

# Cryogenic Room AI 0 223

## 1. General information

### 1.1 Guidelines

- CUSSTR Document: Chapter entitled “Chemical products”  
<http://www.cusstr.ch/repository/57.pdf>
- CERN  
[http://edms.cern.ch/file/335812/LAST\\_RELEASED/IS47\\_E.pdf](http://edms.cern.ch/file/335812/LAST_RELEASED/IS47_E.pdf)

### 1.2 Generalities

Gases, which can be liquefied at room temperature by an increase in air pressure, are classified as « **Cryogenic fluids** ». When liquid or solid (e.g. carbo-ice), cryogenic fluids are used as refrigeration products.

All cryogenic fluids constitute a potential hazard to some extent, including:

- Mechanical hazards associated with the handling of compressed gases (risk of explosion).
- The risk of asphyxiation when the concentration of oxygen in the air falls below 19%.
- The risk of burns and frostbites

Knowledge of the operating procedures and of the safety rules is therefore a strict condition to be allowed to work with cryogenic fluids.

## 2. Rules

### 2.1 Access to the cryogenic room AI 0 223

- Access to room AI 0 223 is restricted to operating hours: Monday to Friday from 07h00 to 19h00.
- Outside operating hours, it is strictly forbidden to draw off cryogenic fluids.
- The room is locked during night hours and weekends. People who need to access the reserve -70°C freezers must call Proctas, dialling the contact number 34000.

### 2.2 Training

- Drawing-off of cryogenic liquids and transport is performed only by trained collaborators.
  - Wear safety goggles with full protection (no lateral apertures) or a facial screen
  - Wear adapted protection gloves and clothes: laboratory gown with long sleeves, long legs trousers, no open shoes.
- Training is given by the “Faculty Safety Manager” for all the safety issues, and by the “Workshop team” for all the mechanical issues.

### 2.3 Safety

- General rule: carbonic ice and cryogenic fluids are never kept in hermetically closed receptacles.
  - Use only receptacles specifically designed for the transportation of cryogenic liquids. Styropore boxes for carbonic ice are not adapted for the transportation of cryogenic fluids.
  - To avoid ice formation and O<sub>2</sub> enrichment, receptacles have to be kept closed with special caps for the control of excessive pressure.

- Wear the **adapted PPE** (personal protective equipment):
  - Protective gloves:  
Due to their low viscosity, cryogenic fluids are rapidly absorbed by usual clothing materials: use non-absorbent materials such as PVC or leather.
  - Eye protection:  
The cornea of the eye is particularly sensitive to splashes of cryogenic liquids. When handling cryogenic fluids, eyes shall be protected with a face shield or full protection safety goggles.
  - Protection of the skin:  
Even brief contact with the cryogenic fluids can cause cryo-burns. Continuous exposure of naked flesh to a cold atmosphere can result in frostbite. Naked or insufficiently protected parts of the body or clothing may stick to cold surfaces by virtue of the freezing and skin may be torn off on removal of the clothing.  
Wear appropriate protective clothes: gown with long sleeves, long legs trousers, no open shoes.

### 3. Drawing off of liquid nitrogen

#### ATTENTION

To draw off liquid nitrogen, it is **strictly compulsory** to use the safety filling station. When using the filling station for the first time, or in case of doubt, please ask the "Workshop team".

#### 3.1 Automatic filling of mobile liquid nitrogen reservoirs (Type Carbagaz )

1. Check that the supply valve is closed (turn right).
2. Connect the "supply" pipe to the input faucet connection on the reservoir. Similarly, connect the "drain" pipe to the output faucet connection. Once both pipes are connected, turn open the two valves.
3. "Switch on" the filling station by pressing the "START" button
4. Gently open the supply valve (turn left).

The filling station switches off automatically when the reservoir is full.

5. Turn off the supply valve on the filling station.
6. Turn off the supply and drain faucets on the reservoir.
7. Disconnect the two pipes.

#### 3.2 Manual filling of liquid nitrogen cell tanks (type Carbagaz )

1. Check that the supply valve is closed (turn right)
2. Connect the filling rod to the supply pipe and insert the rod inside the tank.
3. "Switch on" the filling station by pressing the "START" button
4. Gently open the supply valve (turn left).

