

Common Standard Operating Procedure

for work with

Chemical name/class:	Cryogens	CAS #:	Various
PI: Ken Henderson		Date: 1-23-2013	
Building: Stepan		Room #: Laboratory 386	

1. **Circumstances of Use:**

Various including use of liquid nitrogen traps on Schlenk lines and dry ice-acetone baths.

2. **Potential Hazards:**

Cryogenic materials are liquefied or solidified gases at low temperatures. They can cause tissue damage (frostbite), potential explosion due to pressure buildup, and asphyxiation due to oxygen displacement.

3. **Engineering Controls:**

Each part of a cryogenic system must have its own pressure relief system.

Use and store cryogens in well-ventilated areas. Closets, small rooms, and walk-in cold rooms (or similar small/unvented spaces) should be avoided to prevent buildup of the gas as the cryogen evaporates/sublimes.

If using large quantities of cryogens or if there are concerns about the adequacy of ventilation, consult RM&S, 1-5037, to determine if additional ventilation or an oxygen sensor/alarm is needed. Use of large quantities of cryogens is considered a "high risk procedure" and requires written permission from RM&S. (For example, for LN2, "large" is more than one LN2 freezer and one attached dewar/LN2 tank plus one backup dewar per room, or piping LIQUID nitrogen (not gas) from a tank outside the building, or filling a cryocart or cooler with more than 0.5 L of LN2 at a time. If you are not sure if your cryogen use is "large", please contact RM&S, 1-5037, to determine if written permission is required.)

4. **Work Practice Controls:**

- Use and store liquid hydrogen and helium away from flammable materials and ignition sources. (These gases can condense oxygen out of the air, creating a localized oxygen enriched environment.)
- Use and store liquid oxygen away from flammable materials and open flames.
- Do not put your head inside a liquid nitrogen freezer or other enclosed space containing a cryogen.
- Do not use hollow rods or tubes as dipsticks. (When a warm tube is inserted into a cryogen, liquid will spout from the top of the tube.)
- Check the liquid levels of Dewars regularly. If the liquid evaporates more rapidly than normal, the Dewar may be losing its vacuum.
- Also follow the SOP for asphyxiants.

5. **Personal protective equipment (PPE):**

- Wear cryogenic gloves, safety glasses, and lab coat when handling and transporting cryogenic materials.
- Wear safety goggles, face shield and cryogenic apron (plus cryogenic gloves and lab coat) when working with any open container of liquefied gases (including when retrieving a specimen from a liquid nitrogen freezer).

6. **Transportation and Storage:**

- Never store cryogenic liquids or dry ice in walk-in cold rooms.
- Use and store liquid hydrogen and helium away from flammable materials and ignition sources. (These gases can condense oxygen out of the air, creating a localized oxygen enriched environment.)
- For liquid helium and hydrogen storage systems, check the pressure relief and inspect the system for leaks regularly. These gases are cold enough to solidify atmospheric air; leaks in storage systems for these gases may become plugged with solidified air. If the pressure relief device becomes plugged, the container may over-pressurize and fail.
- Use and store liquid oxygen away from open flames. Post a "No Open Flames" sign in liquid oxygen storage areas.
- Store and transport cryogenic materials only in dewars or cryogenic liquid cylinders designed for that particular cryogen. Inspect dewars daily to insure that no air or ice plugs exist in the neck openings.
- Cryogens may be transported in elevators only in containers certified to leak at less than or equal to 1 liter of liquid (or 1 kilogram of solid) per day.

7. **Waste Disposal:**

- If a cryogen (such as dry ice) has been mixed with a liquid that would normally be disposed of as hazardous waste (such as alcohol, as in a cold trap), follow disposal procedures for that liquid upon warming to room temperature.
- As the unneeded cryogen is evaporating, good ventilation is essential to prevent hazardous air concentrations of the gas. Do not put unneeded cryogen in a sealed container, as the build-up of pressure could cause an explosion.
- Cryogens must not be dumped into sinks, as the thermal shock is likely to damage the sink and/or the plumbing.

8. **Exposures/Unintended contact:**

Contact RM&S for medical advice on occupational chemical exposures, **1-5037**. For an actual chemical exposure or injury, complete the work-related injury or illness report found at: <http://chemistry.nd.edu/safety/supervisors-report-of-injury-to-the-health-center.pdf>. If medical attention is needed, see <http://chemistry.nd.edu/safety/procedures-for-injury-illness-or-incident.pdf>.

9. **Spill/Release Procedure:**

Spills of cryogenic liquid can cause depletion of oxygen in the area. For spills over 1 liter (or smaller amounts in very small rooms), leave the area immediately and contact the Hazardous Material Spill team at: **1-5037** (Risk Management)

10. **Training of personnel:**

All personnel are required to complete the General Lab Safety session thru RM&S. This session includes an introduction to general chemical safety. Furthermore, all personnel shall read and adhere to this SOP.