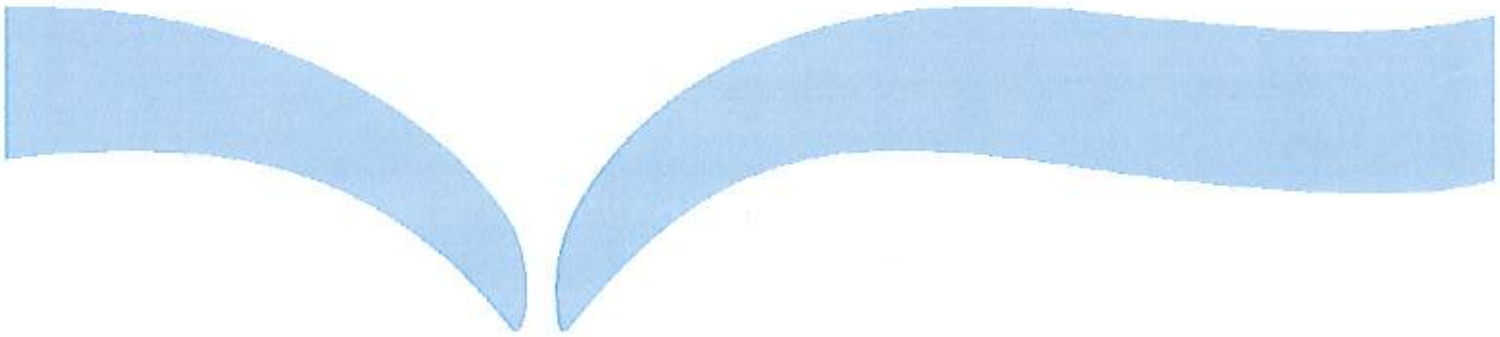
NHS
National Services Scotland

LIQUID NITROGEN PROCEDURE



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1. Introduction

This Procedure will support the NSS Health Safety and Wellbeing Policy. For reference to Roles and Responsibilities for Management, Staff and H&S Representatives please see the policy.

NSS Health Safety and Wellbeing Policy

Liquid nitrogen is a cryogenic gas and is used mainly in the SNBTS for the preservation of tissues and cellular products / samples. The gas in liquid form is at -196°C; has an expansion ratio of 682:1; when cold the vapour is heavier than air and can displace oxygen rapidly.

Since the gas condenses at a lower temperature than oxygen (-196°C c.f. -183°C) it can cause the oxygen in the air to condense resulting in further oxygen depletion, with the risk of asphyxiation and paradoxically oxygen rich hot spots wherein there is an increased risk of explosion and/or fire when in contact with any hydrocarbons..

In accordance with the requirements of the Control of Substances Hazardous to Health Regulations 2002 and other relevant statutory United Kingdom and European legislation, NSS recognises and accepts our responsibility as an employer to protect staff against risk to health, both immediate and long term, from any harm from incorrect exposure to liquid nitrogen. NSS recognises its responsibilities as an employer to:

- assess and record tasks using liquid nitrogen, supported by appointed trained assessors;
- reduce, to as far as is reasonably practicable, the use of liquid nitrogen
- provide information and training for staff on the storage, use and disposal of liquid nitrogen

Any breach of this procedure may be regarded as an offence and the member of staff may be subject to investigation in accordance with the NSS Disciplinary Policy.

Should members of staff have any difficulties with understanding any aspect of this procedure, or require further information in respect of accessibility, interpretation or application of the policy, they should contact their NSS H&S Advisor.

This procedure will be reviewed on a regular basis to take into account any changes to statutory legislation affecting the NSS and changes to the NSS organisation or the arrangements for implementation of the procedure.

2. Organisation

This procedure supports the NSS Health, Safety and Wellbeing Policy which sets out the organisational framework identifying the specific health and safety roles and responsibilities of management and staff, including clear lines of accountability as well as the roles and remit of the various health and safety committees.
Under this framework NSS have appointed suitably competent persons with responsibility for ensuring that all work involving liquid nitrogen is carried out in line with all current relevant statutory legislation.

3. Planning and Implementation

3.1 Definitions

Hazard: something which has the potential to cause harm

Risk: the likelihood of a hazard being realised together with a measure of the effect

Hazardous substance: a substance which is classified as toxic, very toxic, corrosive, harmful or irritant and which also includes biological agents and dusts in substantial concentrations

Liquid nitrogen: a cryogenic gas, used manly in the SNBTS for the preservation of tissue samples. The gas in liquid form is at -196°C; has an expansion ration of 682:1.

