Sport Science

UNIVERSITY of STIRLING

Risk assessment RA12

https://sportsciencesafety.stir.ac.uk

Faculty / Service Area	Faculty of Health Sciences and Sport	Location	1A101/ S11B /Analytical Lab 4B140/Biopsy Lab 3B144G, Sport Science laboratories
Description of work task / equipment /area being assessed			
Liquid Nitrogen Storage and Use			

Change log			
		17/01/2013	Gillian Dreczkowski
		02/02/2015	Gillian Dreczkowski
		25/10/2016	Gillian Dreczkowski
		07/07/2022	Added service contract and supplier details Added link to BCGA Code of Practice CP30
	Version 1.1	29 Aug 2022	New format
	Version 1.2	25 Aug 2023	Added links to safety legislation, Gas Safety Training course and training procedure
	Version 1.3	30 July 2024	Added controlled access to gas store

Head of faculty	Prof Jayne Donaldson	Safety officer	Dr Nidia Rodriguez Sanchez
Completed by	Gillian Dreczkowski	Date	1st Sep 2015
Reviewed by	Kerry Bartie	Date	30/07/2024
	Nidia Rodriguez-Sanchez Chris Grigson	Date of next review	Aug 2025

Equipment used	Liquid nitrogen containers and Dewar flasks		
Categories of people involved	Staff, UG, PG, Visitors		
Duration of activity	Handling of liquid nitrogen normally less than 1 h	Frequency of activity	Daily in some cases
Legal compliance to standards and regulations required	Health and Safety at Work act 1974 (HASAWA) https://www.hse.gov.uk/legislation/hswa.htm Management of Health and Safety at Work Regulations 1999 (MHSWR) https://www.legislation.gov.uk/uksi/1999/3242/contents/made Provision of Work Equipment Regulations 1998 (PUWER) https://www.hse.gov.uk/work-equipment-machinery/puwer.htm The Control of Substances Hazardous to Health Regulations 2004 (COSHH) https://www.hse.gov.uk/coshh/		

COSHH Hazards

Anything in category F.6 (Chemical and biological hazards) should go here

*Details under relevant heading in appendix

Manufacturers MSDS data sheets are required for all chemical hazards and are attached

The Substance What are the hazards and *classification? *Route of exposure	*WEL mg/m3	Who might be harmed and how?	What are you already doing to control the risks?	*Risk rating	What additional controls (if any) are required to reduce the risks?	*Risk rating	Action by who?	Action by when?	Date of completion	Health monitoring
Liquid Nitrogen		Investigators Cryogenic burns Liquid nitrogen contact with skin may cause cold burns or frost bite	SOP Suitable, containers must be used Laboratory coat and cryoprotective gloves and safety glasses should be worn when handling liquid nitrogen **In the event of a cryogenic burn:** All cold burns should be checked by a first-aider or, in extreme circumstances, by a medical expert to confirm the extent of damage. **First Aid Advice:** Flush affected area(s) of skin or	Medium	Only trained users will be able to handle LN2 following completion of a Gas Safety course and supervised practice until deemed competent Users to inform colleagues if entering the nitrogen store alone and confirming safe completion of activities					No

The Substance What are the hazards and *classification? *Route of exposure	*WEL mg/m3	Who might be harmed and how?	What are you already doing to control the risks?	*Risk rating	What additional controls (if any) are required to reduce the risks?	*Risk rating	Action by who?	Action by when?	Date of completion	Health monitoring
			eyes with copious quantities of tepid water but do not apply any form of direct heat.		Controlled access of gas store					
		All Asphyxiation In high concentrations nitrogen may displace oxygen from the air causing asphyxiation.	SOP Adequate ventilation reduces build-up of asphyxiant N2 Oxygen monitor worn whenever entering liquid nitrogen storage facility 1A101. Set to alarm at < 19.5% O2 In the event of an oxygen deficient atmosphere being detected, personnel are instructed to	Medium						No

The Substance What are the hazards and *classification? *Route of exposure	*WEL mg/m3	Who might be harmed and how?	What are you already doing to control the risks?	*Risk rating	What additional controls (if any) are required to reduce the risks?	*Risk rating	Action by who?	Action by when?	Date of completion	Health monitoring
			vacate until the level has returned >20% Attempts to rescue person(s) from oxygen deficient atmospheres only to be made by trained persons using breathing apparatus If medical attention is not immediately available, arrange for the casualty to be transported to hospital In event of a spillage - Evacuate all personnel from the area likely to be affected by liquid nitrogen and evolved nitrogen gas.							

