

STANDARD OPERATING PROCEDURE:
Cryogenic Liquids

PI: _____	Room & Building: _____
Department: _____	Research Group: _____
Date: _____	Pertains to Lab Protocol: _____

USE & PROCEDURE

Attach experimental protocol(s) that involve the use of cryogenic liquid.

POTENTIAL HAZARDS

Most cryogenic liquids can be placed into one of three groups:

- Inert gases do not burn or support combustion; e.g., nitrogen, helium, neon, argon, krypton
- Flammable gases produce gas that can burn in air; e.g., hydrogen, methane, liquefied natural gas
- Liquid oxygen vigorously promotes combustion in otherwise non-combustible materials, like carbon and stainless steels, cast iron, aluminum, zinc, and Teflon. It also reacts explosively with organic materials.

Avoid direct contact and exposure to cryogenic liquids as they

- Can cause severe burns and frostbite.
- Can cause asphyxiation, fire, and explosion from the evaporation of cryogenes.
- Will cause irritation if sprayed directly in the eye.
- Can cause noise from stainless transfer line when filling large dewars.

Containers may rupture or explode if exposed to heat.

ENGINEERING CONTROLS

- Ensure local exhaust ventilation system is in place. This will prevent the buildup of flammable gases or the displacement of breathable air.
- Do not place cylinders in a closet or other enclosed space where fresh air is not supplied to the area (i.e. "cold" room or "warm" room).
- Insulate the transfer line to reduce the noise when filling large dewars.

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

- Chemical splash goggles
- Full face shield (when removing samples from storage dewars)
- Cryogenic resistant gauntlets
 - should be loose-fitting so they are able to be quickly removed if cryogenic liquid is spilled on them.
 - are not made for immersion protection. They will only provide short-term protection from accidental contact with the liquid.
 - will wear out over time. Inspect regularly and replace when needed or when in doubt.
- Protective clothing to cover all exposed limbs (i.e. impervious cryogenic apron or coat, closed-toed impervious footwear)
- Tongs and/or forceps to handle frozen materials.

EQUIPMENT PRECAUTIONS

Cryogenic liquid cylinders:

- Ensure cylinders are equipped with safety relief valves and rupture discs to protect from internal pressure build-up.
- Do not plug, remove, or tamper with any pressure relief devices.
- Avoid direct contact with frozen delivery hose.
- Avoid moisture coming in contact with storage containers and equipment as it can freeze and plug up the relief devices.
- Handle and store cylinders in an upright position.
- Do not roll the cylinders by holding the neck, as it is the main support for the inner vessel of the container and is susceptible to damage. Always use dollies for moving storage containers.

CONDITIONS TO AVOID

- Heat (can create an explosion)
- Water or moisture (can enter the cylinder and plug the relief devices with newly formed ice)
- Incompatibles (metals, oxidizing agents)

MATERIAL SAFETY DATA SHEETS

MSDSs are available electronically via EHS Department's Web page:

<http://www.uos.harvard.edu/ehs/msds/>. An option, but consider collecting in a binder the MSDSs that arrive with each order.

EMERGENCY PROCEDURES

- If you begin to feel dizzy or lightheaded, shut off the cryogenic liquid, close the tank, and leave the area temporarily to get some fresh air. Before returning, be sure there is no oxygen deficiency, flammable atmosphere, or other atmospheric hazard.
- If you come in contact with cryogenic liquid, the first aid procedure is identical to that for frostbite.
 - Rewarm the affected area as quickly as possible by immersing it in warm, but not hot, water (between 102° and 105° F).
 - Do not rub the affected tissues.
 - Do not apply heat lamps or hot water and do not break blisters.
 - Cover the affected area with a sterile covering and seek assistance as you would for burns. (Refer to the emergency flip chart titled "*EHS Procedures and Response Guidelines*" posted in each laboratory.)

References:

- Product Safety, Environmental, Health and Safety, AIR PRODUCTS
- Canadian Centre for Occupational Health and Safety
- Office of Environment, Safety, and Health, Plasma Science and Fusion Center, Massachusetts Institute of Technology
- Environmental Health and Radiation Safety, University of Pennsylvania

ATTACHMENT

Filling Dewars or Other Storage Vessels

- Dewars and other storage vessels (e.g. cylinders) are available in a variety of shapes and sizes. Always use a dewar or storage vessel rated for the cryogen you are refilling or transporting.
- Use only fitted transfer tubes designed for use with the dewar container. Cracked or damaged insulation on transfer tubes should be replaced. Do not handle transfer tubes with bare hands, as the fitting is not insulated.
- Remove all metal jewelry from wrists and hands (a spill/splash could freeze the jewelry to your skin).
- Always wear cryo-gloves when dispensing a cryogenic liquid. Note: Cryo-gloves only provide short-term protection against accidental skin exposures and are not designed to protect skin against prolonged contact.
- When transferring into a secondary container, it is generally not a good idea to stand holding the container during filling. It should be placed on a stable stand or hung so that the transfer tube rests securely inside the neck of the secondary container.
- Only fill a dewar from a transfer line that has a phase separator attached to the end of the line.
- When filling a dewar flask at a filling station, place the phase separator so that it rests on the bottom of the dewar. Do not allow the cryogen to splash into the dewar.
- Never fill containers higher than the indicated level.
- Use stainless tubing to transfer cryogenics. Never use rubber or plastic tubing. The temperature can cause rubber or plastic tubing to become brittle and crack, spraying the liquid onto surrounding surfaces. (Liquid helium must be transferred through a vacuum insulated tube because of its extremely low heat of vaporization.)
- Never leave a filling process unattended.
- Always seek technical advice/guidance from your cryogenic liquid distributor.