

Cryogenic operations

Introduction

The group uses both nitrogen and helium in cryogenic liquid form as well as having equipment that can create cryogenic liquids. These have several potential dangers associated with their use, proper training and work practice is required. No one shall transfer cryogenics without being trained by NPL staff.

Precautions

There are a number of general precautions and safe practices that must be observed because of the extremely low temperatures and high rates of conversion into gas for all cryogenic liquids.

All cryogenic liquids are extremely cold. Cryogenic liquids and their vapors can rapidly freeze human tissue. Wear appropriate personal protective gear, avoid contact and always be aware cold surfaces that may be created during the handling of the cryogenic liquid.

Use and store cryogenic fluids in well ventilated areas only. All cryogenic liquids produce large volumes of gas when they vaporize. When cryogenic liquids form a gas, that gas is very cold and usually heavier than air. This cold, heavy gas does not disperse very well and can accumulate near the floor. Even if the gas is non-toxic, it displaces the air. Oxygen deficiency is a serious hazard in enclosed or confined spaces. When there is not enough oxygen, asphyxiation and death can occur very quickly.

Cryogenic liquids cannot be indefinitely maintained in the liquid state. If they are vaporized in sealed container they can produce enormous pressures that could rupture the container, for this reason pressurized cryogenic container are normally protected with multiple devices for over-pressure prevention. A pressure relief device must protect all selected equipment that may allow for the liquid to become trapped.

General Safety Practices and Personal safety

1. Cryogenic liquids must be handled, stored and used only in containers or systems designed in accordance with applicable standards, procedures or proven safe practices.
2. All systems components piping, valves etc...must be of the appropriate materials to withstand the extreme temperatures.
3. Pressure relief valves must be in place in systems and piping to prevent pressure build up.
4. Any system section that could be valved off while containing cryogenic liquid must have a pressure relief valve. Pressure relief valve relief ports must be positioned to face toward a safe location.
5. Transfer operations involving open cryogenic containers, such as dewars must be done slowly, while wearing all required personal protective equipment (PPE). Care must be used not to contact non-insulated pipes and system components.
6. Open transfers will be allowed only in well-ventilated areas.
7. Do not use a funnel while transferring cryogenic liquids.

8. Use tongs or other similar devices to immerse and remove objects from cryogenic liquids.
9. All apparatus in the laboratory, including that newly purchased, built or modified and using cryogenic materials must meet the safety criteria described herein, and must be used following these guidelines.

Emergency Procedures

Remember, oxygen-deficient atmospheres are an invisible danger. They have no warning properties.

Never enter an area suspected of being oxygen-deprived without a source of supplied air. Use monitoring devices to ensure oxygen levels are adequate.

When it is necessary to work in an oxygen-deficient area, supplied air must be provided.

Should a dewar of cryogenic liquid be venting continuously call the supplying vendor immediately.

Training

Training will be provided NPL staff and NO ONE should transfer or use cryogenic liquid without training and without express permission of NPL staff. Each use is unique and staff will help determine best practice for the specific installation.