The Substance What are the hazards and *classification? *Route of exposure	*WEL mg/m3	Who might be harmed and how?	What are you already doing to control the risks?	*Risk rating	What additional controls (if any) are required to reduce the risks?	*Risk rating	Action by who?	Action by when?	Date of completion	Health monitoring
			Open exterior doors and windows to encourage evaporation of the liquid and safe disposal of the nitrogen gas							
		Transient and short exposure of cold on lungs can produce discomfort in breathing	SOP Adequate ventilation reduces risk of exposure to cold LN2	Low						
Explosion due to formation of ice plug in dewar vessel		Users Ruptured container leads to flying debris and a rapid release of low temperature, asphyxiant gas	If a blockage occurs in the storage vessel - Evacuate all personnel from the storage room area *Contact BOC for further advice and arrange for an engineer to examine	Low						

The Substance What are the hazards and *classification? *Route of exposure	*WEL mg/m3	Who might be harmed and how?	What are you already doing to control the risks?	*Risk rating	What additional controls (if any) are required to reduce the risks?	*Risk rating	Action by who?	Action by when?	Date of completion	Health monitoring
		Injury from flying debris Asphyxiation Cryogenic burns	the storage vessel before returning it to service Annual Service of storage Dewar by BOC engineer carried out in compliance with **BCGA Code of Practice CP30 procedures							

^Service and supply contact details:

Account number 1307590 Stirling University
Location number 2902558 LN2 1A101 Sport Sciences gas store

Contacts in this order:
Joe Fullerton Service engineer and delivery driver Mobile 07774 281665
Cryospeed supply and Cryocare 0800 111 333

References
**BCGA Code of Practice CP30
https://bcga.co.uk/wp-content/uploads/2021/09/BCGA-CP30-Rev-3-23-07-2019.pdf
Cryocare Cryogenic Vessel Maintenance
https://www.boconline.co.uk/en/services/customer-engineering-services/cryogenic-vessel-maintenance/cryogenic-vessel-maintenance.html
Gas safety training www.gassafeconsultants.co.uk

Append supplier safety data sheets for all substances here:

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Safety data sheet
Nitrogen, compressed.

Creation date : 27.01.2005 Version : 1.3 GB / E SDS No. : 8347
Revision date : 12.04.2011 page 1 / 4

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier
Product name
Nitrogen, compressed.

EC No (from EINECS): 231-783-9
CAS No: 7727-37-9
Index-Nr. -
Chemical formula N2
REACH Registration number:
Listed in Annex IV/V of Regulation (EC) No 1907/2006 (REACH), exempted from registration.

1.2. Relevant identified uses of the substance or mixture and uses advised against
Relevant identified uses
Industrial and professional. Perform risk assessment prior to use.
Uses advised against
Consumer use.

1.3. Details of the supplier of the safety data sheet
Company identification
BOC, Priestley Road, Worsley, Manchester M28 2UT
E-Mail Address ReachSDS@boc.com

1.4. Emergency telephone number
Emergency phone numbers (24h): 0800 111 333

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification acc. to Regulation (EC) No 1272/2008/EC (CLP/GHS)
Press. Gas (Compressed gas) - Contains gas under pressure; may explode if heated.

Classification acc. to Directive 67/548/EEC & 1999/45/EC
Not classified as hazardous to health.
Asphyxiant in high concentrations.
Risk advice to man and the environment
In high concentrations may cause asphyxiation.
Compressed gas.

2.2. Label elements
- Labelling Pictograms

- Signal word
Warning

- Hazard Statements

H280	Contains gas under pressure; may explode if heated.
EIGA-As	Asphyxiant in high concentrations.

- Precautionary Statements

Precautionary Statement Prevention
None.

Precautionary Statement Response
None.

Precautionary Statement Storage

P403	Store in a well-ventilated place.

Precautionary Statement Disposal
None.

2.3. Other hazards
None.

SECTION 3: Composition/information on ingredients

Substance / Mixture: Substance.

3.1. Substances
Nitrogen, compressed.
CAS No: 7727-37-9
Index-Nr.: -
EC No (from EINECS): 231-783-9
REACH Registration number:
Listed in Annex IV/V of Regulation (EC) No 1907/2006 (REACH), exempted from registration.
Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures
Not applicable.

SECTION 4: First aid measures

4.1. Description of first aid measures
First Aid General Information:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Inhalation:
Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.
First Aid Skin / Eye:
Adverse effects not expected from this product.
First Aid Ingestion:
Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed
In high concentrations may cause asphyxiation. Symptoms may include loss of mobility/consciousness. Victim may not be aware of asphyxiation.

4.3. Indication of any immediate medical attention and special treatment needed
None.

SECTION 5: Fire fighting measures

5.1. Extinguishing media
Suitable extinguishing media
All known extinguishants can be used.

5.2. Special hazards arising from the substance or mixture
Specific hazards
Exposure to fire may cause containers to rupture/explode.
Hazardous combustion products
None.

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Safety data sheet
Nitrogen, compressed.

