

# CRYOGENIC LIQUIDS TRANSPORT, HANDLING & MAINTENANCE PROCEDURE

## Enhancing Health & Safety in RCSI

RCSI DEVELOPING HEALTHCARE LEADERS WHO MAKE A DIFFERENCE WORLDWIDE

Department Heads have the responsibility of ensuring the safety of staff in their Department. They must also ensure that all of their staff follow the safety practices outlined in this document and receive the necessary supervision and operational training when carrying out all laboratory procedures.

Senior staff are responsible for supervising and training staff in their area and reporting non-compliance with procedures to Department Heads. They must also ensure that all staff they supervise follow the safety practices outlined in this document and provide additional training to staff before they undertake laboratory procedures.

### 1. Procedure

#### Mandatory PPE for Transport & Handling Cryogenic Liquid

The following PPE is mandatory when transporting or handling cryogenic liquids and is available from laboratory suppliers:

- Cryo-Gloves – waterproof and protective to -150°C
- Cryo-Apron – waterproof and insulating
- Chemical face shield

#### Cryogenic Liquid Delivery

All deliveries are to be made in the following locations in order to avoid pedestrian and vehicular hazards:

- 123 St. Stephens Green: Goods Inwards Gate at Glovers Alley
- York House: Proud's Lane
- Beaumont ERC : Services Yard

When placing an order you must specify these locations for delivery.

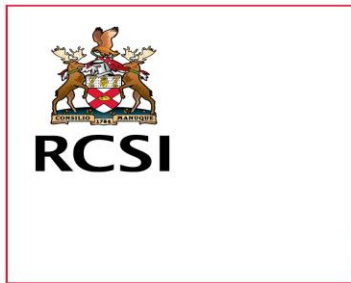
#### Transport Precautions

A minimum of 2 people must transport cryogenic liquids. Move cryogenic liquid containers carefully. Do not move a container by rolling it on its lower rim. Always use a hand truck, cart, or other proper handling device. Use a strap to secure the container to the handcart. Keep the cryogenic liquid containers upright at all times except for the minor tilting on the cart during transport. If cryogenics must be transported by elevator, adhere to the following procedure:

**Do not transport cryogenic liquids in elevators with any passengers** and ensure that no passengers get on the elevator while the cryogen is being transported. If a power failure occurred, a passenger would be trapped in the confined space of an elevator with the cryogen. Excessive amounts of the cryogen could vaporise and displace the oxygen. **Arrange for other lab personnel to control access to the lift at all floors in between the delivery area.**

### 2. Transport Route

From the rear moat in 123 St. Stephens Green, proceed through the student basement area to the main lift. In other buildings use the service elevator or corridors where there are limited numbers of people moving around. If necessary have one person in front of the trolley/cart to warn people to move out of the way.



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### 3. Transfer, Filling, Storage & Cooling of Cryogenic Liquid

#### Containers

When transferring cryogenic liquids from one container to another, cool the receiving dewar flask before filling it. Always start filling slowly to allow the vaporisation to chill the receiving container. After the vaporisation and liquid boiling has decreased, fill the container at the normal rate. Devices which reduce turbulence while filling are available for attachment to your transfer hose.

Fill containers only with liquids they are designed to hold. Mixing flammable cryogens and LIQUID OXYGEN produces a fire hazard. If LIQUID OXYGEN is used in a LIQUID NITROGEN refrigerator, any organic materials in the refrigerator could burst into flames.

#### Filling Devices

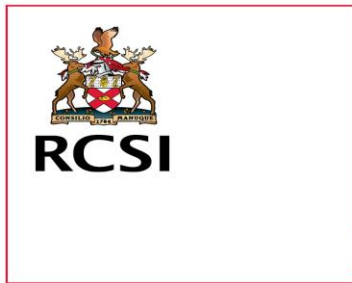
When pouring cryogenic liquids, use an appropriate filling device, such as a funnel for wide mouthed containers. When it is not safe or convenient to tilt the container, use a discharge tube to remove the liquid as follows: Insert the discharge tube through the neck of the container and well down into the liquid. The packing material or stopper on the discharge tube should form a seal in the neck of the container. Normal evaporation usually produces enough pressure to push liquid out. If necessary, the container may be pressurized with the same gas as the liquid or with an oil-free inert gas. Use just enough pressure to force liquid out. Never fill containers higher than the indicated level.

#### Storing Cryogenic Liquid

- Inspect all incoming containers before storing to ensure they are not damaged and are properly labelled. Do not accept delivery of defective containers.
- Keep dewar flasks covered with a loose fitting cap. Use only the stopper or plug supplied with the container.
- Ensure that ice does not form in the neck of flasks. Dewar flasks are not pressure vessels so if the opening is blocked pressure can slowly build up which may cause a violent rupture. Ice can also cause pressure relief valves to malfunction or become blocked.
- Do not store containers where they may come into contact with moisture. Moving parts, such as valves or pressure relief devices, can malfunction due to external ice formation.
- Ensure that ignition sources and combustible materials are kept far away from LIQUIFIED OXYGEN and other flammable material storage and handling areas. Ensure that vessels are insulated from any sources of heat.
- Do not store LIQUID OXYGEN containers on wood, asphalt or oil soaked gravel. When saturated with LIQUID OXYGEN these materials have exploded after an impact as slight as a footstep. Use concrete or clean gravel under storage areas.
- Store all cryogenic liquid containers in well-ventilated areas. Handle them carefully, and avoid dropping, rolling or tipping them on their sides.
- Restrict access to storage areas. Allow only authorised people into the storage areas. Clearly post warning signs and emergency instructions.

