flasks will be less likely to produce flying sharps than plain glass filtering flasks.
- Examine newly fabricated or repaired glass equipment for flaws and strains using polarized light.
- For work with compressed gas cylinders, see the [SOP for compressed gases](#).
- Pressurized apparatus shall have an appropriate pressure-relief device, which needs to be inspected and replaced periodically.
- Work in a chemical fume hood if a pressure-relief device will discharge toxic, corrosive, flammable, or otherwise hazardous or noxious materials.

## Work Practice Controls

In planning the research steps for work in a closed system, consider the effects of heat (including exothermic reactions) and cooling and ensure that the laboratory apparatus is designed to withstand the pressure or vacuum that may be created.

## Personal Protective Equipment (PPE)

Wear PPE that will provide protection if the container fails. Minimum PPE would be safety glasses, lab coat, and standard laboratory gloves. A full face shield is recommended if work is not done inside a chemical fume hood.

## Transportation and Storage

Plan ahead if it is necessary to transport containers under pressure or vacuum. Use a safety cart and/or secondary containment.

## Waste Disposal

If your process that is done under pressure or vacuum generates any hazardous waste, contact EHS at (313) 593-0921 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also refer to EHS's [Hazardous Waste Webpage](#) for more information.

## Exposures/Unintended Contact



***If the employee is in need of emergency medical attention, call 911 immediately.***



Report all work related accidents, injuries, illnesses or exposures to WorkConnections within 24 hours by completing and submitting the [Illness and Injury Report Form](#). Follow the directions on the WorkConnections website [Forms Instructions](#) to obtain proper medical treatment and follow-up.

Complete the [EHS Laboratory Incident and Near-Miss Report](#) form.

### **TREATMENT FACILITIES:**

#### **Midwest Medical Center -- *Campus Employees (including student employees)***

Mon-Fri 7:30 am - 4:30 pm

**9301 Middlebelt Road**

Romulus, MI 48174

Phone: 734-941-1000

After hours - go to:

#### **Midwest Medical Center**

Open 24/7

4700 Schaefer

Dearborn, MI 48126

Phone: 313-581-2600

#### **Henry Ford Medical Center-Fairlane -- *University students (non-life threatening conditions)***

19401 Hubbard Drive

**Dearborn, MI 48126**

**Phone: 313-928-8278**

Click [here](#) for additional information.

## Spill Procedure

- When a spill occurs, ***personal safety should always come first.***
- Alert and clear everyone in the immediate area where the spill occurred.

A **minor (small) chemical spill** is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel, i.e., less than 1 Gallon or 3.5 Liters. A **major/large chemical spill** requires active assistance from emergency personnel.

## Spills Response Steps:

### MINOR CHEMICAL SPILL

- Alert people in immediate area of spill.
- If spilled material is flammable, turn off ignition and heat sources. Don't light Bunsen burners or turn on other switches.
- Open outside windows, if possible.
- Wear protective equipment, including safety goggles, gloves and long-sleeve lab coat.
- Avoid breathing vapors from spill.
- Confine spill to as small an area as possible.
- **Do not wash spill down the drain.**
- Use appropriate spill kits/sorbents to neutralize corrosives and/or absorb spill. Collect contaminated materials and residues and place in container. For powdered chemicals sweep carefully to avoid generation of dust or, if appropriate, use moist sorbent pads or wet the powder with a suitable solvent and then wipe with a dry cloth. Contact EHS (313) 593-0921 for proper disposal.
- Clean spill area with water.

### MAJOR CHEMICAL SPILL

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate.
- If spilled material is flammable, turn off ignition and heat sources. Don't light Bunsen burners or turn on other switches.
- **Call Public Safety at (313) 593-5333 or 911 from a campus phone immediately for assistance.**
- Close doors to affected area.
- Post warnings to keep people from entering the area.
- Have person available that has knowledge of incident and laboratory to assist emergency personnel.

## Additional Spill Links:

- [Chemical Spill Control Information](#)

Report all emergencies, suspicious activity, injuries, spills, and fires to Public Safety by calling at (313) 593-5333 or 911 from a campus phone. Register with the University of Michigan-Dearborn [Emergency Alert System](#).

### Training of personnel

All personnel are required to complete the ***Comprehensive Laboratory Safety*** session (BLS009 or equivalent) via [MyLINC](#). Furthermore, all personnel shall read and fully adhere to this SOP when working with equipment under pressure or vacuum.

### Certification

I have read and understand the above SOP. I agree to contact my Supervisor or Lab manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Prior Approval required – Is this procedure hazardous enough to warrant prior approval from the Principal Investigator? ☐ YES ☐ NO

Principal Investigator \_\_\_\_\_

Revision Date \_\_\_\_\_