5.3. Advice for fire-fighters
Specific methods
If possible, stop flow of product. Move container away or cool with water from a protected position.
Special protective equipment for fire-fighters
In confined space use self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures
Evacuate area. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. Ensure adequate air ventilation. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

6.2. Environmental precautions
Try to stop release.

6.3. Methods and material for containment and cleaning up
Ventilate area.

6.4. Reference to other sections
See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling
Suck back of water into the container must be prevented. Do not allow backfeed into the container. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt. Refer to supplier's handling instructions. Only experienced and properly instructed persons should handle gases under pressure. Protect cylinders from physical damage; do not drag, roll, slide or drop. Never use direct flame or electrical heating devices to raise the pressure of a container. Do not remove or deface labels provided by the supplier for the identification of the cylinder contents. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Ensure the complete gas system has been (or is regularly) checked for leaks before use. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Damaged valves should be reported immediately to the supplier. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminates particularly oil and water. Never attempt to transfer gases from one cylinder/container to another. Do not smoke while handling product. The substance must be handled in accordance with good industrial hygiene and safety procedures.

7.2. Conditions for safe storage, including any incompatibilities
Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. Containers should not be stored in conditions likely to encourage corrosion. Containers should be stored in the vertical position and properly secured to prevent falling over. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from ignition sources (including static discharges). Keep away from combustible materials. Secure cylinders to prevent them from falling.

7.3. Specific end use(s)
None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters
No occupational exposure limit.

8.2. Exposure controls
Appropriate engineering controls
Product to be handled in a closed system. The substance must be handled in accordance with good industrial hygiene and safety procedures. Consider work permit system e.g. for maintenance activities. Systems under pressure should be regularly checked for leakages. Provide adequate general or local ventilation. Oxygen detectors should be used when asphixiating gases may be released.
Personal protective equipment
Eye and face protection
Wear eye protection to EN 166 when using gases.
Skin protection
Other protection
Wear leather safety gloves and safety shoes when handling cylinders.
Respiratory protection
Not required
Thermal hazards
Not required
Environmental Exposure Controls
Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties
General information
Appearance/Colour: Colourless gas.
Odour: None.
Melting point: -210 °C
Boiling point: -196 °C
Flash point: Not applicable for gases and gas mixtures.
Flammability range: Non flammable.
Vapour Pressure 20 °C: Not applicable.
Relative density, gas: 0,97
Solubility in water: 20 mg/l
Autoignition temperature: Not applicable.
Explosive properties:
Explosive acc. EU legislation: Not explosive.
Explosive acc. transp. reg.: Not explosive.
Oxidising properties: Not applicable.
Molecular weight: 28 g/mol
Critical temperature: -147 °C
Relative density, liquid: 0,8

9.2. Other information
None.

SECTION 10: Stability and reactivity

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10.1. Reactivity
Unreactive under normal conditions.

10.2. Chemical stability
Stable under normal conditions.

10.3. Possibility of hazardous reactions
None.

10.4. Conditions to avoid
None.

10.5. Incompatible materials
No reaction with any common materials in dry or wet conditions.

10.6. Hazardous decomposition products
Under normal conditions of storage and use, hazardous decomposition products should not be produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects
General
No known toxicological effects from this product.

SECTION 12: Ecological information

12.1. Toxicity
No ecological damage caused by this product.

12.2. Persistence and degradability
The substance is naturally occuring.

12.3. Bioaccumulative potential
Not applicable.

12.4. Mobility in soil
The substance is a gas, not applicable.

12.5. Results of PBT and vPvB assessment
Not classified as PBT or vPvB.

12.6. Other adverse effects
Not applicable.

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Do not discharge into any place where its accumulation could be dangerous. Vent to atmosphere in a well ventilated place. Contact supplier if guidance is required.
EWC Nr. 16 05 05

SECTION 14: Transport information

ADR/RID

14.1. UN number
1066

14.2. UN proper shipping name
Nitrogen, compressed

14.3. Transport hazard class(es)
Class: 2
Classification Code: 1A
Labels: 2.2
Hazard number: 20
Emergency Action Code: 2T

14.4. Packing group (Packing Instruction)
P200

14.5. Environmental hazards
None.

14.6. Special precautions for user
None.

IMDG

14.1. UN number
1066

14.2. UN proper shipping name
Nitrogen, compressed

14.3. Transport hazard class(es)
Class: 2.2
Labels: 2.2
EmS: FC, SV,

14.4. Packing group (Packing Instruction)
P200

14.5. Environmental hazards
None.

14.6. Special precautions for user
None.

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code
Not applicable.

