|  |  |
| --- | --- |
| C:\Users\z9801168\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\D90HK2AH\UNSW Landscape.png | Working with liquid nitrogen |
| **Faculty/Division** | **School/Unit** |
| Medicine | Medical Sciences |
| **Document number** | **Initial issue date** | **Current version** | **Effective date** | **Next review date** |
| SoMS\_HS\_013 | 14/04/2005 | V4.0 | 29/01/2018 | 29/01/2021 |

**Handling liquid nitrogen**

* + When handling Liquid Nitrogen be aware of the two main risks; asphyxiation and burns. Other risks include frost bite, over-pressurization and embrittlement.
	+ Small amounts of liquid vaporize rapidly to produce large volumes of gas: 1 litre of liquid nitrogen becomes about 700 litres of gas.
	+ Nitrogen gas is invisible; the cloudy vapour which appears when liquid nitrogen is exposed to air is condensed moisture, not the gas itself.
	+ In cold temperatures (below 5°C) the gas/vapour is heavier than air.
	+ There must be a Safe Work Procedure (SWP) for working with liquid nitrogen, used for the purposes of inducting and training people. Only trained people must handle and dispense liquid nitrogen.

**Asphyxiation**

* + High concentrations of the gas/vapour may accumulate and displace air from the room.
	+ Make sure there is enough ventilation in the room. The [liquid nitrogen oxygen calculator](http://www.safety.unsw.edu.au/sites/default/files/documents/HS650_Oxygen_Calculator_-_Nitrogen.XLSX) should be used to determine safe levels.
	+ Where possible, leave the room door open to allow for extra ventilation.
	+ Oxygen monitoring may be needed where there is not sufficient ventilation. Never enter a room when an oxygen sensor is alarming.
	+ People must not ride in a lift that is transporting volumes of liquid nitrogen that are beyond safe levels (as determined by the ready reckoner).
	+ The gas/vapour is heavier than air; take extra care with cellars or low areas where it can gather.

**Burns**

* + Liquid nitrogen can freeze body flesh very rapidly.
	+ Objects cooled by liquid nitrogen can stick to the skin.
	+ Eyes can be damaged by exposure to the cold gas as well as the liquid.
	+ Usually local pain is felt during freezing but sometimes no pain is felt, or it is short lived. Frozen tissues are painless and appear waxy, with a pale yellowish colour. Thawing of the frozen tissue can cause intense pain. Shock may also occur.
	+ Always wear appropriate PPCE (see below).
	+ If a spill occurs do not stand in the area, or allow others to stand in the area (see below for emergencies).

**Frost bite/hypothermia**

* + Low air temperatures arising from the proximity of liquefied gases can cause frostbite and hypothermia. There is usually sufficient warning of frostbite by local pain whilst the freezing action is taking place.
	+ Do not spend longer than necessary in rooms storing liquid nitrogen.
	+ Note that older people are more likely to succumb to hypothermia.

**Over-pressurisation**

* + Normal thermos flasks cannot handle low temperatures and the danger of explosion is present. Always use a flask that is designed for liquid nitrogen.
	+ If liquid nitrogen enters sample vials during storage, the vials when removed from the liquid nitrogen can become rapidly over-pressurised and explode in the face of the user.
	+ Take care that vials are not placed in the liquid phase during storage.

**Embrittlement**

* + Liquid nitrogen damages lino, stone floors, plastic materials, rubber and normal shoe soles.
	+ Floors and surfaces where liquid nitrogen is stored or used should be of robust material.

**Personal Protective Clothing and Equipment (PPCE)**

* + Wear cryogenic gloves under sleeves (i.e. sleeves go over the gloves), so liquid cannot drip inside the gloves.
	+ Cryogenic gloves are designed to be used in the vapour phase only and should not be immersed into liquid nitrogen.
	+ Wear safety goggles or a face visor/shield, depending on the volume dispensed.
	+ Wear closed non-slip footwear.
	+ Wear a cryogenic protective apron when handling large volumes of liquid nitrogen.
	+ Wear clothing that covers arms and legs.
	+ Avoid wearing clothing with open pockets and turn-ups where liquid could collect.
	+ Trouser bottoms should over-lap shoes
	+ Woven materials are best avoided, but if they are used for protective clothing, it is essential to ensure that they do not become saturated with cold liquid.

**Dispensing liquid nitrogen**

* Dispense only into Dewars that are rated for liquid nitrogen:
	+ Never use a Dewar that does not have a pressure relief valve or pressure venting lid/stopper.
	+ Use pressure venting lids/stoppers supplied by the Dewar manufacturer do not plug the entrance with any device that would interfere with the venting of gas.
	+ Ensure they are stable/not in danger of tipping over easily.
* Always stay in attendance during filling
* To prevent splashing place the filling hose at or below the mouth of the receiving Dewar
* Use a dipstick to assess the level of the liquid where necessary (never use a hollow dip-stick).
* Do not use a funnel.
* Use a trolley to transport dewars. Dewars larger than 20L should be lifted by two people.

**Transporting liquid nitrogen**

* Only use Dewar flasks or pressurised containers for liquid nitrogen transport, ensure they have carrying handles or wheels and are in good condition.
* Containers holding liquid nitrogen (or dry ice) should be vented or not fully sealed.
* Do not carry anything else other than the Dewar (e.g. no notepads).
* Where possible, use a goods lift for transporting liquid nitrogen, see following conditions.
* In the Wallace Wurth building: Where it is not practical to use the staircase then the Wallace Wurth goods lift may be used to transport liquid nitrogen of a volume no greater than 0.5 litres.
* Where volumes larger than 0.5 litres need to be transported the Dewar must be secured safely in the lift and travel unaccompanied. Place a large clear sign on the Dewar indicating that persons must not enter the lift.
* Along the transport route, avoid other people who may bump into you, grates, large cracks in flooring, and other hazards that could cause tipping of the liquid nitrogen.

**Emergency procedures**

* If cryogenic liquid is spilt indoors make sure there is adequate ventilation.
* Evacuate the area where necessary until the liquid has evaporated and oxygen level has returned to normal (20%).
* If cryogenic liquids are spilt outside, keep up wind of the spill.
* If there is an injury, a large spill, or a leaking vessel, contact UNSW emergency services (x56666) and a first aider.
* Never attempt a rescue of an unconscious victim exposed to liquid nitrogen gas without first determining the oxygen levels in the area are safe.
* SoMS has an oxygen monitor available from the Research Manager on Level 2 that can be used in the event of emergencies.

|  |
| --- |
| Accountabilities |
| Responsible Officer | Peter Gunning, Head – School of Medical Sciences |
| Contact Officer | Cristan Herbert, Chairperson SoMS Level 3 HS Consultation Committee |
| Supporting Information |
| Related Documents | HS-650 – Calculation of % O2 remaining following leak, spill or release of liquid nitrogen |
| Superseded Documents | SoMS\_HS\_013 (v3.1) 10/06/2015 |
|  |
| Revision History |
| Version | Approved by | Approval date | Effective date | Sections modified |
| 4.0 | Chairperson, SoMS L3 HS Consultation Committee | 29/01/2018 | 29/01/2018 | Document reviewed |