Controlled area - an area where it is necessary for any person who enters or works in the area to follow special procedures designed to restrict significant exposure to liquid nitrogen in that area. Access to a controlled area should be restricted to approved persons under the control of the line manager working to local rules determined by the risk assessment

Tissue and cellular products: any biological material that requires preservation and storage at ultra low temperatures

3.2 Appointments

NSS have appointed necessary competent persons to ensure all installations, equipment and working procedures are implemented in line with all current relevant legislation. Those competent persons include risk / COSHH assessors, first aiders, manual handling assessors, approved liquid nitrogen staff and engineering staff with particular training in the knowledge and safety of cryogenic gases.

3.3 Risk Management

3.3.1 Risk Assessment

In line with the Management of Health and Safety Regulations 1999, NSS will undertake and review suitable and sufficient risk assessments to ensure appropriate control measures are implemented to achieve the most effective means of restricting, so far as is reasonably practicable, incorrect exposure to liquid nitrogen

3.3.2 Accident / Incident Reporting

Any liquid nitrogen accident or incident will be reported in accordance with the NSS Accident / Incident Reporting Procedure. The local H&S Advisor should also be notified of any such accident or incident who will provide assistance to the competent person with any subsequent investigation, and also advise on any further action required.

3.3.3 Equipment

The following are deemed to be minimum requirements for any liquid nitrogen using area:-

(a) All liquid nitrogen areas will have at least one external wall.

(b) Extraction fans will be mounted in the external wall.

(c) Extraction fans will be mounted at ground level to allow removal of gases from the lowest level in the room.

(d) High level input ventilation will feed air into the area.
Overall ventilation will be a minimum of 10 changes and preferably 20 changes per hour or higher if assessment indicates such a requirement.

(e) Automatic filling equipment will be adopted as standard. An emergency stop valve will be fitted at the supply tank and linked to operate from the alarm setting of the fixed oxygen monitor. A manual cut-off switch will be provided to allow the guardian to cut the flow of liquid nitrogen should a potentially hazardous situation arise.

(f) It is preferred that liquid nitrogen areas be dedicated for that purpose, with a minimum of a clear $24m^3$ working space for each staff member present in the area.

(g) Extraction fans will be fitted with alarms activating in the event of failure. The alarm should be of a type which monitors the performance of the fan rather than the power supply to it.

(h) Nitrogen areas will have wall mounted oxygen monitors fitted, linked to alarm systems. The monitors will provide two-stage alarm information, alert then evacuation. The room must not be entered when oxygen level is less than 19% or the alarm is sounding. There must be logged controlled entry

(i) There will be provided a sufficient number of personal oxygen monitors to allow all likely numbers of workers in the area to carry one. These monitors will be donned prior to entering any liquid nitrogen area. Personal monitors should be placed in holders at the exterior of the entrance to the liquid nitrogen area.

(j) Repeater oxygen alarms will be fitted adjacent to the access doors to the area.

(k) Alarms should also be repeated in an area which is manned 24 hours a day.

(l) Where a louvered door is fitted to the external wall, this should be covered with wire mesh for security purposes.

(m) All equipment will be inspected, maintained, serviced and calibrated at 12 monthly intervals or at shorter intervals if recommended by the manufacturers. Work will only be carried out by an experienced and competent engineer. The maintenance will cover oxygen monitors (fixed and personal), pipework including valves, fans etc. All provided personal protective equipment will be checked, on a daily basis, for damage and repaired or replaced as necessary. In all cases, the principle of planned preventative maintenance will be applied. All inspections, servicings and maintenance will be duly recorded in a log book which will be signed by a senior member of staff.

(n) Elasticated wrist gloves or full arm gauntlets (cold-resisting), face protection, goggles and aprons must be available for use by staff using the area. Appropriate footwear should be worn. Assessments will need to be carried out on required personal protective equipment.

(o) Emergency power supplies should be provided to the nitrogen areas so that fans, lighting and monitors continue to function in the event of mains failure.

(p) Area to carry signage as appropriate "Liquid N_2 Hazard", "Cold Hazard" "No Unauthorised Entry" etc.

(q) All incidents involving activation of emergency cut-offs, leaks, failure to observe procedures etc will be recorded in a log book and the entry initialled by a senior manager. Accident / Incident (AIR) forms will also be generated to cover each event where appropriate.

