General Use SOP for Cryogenic Liquids

#1	Process or Experiment Description

This standard operating procedure (SOP) is intended to provide general guidance on how to safely work with cryogenic liquids and dry ice. This general use SOP only addresses safety issues specific to cryogenic hazards of chemicals. In some instances, several general use SOPs may be applicable for a specific chemical (i.e., for liquid hydrogen, both this general use SOP and the general use SOP for flammable liquids would apply). If you have questions concerning the applicability of any item listed in this procedure contact the Principal Investigator/Laboratory Supervisor of your laboratory or Environmental Health and Safety (x3-0448).

#2	Hazardous Chemicals/Class of Hazardous Chemicals

Cryogenic liquids are materials with extremely low boiling points (i.e. less than -150 °F/-101 °C). Common examples of cryogenic liquids are liquid nitrogen, liquid helium, and liquid argon. One special property of both cryogenic liquids and dry ice (frozen carbon dioxide) is that they undergo substantial volume expansion upon evaporation or sublimation, which can potentially lead to an oxygen deficient atmosphere where ventilation is limited. Some cryogenic liquids can also pose additional hazards including toxicity and flammability (i.e. liquid carbon monoxide).

#3	Control of Hazards- General

• Only work with cryogenic liquids in well-ventilated areas to avoid localized oxygen depletion or build up of flammable or toxic gas.
• Handle objects that are in contact with cryogenic liquids with tongs or proper gloves.
• Transfers or pouring of cryogenic liquids should be done carefully to avoid splashing.
• Containers and systems containing cryogenic liquids should have pressure relief mechanisms.
• Cryogenic liquid cylinders and other containers (such as Dewar flasks) should be filled no more than 80% of capacity to protect against thermal expansion.
• Cryogenic liquid/dry ice baths should be open to the atmosphere to avoid pressure build up.
• Keep liquid oxygen away from organic materials and ignition sources.
• Transfer of liquid hydrogen in an air atmosphere can condense oxygen in the liquid hydrogen, creating an explosion risk.
• Cryotube thawing – In addition to wearing proper safety equipment, when thawing cryotubes, place the cryotube in a heavy-walled container (e.g., a desiccator) or behind a safety shield to protect yourself in the event that the tube shatters.
• Shield or wrap fiber tape around glass dewars to minimize flying glass and fragments should an explosion occur. Note: Plastic mesh will not stop small glass fragments.

#3a	Engineering/Ventilation Controls

If the process does not permit the handing of cryogenic liquids in well-ventilated areas (i.e., lab ventilation having a minimum of 6 air changes per hour), contact Environmental Health and Safety at x3-0448 to determine necessity of an oxygen-deficiency monitor.

#3b	Personal Protective Equipment

In addition to proper street clothing *(long pants (or equivalent) that covers legs and ankles, and close-toed non-perforated shoes that completely cover the feet)*, wear the following Personal Protective Equipment (PPE) when performing lab operations/tasks involving cryogenic liquids:
• Safety glasses (If splash potential exists, use goggles + face shield instead)
• Lab coat
• Insulated cryogenic gloves

#4	Special Handling Procedures and Storage Requirements

Cryogenic liquid dewars are to be stored in well-ventilated areas. Storage in unventilated closets, environmental rooms, and stairwells is prohibited.
Large dewars must be tethered/ anchored to a wall.
Store flammable cryogenic liquids and liquid oxygen away from combustible materials and sources of ignition.
Additionally, follow all substance-specific storage guidance provided in MSDS documentation.

#5	Spill and Accident Procedures

Do not attempt to clean up any spill of cryogenic liquid. If a large spill or dewar leak occurs, immediately exit the area and call x5-9999 (or in the School of Medicine, x286) for emergency assistance.For further general guidance, refer to "Response to Chemical Spills and Exposures".
Laboratory personnel who work with hazardous chemicals are to be provided the opportunity to receive medical attention/consultation when:
• A spill, leak, explosion or other occurrence results in a hazardous exposure (potential overexposure).
• Symptoms or signs of exposure to a hazardous chemical develop.

#6	Waste Disposal

Coordinate w/ vendor for return of dewar(s).

#7	Minimum Training Requirements
• Compressed Gas Safety (EHS 2200) • General Safety & Emergency Preparedness (EHS-4200) • Chemical Safety for Laboratories (EHS-1900) • Laboratory-specific training	
#8	**Approval Required**
Consult with PI regarding need for prior approval. Laboratory personnel shall seek and the PI must provide prior approval of any chemical usage involving the following list of restricted chemicals.	
#9	**Decontamination Procedures**
Personnel: If skin or eye(s) comes in contact with a cryogenic liquid, run the area of skin under cool or warm water for fifteen minutes (do not use hot or cold water). DO NOT RUB OR MASSAGE AFFECTED AREAS— this can cause further tissue damage. Refer to MSDS for any specific instructions. Where medical attention is required, ensure to bring along MSDS(s) of chemical(s) to aid medical staff in proper diagnosis and treatment.	
#10	**Designated Area**
For cryogens that are also considered particularly hazardous substances, a designated area shall be established per the other applicable SOP(s).	