ECKERD COLLEGE

Safe Operating Procedure

(2/04)

HANDLING CRYOGENIC MATERIAL

General tips for safely working with cryogens are provided below.

- Wear eye protection at all times. Wear a face shield if splashing could occur.
- Do not wear gloves if there is a chance of the material getting inside the glove and freezing the skin. Potholders are preferable. Likewise, avoid loose-fitting clothing, jewelry or other items that trap the material against the skin.
- Cryogenic gases can cause asphyxiation by displacing oxygen in the air. Ensure adequate ventilation in use areas.
- Do not allow moisture to contact critical storage container or cryogen equipment safety devices, such as pressure relief valves. The moisture could freeze, creating an ice plug that incapacitates the relief devices. Caps should be kept in place at all times to prevent moisture from entering and forming an ice plug.
- The NMR spectrometer has a Helium storage Dewar that has an outer container that is filled with liquid nitrogen to act as a heat shield and must be kept filled to be effective.
- Exposed glass areas of Dewars should be taped to prevent the spattering of broken glass should the high vacuum cause the container to implode. Use any plastic or rubberized tape.
- Never use a thermos bottle for cryogenic service. Explosions can occurred when the liquid or cold gas finds its way into the outer vessel at the mouth of the container, which is not adequately sealed from the inner vessel.
- When working with flammable, cryogenic liquids, ensure that equipment is scrupulously clean. Greases, waxes, or other impurities could react with the liquid/gas. Very Dangerous!

All cryogenic liquids are gases at normal temperatures and pressures. When cooled and placed under pressure, the gases condense to the liquid state and maintain a very cold temperature when placed in specially designed systems or storage containers. Various gases can be used as cryogenic liquids. The most common cryogens used at Eckerd are nitrogen and helium.

Cryogens, when exposed to the skin can cause severe burns or frostbite, especially when trapped against the skin in loose-fitting gloves or apparel. Cryogens can also expand very rapidly when changing from their liquid to gaseous state. If this change occurs in an unventilated area, it could lead to displacement of oxygen in a quantity sufficient to sustain life. Some cryogens, such as propane, hydrogen, and oxygen, present serious risk of fire due to their flammability. Others increase the risk of fire by condensing oxygen normally present in the air. Some cryogens are also toxic. Consult the Material Safety Data Sheet for the particular cryogenic liquid being used for a complete discussion of associated hazards.

Cryogenic liquids are shipped and stored in insulated containers. Depending on the specific cryogen, the container may also be pressurized. Regardless, all cryogen storage containers must be specifically designed for that use and able to withstand the cold temperatures and rapid pressure changes. Examples of storage containers are provided below.

- Liquid Dewar Flasks. Liquid Dewar flasks are non-pressurized, vacuum-jacketed vessels, equipped with a loose fitting cap or plug that prevents air and moisture from entering, yet allows excess pressure to vent. Flasks containing helium, hydrogen, and other low- boiling liquids have an outer vessel of liquid nitrogen for insulation. Laboratory liquid Dewars have wide-mouthed openings and do not have lids or covers. These small containers are primarily used in laboratories for temporary storage.

- Liquid Cylinders. Liquid cylinders are pressurized containers specifically designed for cryogenic liquids. They have pressure relief valves to prevent extraordinary pressure buildup. They may contain a combination of liquid and gas, gas only, or liquid only. Liquid and liquid/gas cylinders are equipped with "dip tubes" to dispense the liquid from the bottom of the cylinder.