(r) All wall mounted systems will be required to have a key-operated muting system. The access to the key will be under the control of senior staff and in all cases where the key is required a log entry will be required.

(s) A maximum number of liquid nitrogen containing vessels will be defined and must be open at any one time. If this requirement is breached a log entry must be made and an incident report generated.

3.3.4 Warning Devices and Safe Systems of Work

NSS will ensure that all equipment within its liquid nitrogen controlled areas, including all visual and audible alarms, security systems and signage is suitably maintained and used in accordance with the manufacturer's recommendations and all current relevant legislation. All maintenance work required in an NSS liquid nitrogen controlled area will be carried out by suitably trained competent persons under a written safe system of work.

3.3.5 Procedures

(a) All open operations will be based on a two person standard. One person working and the other guarding and monitoring

(b) No one will enter an area if the alarms are indicating a hazard. If an alert sounds staff will prepare to evacuate the area and if an evacuation alarm sounds staff will immediately leave the area. In an emergency the liquid nitrogen flow is shut off as they leave using the manual cut-off.

(c) All units using liquid nitrogen will, on the basis of risk assessment, develop emergency procedures.

(d) All units should liaise with the emergency services to ensure that there is co-operation and co-ordination covering the hazards and risks of these areas.

(e) Staff working in liquid nitrogen areas, whether with it or not, must be made aware of the hazards, risks and procedures involved.

(f) Staff will use all the equipment provided for their safety.

(g) Staff will wear safety goggles or full-face protection when working with liquid nitrogen. This will be based on the risk assessment.

(h) Under no circumstances should lone working with liquid nitrogen be sanctioned.

(i) Any contractor working in a liquid nitrogen area should be given instruction and training and should only work under permit-to-work systems.

(j) In the event of power failure staff should evacuate the area until the consequences of failure can be evaluated, this should be covered by risk assessment.

3.3.6 Personal Protective Equipment (PPE)

NSS will ensure that any PPE it provides for the purposes of protecting an individual from exposure to liquid nitrogen is adequate and suitable in line with the PPE Regs 1992. All PPE used for this purpose will be subject to examining and testing at suitable intervals dependent on use throughout a calendar year and as advised by the competent person. Records of such examinations must be retained for two years. Suitable storage facilities are provided for the PPE when not in use. Wearing of all such PPE will be rigorously enforced by the line managers.

4. Roles and Responsibilities

These are the definitions and descriptions of key roles and responsibilities of NSS management, staff and others which relate specifically to the implementation and application of this procedure.

Divisional Director / Senior Managers

Responsible and accountable for the health and safety of all staff and anyone else who may be affected by the work activities associated with their area of control. Specific duties required under this procedure are -

- Responsible for providing adequate information, instruction, and training to line managers, including communicating this policy to all those involved in liquid nitrogen activities.
- Responsible for appointing suitable approved persons and ensuring that all liquid nitrogen staff are suitably trained and that local rules incorporating safety procedures and safe systems of work, are developed and in place to protect staff and anyone else who may be affected by liquid nitrogen work undertaken within their areas of responsibility

Divisional Line Managers / Supervisors

- Responsible for the day to day management of approved liquid nitrogen users including implementation and enforcement of this policy and the safe systems of work and local rules associated with it.
- Responsible for providing adequate information, instruction, and training to staff, including communicating this policy to all those involved in liquid nitrogen activities

Competent Risk / COSHH Assessor

Appointed competent member of staff who has completed the NSS risk / COSHH assessment course provided by Healthy Working Lives and approved by OHSAC. Specific duties under this procedure are –

- Responsible for ensuring that all risk / COSHH assessments to which they are assigned are completed on the appropriate NSS documentation and in line with the NSS training courses provided by Healthy Working Lives and approved by OHSAC.
- Ensure that staff who are directly involved with the work activity are consulted as part of the risk assessment process and where necessary source additional support from those with specific expertise necessary, to ensure that suitable and sufficient risk assessments are carried out. (e.g. this could be from internal sources such as local health and safety committee reps, Healthy Working Lives H&S Advisors, Engineering maintenance staff with knowledge of plant & machinery or externally such as HSE, ROSPA, wider NHS colleagues or manufacturers and suppliers of materials or equipment etc)
- Responsible for signing off risk assessment on completion and submitting to Line Manager for sign off and copied to appropriate Site H&S Committee Chair and NSS National Health and Safety Advisors, when satisfied that it is suitable and sufficient
- Ensure appropriate review date is assigned to the risk assessment depending on the level of risk and undertake review as and when required, including following any significant change, such as following an incident / accident or change of personnel, process, equipment or premises.