#### Cooling Operations

When using cryogenic liquids to cool an object, insert the object SLOWLY using tongs. This procedure minimises any boiling and splashing which occurs when warm objects are added rapidly. Never wear



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watches, rings, bracelets or other jewellery, because if splashed by a cryogen, they can freeze to exposed skin.

#### 4. Training

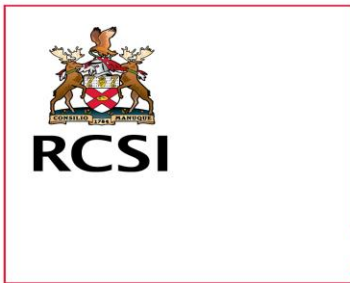
Contact your Lab Technician to organise training instruction on safe handling practices to anyone who handles stores or transfers cryogenic liquids. Specific areas of instruction should include:

- Properties of the cryogen both as a liquid and a gas;
- Specific instructions on the equipment being used, including safety devices;
- Approved materials that are compatible with the cryogen;
- Selection, use and care of protective equipment and clothing;
- First aid, including self-treatment;
- Dealing with emergencies such as fires, leaks and spills;
- Good housekeeping practices.

#### 5. Basic Safety Precautions for Handling Cryogenic Liquids

Following these basic general safe practices will help protect you from the hazards of cryogenic liquids:

- Read the SDSs and labels for all of the materials you work with.
- Know all of the hazards (fire/explosion, health, chemical reactivity, pressure) of the materials you work with.
- Store cryogen containers in cool, dry, well-ventilated areas, away from incompatible materials and ignition sources.
- Store, handle and use cryogen containers securely fastened in place in the upright position.
- Ensure that pressure relief valves are working properly.
- Never tamper with safety devices on vessels, valves or equipment.
- Never roll, drag, or drop vessels or permit them to strike each other.
- Move containers in handcarts or other devices designed for moving cryogenic liquid vessels.
- Ensure proper ventilation in areas where cryogenics are stored or used to reduce the risk of fire, explosion or asphyxiation.
- Fill containers only with the liquids for which they were designed. Label each container. Fill vessels to the indicated level only. Do not overfill.
- Proceed slowly when filling a container or inserting objects into a cryogen to minimize boiling and splashing.
- Prevent frostbite by never allowing cryogenic liquids to touch your skin.
- Never wear watches, rings, bracelets, or other jewellery that could freeze to your skin.
- Always wear loose fitting insulated gloves when handling anything that may have been in contact with a cryogen.
- Wear safety glasses whenever you are near a cryogen, and a face shield, gloves and apron when pouring a cryogen.
- Wear the proper personal protective equipment for each of the jobs you do.
- Know the location of eyewash stations and safety showers.
- Obtain proper training on how to use all of the materials and equipment you are using.
- Know how to deal with emergencies (fires, leaks, personal injury).
- Follow the health and safety rules that apply to your job.
- Do not contaminate cryogenic liquids or their containers.
- Never allow combustible organic materials near LIQUID OXYGEN.
- Prevent mixing of flammable and oxidizing cryogenics.



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- Never allow any absorbent materials to be exposed to flammable or oxidizing cryogenics.
- When venting storage containers, proper consideration must be given to all the properties of the gas being vented. Venting should be to the outdoors with appropriate environmental considerations.

## 6. First Aid & Emergency Procedures

### First Aid

Avoid contact with cryogenic liquids, their vapours and any cooled surfaces. If contact does occur, immediately flush the area with large quantities of warm (not hot) water. Remove all contaminated clothes. If the skin is blistered or the eyes have been exposed, obtain medical attention immediately. Locate emergency eyewash stations and safety showers wherever there may be accidental exposures to cryogenics.

### Emergency Procedures

The Safety Data Sheets should be consulted. SDSs have specific sections on spill and leak procedures, first aid instructions and fire and explosion hazards. If the directions in each SDS section are not clear or seem incomplete, contact the cryogen supplier or manufacturer for help. Act quickly in emergencies such as chemical fires or cryogenic vessel leaks.

- Evacuate the area at once if you are not trained to handle the problem or if it is clearly beyond your control.
- Alert other people in the area to the emergency.
- Call the fire brigade immediately.
- Obtain first aid if you have been exposed to harmful chemicals.

If a LIQUID OXYGEN container falls over, evacuate the area and observe the container from a safe position for 30 minutes. If the inner vessel is damaged, a leak could cause an ignition in the insulation space when the vessel is moved. Contact your supplier immediately if the inner vessel of a LIQUID OXYGEN container is damaged.

Cryogenics can be particularly dangerous during fires. Cryogenic liquids can freeze water very rapidly. Careless use of water can lead to heavy icing, possibly blocking pressure relief valves. The relatively warm water can also cause a flammable cryogenic liquid to vaporise more rapidly. This rapid evaporation produces more flammable gas to feed the fire.

## 7. Maintenance

Regular equipment maintenance can prevent hazardous conditions in the workplace.

- Always follow all the manufacturer's procedures for operating and maintaining equipment used with cryogenics.
- Comply with applicable regulations and follow the advice of the cryogenic liquid supplier.
- Repair equipment properly using tools and procedures suitable for the contents of the cryogenic liquid container.
- Avoid forcing connections, using homemade adaptors, or tampering with containers in any way.
- When doing maintenance work on oxygen handling systems, cleanliness is required. Grease or oil must not be allowed to contaminate any parts.
- Regular workplace inspections can help to spot situations in which cryogenic liquids are stored, handled or used in potentially hazardous ways.