IATA

14.1. UN number
1066

14.2. UN proper shipping name
Nitrogen, compressed

14.3. Transport hazard class(es)
Class: 2.2
Labels: 2.2

14.4. Packing group (Packing Instruction)
P200

14.5. Environmental hazards
None.

14.6. Special precautions for user
None.

Other transport information
Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the cylinder valve is closed and not leaking. Ensure that the valve outlet cap nut or plug (where provided) is correctly fitted. Ensure that the

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Nitrogen, compressed.

valve protection device (where provided) is correctly fitted. Ensure adequate ventilation. Ensure compliance with applicable regulations.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture
Seveso Directive 96/82/EC: Not covered.

15.2. Chemical safety assessment
A CSA does not need to be carried out for this product.

SECTION 16: Other information

Ensure all national/local regulations are observed. The hazard of asphyxiation is often overlooked and must be stressed during operator training. Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
Advice
Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted. Details given in this document are believed to be correct at the time of going to press.
Further information
Note:
When using this document care should be taken, as the decimal sign and its position complies with rules for the structure and drafting of international standards, and is a comma on the line.
As an example 2,000 is two (to three decimal places) and not two thousand, whilst 1.000 is one thousand and not one (to three decimal places).

End of document

8347 / EDV / 12.04.2011

Standard operating procedure

Procedure:

Room 1A101 (S11B) liquid nitrogen storage facility contains a Cryostor 180 litre storage vessel and a 50 litre sample storage Dewar.

Entering the storage facility
A personal oxygen monitor must be worn on entry into the storage area. The oxygen monitor can be obtained from room 3B142C along with the storage room access key. The monitor displays the oxygen concentration continuously and should read "20.9" in open air (it cannot be switched off). If in the event of low oxygen readings (19.5% or less) the monitor alarm will sound and the LCD display will repeatedly flash. All personnel should vacate the room and not re-enter until the oxygen level has returned to normal. If working alone tell a colleague of your intention to enter the LN2 storage facility and check out.

Dispensing Liquid Nitrogen
Only trained members of staff or students are allowed to dispense liquid nitrogen from the Cryostor storage vessel. Cryoprotective gloves, a face visor/goggles and a protective apron/ lab coat must be worn when dispensing liquid nitrogen.

Liquid Nitrogen Sample Storage
Cryoprotective gloves, lab coat and goggles are worn when adding or removing samples to or from the liquid nitrogen storage Dewar. Avoid splashing or spillages and remember to replace the storage Dewar plug after use before closing the lid.

Transportation Procedure
The transport Dewar (25 litre Cryolab with trolley) should only be filled to 90% of the net capacity to reduce the risk of spillage. The transport Dewar must be adequately secure during transportation and protective clothing must be worn at all times ie. Non-absorbent gloves (PVC or leather) and a lab coat. Shoes or boots must be worn and not open-toe sandals or flip flops.
Two people are required to transport the dewar from the storage area to the Analytical or Biopsy labs (Room 4B140/Room 3B144G).

Transportation of liquid nitrogen to the lab area is permitted by lift access, providing that access is restricted during transportation and the vessel is placed in the lift and collected at the other end. (Never accompany the filled liquid nitrogen dewar in a lift).

Use of Liquid Nitrogen
Rooms 4B140/3B144G. Ensure that the working area is well ventilated. Wearing appropriate gloves and clothing, carefully decant liquid nitrogen from the transport Dewar into the small Nalgene 1 L/2L Dewars for snap freezing or temporary storage of samples. Remove samples from the Dewar using cryo tongs or forceps. Avoid storage and spillage of large volumes of liquid nitrogen.

(Volumes of 20 L and under are acceptable for lab storage providing that the liquid nitrogen is stored in a suitable storage vessel as directed by **BCGA Code of Practice CP30)

Method of Disposal/Waste Liquid Nitrogen
Allow to evaporate slowly at room temperature in a well-ventilated area.
If a blockage occurs in the storage vessel - Evacuate all personnel from the storage room area.

^Contact BOC for further advice and arrange for an engineer to examine the storage vessel before returning it to service. Ensure that regular maintenance checks are carried out in compliance with **BCGA Code of Practice CP30 procedures.

In the event of an incident

Oxygen deficient atmosphere detected:

- Attempts to rescue person(s) from oxygen deficient atmospheres should only be made by trained persons using breathing apparatus
- If medical attention is not immediately available, arrange for the casualty to be transported to hospital

Cryogenic burn

- All cold burns should be checked by a first-aider or in extreme circumstances, by a medical expert to confirm the extent of damage
- First Aid
  + Flush affected area(s) of skin with copious quantities of tepid water but do not apply any form of direct heat
  + Move casualty to a warm place and advise them to seek medical attention

Spillage:

- Evacuate all personnel from the area likely to be affected by liquid nitrogen and evolved nitrogen gas
- Open exterior doors and windows to encourage evaporation of the liquid and safe disposal of the nitrogen gas