Site Responsible Person

A senior manager who has been appointed to take responsibility for work with liquid nitrogen.

The name and job title of the Appointed Person is given in the local arrangements

The site responsible person will be responsible for training all liquid nitrogen approved staff to required standards based on safe systems of work and current H&S legislation.
They will also carry out competency assessments of staff on site to evaluate the effectiveness of training and take necessary action when inadequacies are highlighted.

Liquid Nitrogen Approved Staff

Nominated, competent member of staff who has specifically been trained in Liquid Nitrogen Handling and Safety. Specific duties under this procedure are –

- Help the Competent Risk / COSHH Assessor to undertake specific risk assessments relative to the use and operation of liquid nitrogen
- Develop and enforce the use of a safe system of work around all liquid nitrogen activities
- Ensure all equipment is fully maintained, serviced and faults are reported promptly to the site responsible person

Other Sources Internal/External

Competent persons from inside or outside the Organisation with a particular level of knowledge or expertise which may be required to ensure all relevant necessary information has been considered to provide a suitable and sufficient risk assessment, e.g., Tissue Services staff,

engineering maintenance staff, contractors, manufacturers, suppliers, etc. Requirement under this procedure is -

- Provide necessary information, knowledge and expertise to the Competent Risk Assessor and Line Manager when required in order to assist the risk assessment process

5. Training and Education

How to access to Training and Education:

For all courses currently offered by the HWL Team which are centrally funded please review the HWL Learning and Development Guide which is available on the HWL GeNSS training page and the Learning and Development Website.

To enrol on a workshop you are required to discuss and agree this with their Line Manager, add the course to their PDP and then enrol through the NSS L&D Website http://www.nsslearning.scot.nhs.uk Individuals will be contacted by the HR Service Centre with course details.

Refresher Training
All risk assessors will be required to undertake a refresher course every 3 years.

Refresher Training
All COSHH Assessors will be required to undertake a refresher course every 3 years.

Liquid nitrogen training

Site Responsible Person

There must be a minimum one named contact for each site, dealing with liquid nitrogen, who will attend a course run by an accredited external company on cryogenic gases. One contact is named in the local arrangements.
The site responsible person will be responsible for training all liquid nitrogen approved staff to required standards based on safe systems of work and current H&S legislation.
They will also carry out competency assessments of staff on site to evaluate the effectiveness of training and take necessary action when inadequacies are highlighted.

Liquid nitrogen approved staff

All staff who work with liquid nitrogen will undergo minimum three yearly refresher training from the site responsible person and must receive training prior to working with liquid nitrogen

6. Health Surveillance

There is no direct requirement for Occupational Health involvement in the implementation or application of this procedure.

7. NSS Support

Should members of staff have any difficulties with understanding any aspect of this procedure, or require further information in respect of accessibility, interpretation or application of the procedure, they should contact their:

- Divisional Line Manager
- Divisional/Site Health and Safety Committee Chair & Committee Reps
- Divisional/Site Health and Safety Advisor & Trade Union H&S Rep
- Healthy Working Lives contacts, Health and Safety Advisors
- Healthy Working Lives contacts, email; healthyworkinglives@nhs.net
  Health and Safety 0131 275 7671, Occupational Health 0131 275 6360
- Help is also available via the Healthy Working Lives Website on geNSS where other NSS policies, procedures and guidance documents can be found.

8. External Sources of Help

Contacts:
The Health and Safety Executive (HSE) http://www.hse.gov.uk/
Royal Society for the Prevention of Accidents (ROSPA) http://www.rospa.com/
British Compressed Gases Association (BCGA) http://www.bcga.co.uk/

References:

1. Control of Substances Hazardous to Health (COSHH) Regulations 2002
2. Health and Safety at Work etc Act 1974
3. Management of Health and Safety at Work Regulations 1999
4. The Personal Protective Equipment at Work Regulations 1992

9. Sign Off and Review Date

Date Procedure is effective

Reviewed By: NSS Safety Working Group (SWG)

Agreed by: ..... Date: 25 April 2012
Joint Chair, NSS Occupational Health & Safety Advisory Committee (OHSAC)

Agreed by: ..... Date: 25 April 2012
Joint Chair, NSS Occupational Health & Safety Advisory Committee (OHSAC)

Next scheduled review date: April 2014