

## Standard Safety Protocol

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### Safe Use and Transportation of Cryogenic Substances

#### 1. Introduction

##### 1.1. Purpose

The purpose of this document is to familiarize the user with the procedures involved when cryogenic liquid or solid (defined by the NIST as being below 93.15 K) used in an authorized and control manner in a laboratory environment. This document will highlight the dangers and protocols for the safe use and transportation of cryogenic substances within the EV Building. This document when referring to dewars, flask and containers are specifying the use of 'open top' containers ONLY. \*

##### 1.2. Scope

The use of cryogenic substances is restricted to advanced staff and students who have been trained in the dangers, use and transportation (See Section 2)

This procedure is applicable to undergraduate and graduate students enrolled in courses within the Department of Physical and Environmental Sciences. This document may also be used as a template for research users within the Department of Physical and Environmental Sciences.

##### 1.3. Responsibility

User

##### 1.4. Accountability

Principal Investigator/Course Instructor/Teaching Assistant

##### 1.5. Emergency Contacts

- Emergency Fire/Police/Ambulance:911
- UofT Police:416-978-2222

#### 2. Referenced Documents/Courses

- 2.1. [Standard for Inert Cryogenic Liquid Usage in the Laboratory](#) (link)
- 2.2. [Control Program for Liquid Cryogenic Transfer Facilities](#) (link)
- 2.3. [Cryogenic Liquids – Hazards \(CCOHS.ca\)](#) (link)
- 2.4. [Safely work with Cryogenic Liquids \(CCOHS.ca\)](#) (link)
- 2.5. [EHS101 WHMIS and Lab Safety](#) (course)

#### 3. Responsibilities

##### 3.1. Before using cryogenic liquids or solids in the lab you must:

- Read and understand the [Standard for Inert Cryogenic Liquid Usage in the Laboratory](#) provided by the University of Toronto.
- Be aware of the properties and dangers of cryogen(s) of interest.
- Complete and obtain a passing grade in the EHS101 WHMIS and Lab Safety course.
- Understand the limitations placed on the transportation of cryogens.
- Ensure you have access to the correct PPE for the safe use and transportation of cryogens.

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### 3.2. TRACES Users

- All Users must obtain training with TRACES Staff prior to the use and transportation of liquid or solid cryogens. It is the responsibility of the User to ensure they have a good understanding of the dangers and procedures laid out in Section 2.

3.3. If additional training sessions are needed it is the responsibility of the User to schedule these with EH&S and/or TRACES Staff.

3.4. Email sent by the User to a TRACES Staff member to coordinate the delivery of an approved cryogen container for transfer.

### 4. TRACES Staff

4.1. It is the responsibility of TRACES Staff to provide introductory and, if required, subsequent training to all users.

4.2. Are solely responsible for the safe transfer of cryogen to the approved containers.

4.3. Are responsible for billing of the services.

### 5. Equipment

5.1. PPE required under the [Standard for Inert Cryogenic Liquid Usage in the Laboratory](#)

- Approved Gloves: Elbow-Length Cryogenic Gloves
  - Approved Eye Protection: Goggles and Face Shield
  - Approved Lab Coat: Non-disposable
  - Approved Shoes/Footwear: Closed toe/all covering
- Please refer to the University's Personal Protective Equipment (PPE) website for more details;  
<https://ehs.utoronto.ca/resources/personal-protective-equipment-ppe/>

5.2. 'Open Top' Cryogen Vessel

- Flask or dewar must **NOT** be under pressure or stress and the top can be opened for filling.
- Ensure the flask is approved for cold temperature work/storage.
- Vessels meets ISO 21009-1

### 6. Procedure for Transferring Cryogens to an 'open top' flask or dewar

6.1. **Transferring cryogens will be completed by TRACES Staff in the Cryogenic Facility (EV017).**

- The O<sub>2</sub> sensor must be operational and in good working order.
- The TRACES Staff member will be protected with his/her PPE and no one is present during this time. Doors remain opened.
- Supervisor is aware of your presence.
- Remain outside the facility as the flask fills. When completed TRACES Staff will contact you by email

6.2. Flask or dewar must NOT be under pressure or stress and the top can be opened for filling.

6.3. Ensure the flask is approved for cold temperature work/storage.

- **Rubbermaid/ice containers** are not recommended.

6.4. Refer to Figure 1 for examples of acceptable 'open top' flask or dewars.

6.5. TRACES Staff will fill the flask to no more than 75% of the capacity. No overflowing is acceptable.

6.6. If not present, client will be informed (via email) when the cryogen is ready (wait 5-10 min after filling).

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Figure 1. Examples of acceptable 'open top' flask or dewars for transferring of cryogenic liquids

### 7. Transportation of Cryogenics

- 7.1. Proper PPE must always be worn when transporting cryogenics.
- 7.2. **It is strictly forbidden to transport cryogenic liquids or solids between floors via the stairs.**
- 7.3. When transporting cryogenic liquid volumes of **1L or less**, the elevator can be used without cordoning off the entrances.
- 7.4. When transporting cryogenic liquid volumes **greater than 1L**, the elevator must be cordoned off at both entrances, see figure 2 below. No one is permitted to enter the elevator while the cryogenic liquid is in transport.
- 7.5. **Note:** Signs to use for cordoning the elevator during cryogen transport are available from ChemStores (EV120).



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Figure 2. Example of the proper transport of cryogenic liquids greater than 1L via the elevator

### 8. Safe Use of Cryogen in the Lab\*

- Cryogenics must only be used for authorized and approved laboratory work.
- Cryogenics must be handled in a well-ventilated area.
  - Fume hood is the preferred area to conduct the lab work
- Cryogenics may only be used in a fume hood where there is no forced air ventilation.
- Where transfer of cryogenics is occurring in the lab, the equipment should never be left unattended.
- Cryogenic liquids and their containers should be kept free of contaminants of any kind.
- Absorbent materials should not be exposed to cryogenics.
- When a cryogen is vented, it should be to the outdoors, for instance via a fume hood.
  - Some facilities contain piping for cryogen venting to the outside (ie TRACES Cryogen Facility)
- Label containers with a WHMIS workplace label.
  - Label the cryogen container with an appropriate warning
- Do not overfill secondary containers.
  - Keep excess cryogen in a well-ventilated area.
- When filling containers or inserting objects into a cryogen, minimize splashing by proceeding slowly.
- Keep recently cooled containers/NMR tubes behind a protective shield and in the fume hood
- Do not hold recently cooled containers/NMR tubes in your hand or outside a protective shield
  - This can cause heating or quick expansion of gases; causing the container/tube to explode.

\*Contact the TRACES Manager for further details.

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