

CRYOGENICS

Environmental Health & Safety



VISION STATEMENT

We provide expert guidance and timely service to the University Community through our commitment to health and safety. Employing best practices and collaboration, and by building long term relationships, we promote a productive and safety conscious work environment.

<http://www.ehs.columbia.edu>

Campus Contact Numbers:

Columbia University Medical Center
212.305.6780

Morningside
212.854-8749

Control Measures:

- **Engineering:** Ensure Ventilation is adequate, oxygen alarms/sensors are installed
- **Administrative:** Written Standard Operating Procedures (SOP's), Posting Warnings Signs/Labels & Training
- **Personal Protective Equipment (PPE):** Cryo-gloves, faceshield, safety goggles, lab coat, & long pants
- **Storage:** Store in insulated & labeled containers. In addition, adequate pressure-relief devices must be provided due to the potential for high-pressure gas build-up as the liquid evaporates



Spills: If cryogenic material is spilled on skin immediate medical attention is required.

- Any covering or clothing that may restrict circulation should be removed carefully, taking caution not to peel off skin.
- Any material which has frozen to the skin should be left in place until removed by medical personnel.
- Large spills, especially in a confined space, can lead to dangerous oxygen-deficient environment, therefore, immediately evacuate the area.
- Call Public Safety, and EH&S as soon as possible
- Use appropriate PPE during any spill clean-up
- Dispose of all hazardous waste generated during spill through EH&S.



Safe Work Practices:

- **Remove** all metal jewelry from wrists & hands before use (a spill/splash could freeze the jewelry to your skin)
- **Wear appropriate PPE** (consult EH&S if not certain of PPE)
- **Label** all cryogen containers clearly with a cryogen warning & the cryogen's name
- **Always** use appropriate glassware rated for use with cryogenics
- **Do not** store cryogenic containers in enclosed spaces
- **Store** flammable cryogenics away from oxygen
- **Maintain** proper ventilation during use.



Cryogenic Use Guidelines:

- To review policy guidelines log onto (www.ehs.columbia.edu), click specific campus and then policies and procedures
- Review online or print "Guidelines for Working Safely With Cryogenic Materials"
- Seek EH&S help if there are any further questions



Printed on recycled paper



Cryogenics: Is the study of the production of extremely cold temperatures. This field of science also looks at what happens to a wide

variety of materials from metals to gases when they are exposed to these temperatures. Cryogenics has a wide number of potential and actual applications, ranging from tempering metals so that they will be more durable to improving the tone of musical instruments.

Background: The temperature ranges used in cryogenics vary. Many people consider the study of any temperatures below -190 degrees Fahrenheit (-123 degrees Celsius) to be cryogenics. These temperatures are well below the freezing point, and they can have a dramatic impact on materials introduced to these very cold environments. There are a number of ways to produce temperatures this cold, ranging from specialized deep freezers to the use of liquefied gases like nitrogen which will control temperatures under the right pressure conditions.

Important: Cryogenics have very low boiling points. The gases released can produce frostbite and permanently damage delicate tissues, such as the eyes even by brief exposure. Direct contact with cryogenics can result in immediate injury, whereas being subjected to a very cold atmosphere for an extended period of time, such as a result of a spill, can also cause physical harm by inducing hypothermia.



Hazards: There are four principal areas of hazards related to the use of cryogenic fluids or in cryogenic systems:

- **Burns & Frostbite:** Cryogenic fluids (liquid or cold gas) allowed to come into direct contact with human skin can cause severe damage to living tissue. Damage occurs within seconds with only a brief episode of contact.
- **Flammability:** Some cryogen gases are flammable, including hydrogen, methane, & acetylene, while oxygen can support & accelerate the combustion of flammables and other materials. Ignition sources include: open flames, welding, and electricity.
- **High-Pressure Gas:** Due to the large expansion ratio from liquid to gas, a build-up of high pressure can occur when the liquid evaporates. The vaporization rate will depend upon the fluid, storage container design, and environmental conditions. The container capacity must include an allowance for the evaporation of the liquid into the gaseous state.
- **Displacement of Oxygen/Asphyxiation:** Due to the large expansion that takes place upon the evaporation of a cryogenic fluid, cryogenics, other than oxygen, are capable of causing asphyxiation by displacing breathable air.



Work Methods:

The PI must incorporate safe work practices into the laboratory's **Chemical Hygiene Plan (CHP)** for the specific work involving cryogenics.

The following work methods should be implemented when handling cryogenics:



- **Do not** directly touch or make contact with cryogenic liquids or uninsulated cryogenic equipment or pipes.
- **Do not** withdraw objects immersed in a cryogenic liquid without using tongs.
- **Do not** overfill containers. When pouring or transferring cryogenics, do so slowly to minimize boiling and splashing.
- **Avoid** the path of boil-off gases.
- **Store** cryogenic liquids in appropriately labeled and insulated containers (Dewar flasks are commonly used) which minimize the loss due to boil-off.
- Containers of cryogenic liquid must never be closed so that they cannot vent.