During a manual operation, the filling station automatically switches off after 3 minutes for safety reasons. To get a complete refuelling of the tank, it is therefore necessary to continuously press the start button until the tank is full.

5. Once the tank is full, turn off the supply valve.
6. Remove the supply rod and disconnect it from the supply pipe.

#### 3.3 Troubleshooting

|                           |   |   |
|---------------------------|---|---|
| Fast <b>red</b> flashes   | : | Supply valve is not closed                              |
| Slow <b>red</b> flashes   | : | The tank is not connected                               |
| <b>Red</b> light          | : | Tank already full or connections set up the reverse way |
| Fast <b>green</b> flashes | : | Start filling and checking presence of tank             |
| Slow <b>green</b> flashes | : | Filling the tank  |
| <b>Green</b> light        | : | Tank is full  |

#### 3.4 Transport of liquid nitrogen tanks

1. Due to the danger of asphyxiation (see point 4.1), it is forbidden to use public lifts for the transport of cryogenic liquid containers. You must use lifts dedicated to the transport of goods and materials.

2. If the ratio of transported cryogenic liquid exceeds 0.3 l/m<sup>3</sup> of the lift cage, it is forbidden to be transported at the same time as the cryogenic fluid. Transport must be coordinated from one floor to the other.

## 4. Emergency

### 4.1. Asphyxiation

The gases formed by cryogenic liquids are not toxic but, in view of the ratio between their gas and liquid volumes and their expansion on being warmed up to ambient temperature, they can cause asphyxiation by replacing the oxygen in the atmosphere. Owing to the density difference, helium rises (even when released in liquid form in air at ambient temperature), while argon, nitrogen, and krypton stagnate at ground level.

In sudden and acute asphyxiation, such as that from inhalation of pure nitrogen or helium gas, unconsciousness is immediate. The person falls as if struck down and may die in a few minutes. Cryogenic vapour and mist may extend along the floor or ceiling level to distances far from the source depending on their relative density compared to air.

| Percentage of oxygen in the atmosphere [%] | Symptoms  |
|--|---|
| 21 - 19                                    | no symptoms   |
| 19 - 15                                    | markedly slower reaction times                            |
| 15 - 12                                    | heavy breathing, rapid pulse, lack of co-ordination       |
| 12 - 10                                    | dizziness, unclear thinking, lips slightly bluish         |
| 10 - 8                                     | nausea, vomiting, loss of consciousness                   |
| 8 - 6                                      | death within 8 minutes, brain damage within 4 - 8 minutes |
| 4  | coma after 40 seconds, respiratory failure, death         |

**Reminder :** A low oxygen detection alarm system is needed when the quantity of cryogenic liquid for a container is:

a) in a non-ventilated area: up to 0.3 l/m<sup>3</sup> of room.

b) in a ventilated area: up to 0.4 l/m<sup>3</sup> of room.

[http://sb-sst.epfl.ch/files/content/sites/sbst/files/shared/Documentation/DirectiveInterneCryogenie\\_en.pdf](http://sb-sst.epfl.ch/files/content/sites/sbst/files/shared/Documentation/DirectiveInterneCryogenie_en.pdf)

- **Low oxygen alarm:**

Following an accidental release of liquid nitrogen, oxygen levels may fall below 18% in the room atmosphere.

This is an emergency situation and a two-steps alarm signal is activated:

|   |   |
|---|---|
| <i>Une alarme avec sirène et voyant lumineux se déclenche quand le niveau d'oxygène atteint le niveau d'alarme.</i>                     | <i>Low levels of O2 triggers the alarm system: flashing light and fire alarm horn</i>   |
| <p align="center"><b>Alarme niveau 1</b></p> <p align="center"><b>Voyant lumineux</b> = 18 % O2</p>                                     | <p align="center"><b>Alarm level 1</b></p> <p align="center"><b>Flashing light</b> = 18 % O2</p>                                    |
| <p align="center"><b>Alarme niveau 2</b></p> <p align="center"><b>Voyant lumineux</b> + <b>sirène</b> =</p> <p align="center">17%O2</p> | <p align="center"><b>Alarm level 2</b></p> <p align="center"><b>Flashing light</b> + <b>horn</b> =</p> <p align="center">17 %O2</p> |

