

Cryogenic Materials

General

The use of cryogenic liquids in the laboratory presents a number of hazards. Employees should be properly trained in these hazards prior to use. The transfer of liquefied gases from one container to another should not be attempted for the first time without the direct supervision and instruction of someone experienced in the operation.

Storage and Use of Cryogenic Materials

- Cylinders and other pressure vessels used for the storage and handling of liquefied gases should not be filled to more than 80% of capacity, which will prevent the possibility of bursting the vessel by increased hydrostatic pressure.
- Use care when filling portable Dewars and do not overfill them.
- Transfer or pour cryogenics slowly to minimize boiling and splashing. Use a phase separator or special filling funnel (the top of the funnel should be partly covered to reduce splashing). If the liquid cannot be poured, use a cryogenic liquid withdrawal device for the transfer (be sure to follow all instructions provided with the device).
- Remove metal jewelry/watches on your hands and wrists before working with cryogenic materials. If exposed to cryogenic liquids or boil-off gases, the jewelry can freeze to the skin.
- Wear an apron when working with cryogenic liquids.
- When hand-carrying cryogen-containing Dewar, ensure the Dewar is your only load (no books, coffee or other items). Watch carefully for people who may run into you, and ensure that the Dewar is carried with both hands and as far away from your face as comfortably possible.
- Ensure Dewars are properly labeled with the identity of the cryogen. Do not mix different cryogen Dewars.
- To avoid asphyxiation, an oxygen monitor in good working order is recommended if you are working with a cryogen in a confined space.
- Do not permit smoking or open flame in any area where oxygen or hydrogen is stored, handled or used.
- Do not lubricate oxygen equipment with oil, grease or unapproved lubricants.

Hazards

- Fire/Explosions
 - Neither liquid nitrogen nor liquid air should be used to cool a flammable mixture in the presence of air. Oxygen can condense from the air and lead to a potentially explosive condition.
 - Adequate ventilation must always be used to prevent the build-up of vapors of flammable gases such as hydrogen, methane, and acetylene.
 - Adequate ventilation is also required when using gases such as nitrogen, helium, or hydrogen. In these cases, oxygen can be condensed out of the atmosphere creating a potential for explosive conditions.

- Pressure Buildup and Explosions
 - Without adequate venting or pressure-relief devices on the containers, high pressures can build up by cryogen evaporation. Cryogens boil as they sit in their storage vessels by absorbing heat energy from the (much warmer) surroundings. The gas boiling out of the liquid must expand or the pressure will increase. Thus, users must make certain that cryogenic liquids are never contained in a closed system. Use a pressure relief vessel or a venting lid to protect against pressure build-up.
 - Liquid Dewar flasks are non-pressurized vacuum-jacketed vessels that are somewhat like a "Thermos bottle." Dewars are designed with loose-fitting caps or pressure-relief valves that prevent air and moisture from entering, yet allows excess pressure to vent. Do not use any stopper or other device that would interfere with venting of gas.
- Appropriate impact-resistant containers must be used that have been designed to withstand the extremely low temperatures.
- Asphyxiation
 - As the liquid gas warms and evaporates, oxygen may be displaced to the point that employees may experience oxygen deficiency or asphyxiation. Any area where such materials are used should be well ventilated. If there are any concerns about entering a room with suspected oxygen deficiency, do not enter and either increase ventilation, or (in the case of a confined space) call EHS.
 - Asphyxiation is a concern, because the threat may not be obvious. Rescue of an asphyxiated employee will endanger the life of the rescuer if oxygen is not provided. Laboratory entrance signage should alert the responder concerning the use of cryogenic liquids or solids.
- Contact with and Destruction of Living Tissue
 - Even very brief contact with a cryogenic liquid is capable of causing tissue damage similar to that of thermal burns.
 - Prolonged contact may result in blood clots that have potentially serious consequences. In addition, surfaces cooled by cryogenic liquids can cause severe damage to the skin.
 - "Chunks" or cubes should be added slowly to any liquid portion of a cooling bath to avoid foaming over.

First Aid

- Take the victim away from the cryogen hazard.
- Any clothing that may interfere with the circulation of blood to the frozen tissues should be removed in a slow, careful manner to prevent salvageable skin from being pulled off.
- Do not rub or massage the affected parts of the body. Rubbing may further damage the tissue.
- Immerse the affected area in a warm water bath not to exceed 105 °F or expose to warm air.
- The rewarming (thawing) of affected area(s) should be done gradually. It may take up to 60 minutes to thaw the affected area(s) and bring back the natural color of the

skin.

- If the eyes are affected, flush them with warm water for at least 15 minutes and then seek medical attention.

Personal Protective Equipment

- Gloves, eye protection, and face shield should be worn at all times when handling cryogenic liquids.
- Gloves should be chosen that are impervious to the fluid being handled and loose enough to be tossed off easily. Appropriate dry gloves should be used when handling dry ice.
- Proper attire includes long sleeve shirts, long pants (skirts), a long sleeve lab coat, well-fitted leather shoes (no sneakers), and gloves.