Cryogenic Liquids--Generic Procedures for Safe Handling and Storage[1]

Cryogenic liquids are liquefied gases having boiling points of less than 100º F (73.3º C). The primary hazards of cryogenic liquids include both physical hazards such as fire, explosion, and pressure buildup and health hazards such as severe frostbite and asphyxiation. Potential fire or explosion hazards exist because cryogenic liquids are capable, under the right conditions, of condensing oxygen from the atmosphere. This creates an oxygen-rich environment which is potentially hazardous and can lead to a fire or explosion. Pressure is also a hazard because of the large volume expansion ratio from liquid to gas that a cryogen exhibits as it warms and the liquid evaporates. This expansion ratio also makes cryogenic liquids more prone to splash and therefore skin and eye contact is more likely to occur. Contact with living tissue can cause frostbite or thermal burns, and prolonged contact can cause blood clots and have very serious consequences. All laboratory personnel who handle cryogenic materials should follow prudent safety practices. Additional information on the use and handling of cryogenic liquids is found in the following DRI documents: Safety Guidelines for Cryogenic Liquids and in the Use, Handling and Storage of Compressed Gases and Cryogenic Liquids.

Handling

- Appropriate PPE shall be worn when handling cryogenic liquids. This includes at a minimum special cryogen gloves, safety glasses or goggles plus a face shield, lab coat, long pants, and high topped shoes. Gloves should be impervious and sufficiently large to be readily removed should a cryogen be spilled. Watches, rings, and other jewelry must not be worn.
- Unprotected body parts should not come in contact with vessels or pipes that contain cryogenic liquids because extremely cold material may bond firmly to the skin and tear flesh if separation is attempted.
- Objects that are in contact with cryogenic liquid must be handled with tongs or proper gloves.
- All precautions must be taken to keep liquid oxygen from organic materials; spills on oxidizable surfaces can be hazardous.
- All equipment should be kept clean, especially when working with liquid or gaseous oxygen.
- Work areas should be well ventilated.
- Transfers or pouring of cryogenic material must be done very slowly to minimize boiling and splashing.
- Cryogenic liquids and dry ice used as refrigerant baths must be open to the atmosphere. They should never be in a closed system where they may develop uncontrolled or dangerously high pressure.
- Dewar flasks should be shielded with tape or wire mesh to minimize flying glass and fragments should an implosion occur. Plastic mesh will not stop small glass fragments.
- Liquid hydrogen must not be transferred in an air atmosphere because oxygen from the air can condense in the liquid hydrogen presenting a possible explosion risk.

[1]Additional topics, such as appropriate PPE, spill procedures, disposal, etc., must be added in order to use this document as a stand alone training tool to satisfy lab specific training requirements.

Storage

- Cryogenic liquids must be handled and stored in containers that are designed for the pressure and temperature to which they may be subjected. The most common container for cryogenic liquids is a double-walled, evacuated container (Dewar flask).
- Containers and systems containing cryogenic liquids must have pressure relief mechanisms.
- Cylinders and other pressure vessels such as Dewar flasks used for the storage of cryogenic liquids should not be filled more than 80% of capacity, to protect against possible thermal expansion of the contents and bursting of the vessel by hydrostatic pressure. If the possibility exists that the temperature of the cylinder may increase to above 86º F (30º C), a lower percentage (e.g., 60% capacity) should be the limit.
- Dewar flasks must be labeled with the full cryogenic liquid name and hazard warning.

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