- **Behaviour in case of low oxygen alarm:**

|          |  |   |
|----------|--|---|
| <b>1</b> | <p>L'utilisateur est dans le local avec</p> <p><b>voyant lumineux</b> uniquement</p> <ul style="list-style-type: none"> <li>- Fermer la vanne d'arrivée d'azote sur la station de remplissage.</li> <li>- Ouvrir la fenêtre.</li> <li>- Sortir et attendre devant la porte que le niveau de concentration redescende.</li> </ul> | <p>User present in the room with</p> <p><b>flashing light</b> on</p> <ul style="list-style-type: none"> <li>- Turn off the N2 supply valve</li> <li>- Open the window</li> <li>- Leave the room and wait until the O2 level returns to normal levels</li> </ul> |
|----------|--|---|

|   |   |   |
|---|---|---|
| 2 | <p>L'utilisateur est dans le local avec</p> <p><b>Voyant lumineux</b> + <b>alarme sonore</b></p> <ul style="list-style-type: none"> <li>- Sortir du local et appeler le 115 pour activer le SDIS (Service de défense incendie - SHE)</li> </ul>                               | <p>User present in the room with</p> <p><b>Flashing light</b> + <b>fire alarm horn</b></p> <ul style="list-style-type: none"> <li>- Leave the room and immediately call 115 to require the SDIS (Service de défense incendie - SHE))</li> </ul>                           |
| 3 | <p>Personnes à proximité +</p> <p><b>Voyant lumineux</b> + <b>alarme sonore</b></p> <ul style="list-style-type: none"> <li>- Ne pas entrer dans la pièce</li> <li>- Vérifier s'il y a une présence dans le local par les portes vitrées.</li> <li>- Appeler le 115</li> </ul> | <p>Nearby persons in the case of</p> <p><b>Flashing light</b> + <b>fire alarm horn</b></p> <ul style="list-style-type: none"> <li>- Never enter the room</li> <li>- Check if somebody is in the room by looking through the door's window.</li> <li>- Call 115</li> </ul> |

- **First aid:**

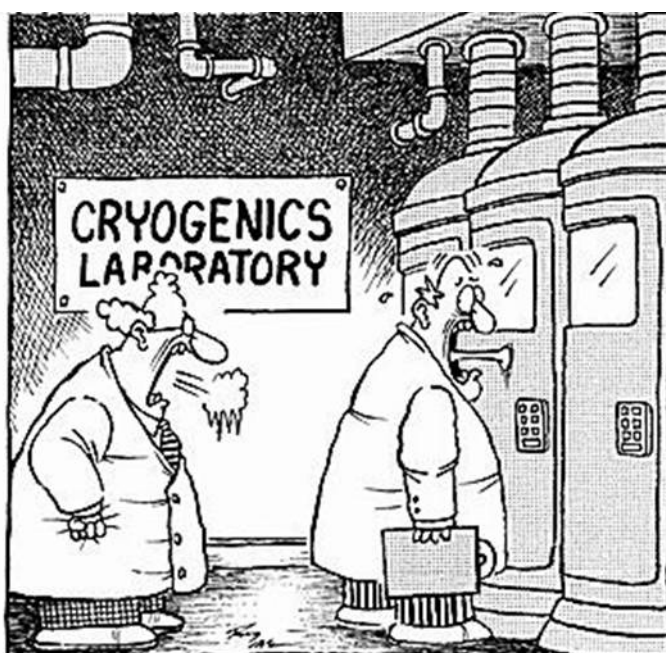
In cases of asphyxiation due to lack of oxygen, the victim shall be removed from the oxygen deficient site. Precautions must be taken before attempting to rescue, including wearing of breathing apparatus. First aid and resuscitation, if necessary, shall be immediately started, provided that the trachea is free and the heart is working. Oxygen shall be administered by the first-aiders, preferably by a breathing apparatus, until skilled medical attention can be obtained.

#### 4.2. Frost burns

"Frost burns" shall receive treatment as for normal burns. Remove any clothing that may constrict the blood circulation to the frozen area. Place the part of the body exposed to the super-cold in a flow of tepid water for 10-15 minutes. State clearly the cause of the burn (thermal, not chemical) when seeking for medical attention.

#### 4.2. Splashes in the eye

Splashes in the eye shall be dealt with by continuously washing the eye with tepid water (15-20°C for a period of 10-15 minutes followed immediately by medical treatment.



"Blast it, Perkins, not again!"