Chemical Safety Management

Information Sheet: Cryogenic Substances

Purpose

The purpose of this information sheet is to guide workers and supervisors in general precautions and emergency responses for cryogenic substances. This information should be read in conjunction with the HSW Handbook Chapter Chemical Safety Management.

Q1 Why do cryogenic substances warrant special care?

A cryogenic substance is extremely cold (usually has a boiling point below –90°C). Working with cryogenic substances exposes workers to a number of potential hazards including cold-contact burns, frostbite, suffocation, lung disorders and general body cooling. These liquids can produce large volumes of gas when they vaporise and may create oxygen-deficient conditions. The vapours themselves may also cause cold-contact burns

Q2 What level of information, instruction and training is required for cryogenic substances?

All workers who are directly involved with cryogenic substances must be fully informed by their supervisor/person in control of the area, of the associated hazards and control measures to be followed. The level of information/instruction is to be in accordance with the Provision of HSW information, instruction and training HSW Handbook chapter (i.e. level 2 instruction). The individual records are to be kept on file (hard or electronic copy).

Q3 Is there anything I need to consider before handling and transporting cryogenic substances?

- Ensure appropriate control measures are put in place by the School/Area including emergency/contingency arrangements.
- The Supervisor/Person in control of the area is to ensure that all workers who handle cryogenics are provided with the appropriate personal protective equipment.
- Use appropriate personal protective equipment (PPE) including insulated gloves, eye protection (face shield) and closed-in shoes during transfer of cryogenic substances. Lab coats that provide total cover are to be worn. Avoid clothing that can trap spilled liquid against the skin. Do not handle dry ice with bare hands. **NEVER** place gloved hands into liquid nitrogen.
- Only use containers and trolleys that have been specifically designed for transportation.
- Minimise boiling and splashing of cryogenic substances during transfer to containers (use Dewar flasks and liquid withdrawal devices).
- DO NOT travel in lifts when transporting cryogenic substances (even when stored in a Dewar flask).
- Do not drop the container.
- Liquid nitrogen and dry ice must not be transported by road in an enclosed vehicle, use the tray of a utility/outside cab.
- **NEVER** place cryogenic substances in a sealed or sealable container.
- Biological specimens packed in cryogenic substance, to be transported by road, are required to be packed in accordance with the Australian Code for transport of Dangerous Goods by road or rail, which includes venting holes and cryogenically suitable containers.
- If chemicals are being transported by post, refer to Australia Post Guidelines
- If biological samples packed in a cryogenic substance are to be transported by air refer to CASA Guidelines
- Mixing liquid oxygen with flammable material greatly increases the flammability risk of the material. Mixing liquid oxygen and grease will result in an explosion or fire.
- For handling of other types of cryogenic substances refer to the following: Ammonia (refer to Australian Standard 2022); and Chlorine (Australian Standard 2927); For other gases refer to the manufacturer's instruction for handling

Q4 How should I store cryogenic substances?

- Internal storage is only to be considered after exhaustive investigation has shown that there is no suitable outdoor location. If this is the case, the vessel shall be placed on a level floor as far away from normal work locations as is practicable. The area where cryogenic liquids are stored must be ventilated to prevent the accumulation of gas or vapour.

Continued

Q4 How should I store cryogenic substances? Continued

- Cryogenic substances must not be stored in an unventilated or small room (e.g. cold room) because of the risk of oxygen depletion and asphyxiation. Oxygen monitoring and other controls may be required in all other rooms. Contact the HSW Team for advice.
- Only store in a suitable container designed to hold cryogenic substances, i.e. use high quality Dewar flasks, with protective covers- not standard "Thermos" flasks. **NEVER** use a sealed or sealable container.
- Pressure relief valves are required on containers since large volumes of gas formed from these liquids may cause explosions if not vented correctly. Regular inspection of these valves is required in accordance with the manufacturer's instructions.
- Do not store dry ice or liquid nitrogen in screw-top containers (pressure will build and may cause an explosion due to the lack of venting).
- Using or storing large quantities in basement laboratories and basement storage areas is not advisable.

For specific requirements for indoor and outdoor installations (including ventilation) refer to AS 1894 "The storage and handling of non-flammable cryogenic and refrigerated liquids."

Q5 Identification of cryogenic and refrigerated liquids and equipment

Storage vessels and equipment used for cryogenic and refrigerated liquids must be clearly marked to show the liquid for which the vessel or equipment is designed and used. The marking is to be in accordance with AS 1319 "Safety signs for the occupational environment" and the Worksafe Australia Guidance note for placarding stores for dangerous goods and specified hazardous substances.

Q6 What should you do in the event of an emergency with cryogenic substances?

First Aid

- A suitable first aid kit and instructions e.g. Safety Data Sheet (SDS) must be provided/accessible.
- All staff, who handle cryogenic substances, are to be provided with information in the appropriate first aid procedures as part of their Level 2 instruction (refer to the HSW Handbook Chapter Provision of HSW Information Instruction and Training).
- In the event of a spill onto the body, quickly remove any clothing that has come into contact with cryogenic liquids, but take care not to remove clothing which is frozen to flesh.
- Do not rub the skin; in the event of skin contact, gently flush the area with large quantities of room temperature tap water (do not apply hot water or any other form of direct heat).
- It is important that qualified medical attention be sought as quickly as possible.
- Refer to AS 1894 The storage and handling of non-flammable cryogenic and refrigerated liquids (1997) for a complete medical treatment guide for cryogenic liquids.

Spills or leaks

If a spill with a cryogenic liquid cannot be contained then the area should be evacuated immediately and the Emergency Services contacted. Advise Security (ext 35444), your Warden and follow their instruction/Emergency Procedures for evacuation.

The potential hazards associated with some cryogenics are:

- **Extreme Cold:** Cryogenic liquids and their associated cold vapours and gases can produce effects on the skin similar to a thermal burn. Brief exposures can damage delicate tissues, such as the eyes. Prolonged exposure of the skin can cause a cold burn and frostbite.
- **Asphyxiation:** When cryogenic liquids form a gas, the gas is very cold and usually heavier than air; even if the gas is non-toxic, it displaces air. Oxygen deficiency (i.e. asphyxiation) can cause death and is a serious hazard in confined spaces.
- **Toxicity:** Each gas can cause specific health effects. See SDSs for information about the toxic hazards of a particular cryogen.
- **Adhesion:** Plastic, carbon steel, and rubber can become brittle and break if using them with a cryogenic material.
- **Physical Hazard:** Without adequate venting or pressure-relief devices, pressure can build up and cause serious physical hazards including an explosion.
- **Flammability:** Flammable gases such as hydrogen, methane, carbon monoxide, and liquefied natural gas can burn or explode so therefor should be kept away from possible ignition sources.

Q7 Where do I obtain further information on cryogenics?

Contact your local HSW Team.