

INTRODUCTION	
Date of Inspection:	15 <sup>th</sup> /21 <sup>st</sup> /22 <sup>nd</sup> May 2003
Area Inspected:	All SLS liquid nitrogen storage and dispensing facilities
Name of Inspector(s):	SLS Health & Safety Working Group members: Lisa Grayson, Irene Blair, Gail Alexander, Monica Lacey.
Objective of Inspection:	To establish the current status of all LN <sub>2</sub> dispensing and storage facilities, in terms of the availability of suitable and sufficient personal protective equipment, risk assessments, training, training records, signage and standard operating procedures.
SUMMARY	
<p>All areas were found to be lacking in one or more of the following:</p> <ul style="list-style-type: none"> <li>• up-to-date, signed risk assessments;</li> <li>• a formal training program and training records;</li> <li>• adequate signage;</li> <li>• a clearly displayed emergency procedure and emergency contact information;</li> <li>• adequate PPE.</li> </ul> <p>Rather than produce an individual report for each area, this one report will address all the relevant issues and be copied to all persons responsible for LN<sub>2</sub> facilities. These individuals must identify the sections relevant to their facility and, where necessary, implement the recommended remedial action by the date specified in the "ACTION" column.</p> <p>The H&amp;S Working Group will produce generic risk assessments, official training record forms, standard operating procedures and signage to aid in the implementation of corrective action. A standard training program will also be devised, as part of the ongoing SLS Health &amp; Safety Portfolio initiative.</p>	
OBSERVATIONS & REMEDIAL ACTION	ACTION
<p><b>1. Risk Assessments</b></p> <p>One or two areas were exemplary, having current, signed risk assessments on display. No action is required in these areas. However, in many areas, the risk assessments were out-of-date and/or not made available to, or signed by, all those undertaking the activity. In certain areas there were no risks assessments whatsoever.</p> <p>Generic risk assessments will be updated by the H&amp;SWG and issued to all facilities.</p> <p>The person responsible will be required to customise the generic assessments to address all issues specific to their facility. Acceptability of lone/out-of-hours working must be assessed on case-by-case basis and stipulated in the risk assessment, as should the requirement for an oxygen depletion monitor. Once complete, a master copy of each risk assessment must be read and signed by all persons undertaking the activity. Signed master copies must be prominently displayed in the LN<sub>2</sub> facility and reviewed every three years, or sooner, if circumstances dictate. The signature page(s) must be kept up-to-date.</p>	<p>L Grayson Oct 2003</p> <p>Person Responsible End 2003</p>
<p><b>2. Training</b></p> <p>In most instances, training in the use of LN<sub>2</sub> dispensing/storage equipment is given but it goes unrecorded and standards are variable.</p> <p>Those required to deliver training must be trained to do so. This training must be consistent and of a high standard. This will ensure all facility users are, in turn, trained to the same high</p>	<p>L Grayson I Blair End 2003</p>

<p>standard. A training program satisfying this requirement will be developed as part of the SLS H&amp;S Portfolio initiative.</p> <p>In the interim, any training currently given must be recorded on an official training record form that will be made available as soon as possible.</p> <p>Training records must be kept by the person responsible for the facility. Any training delivered by BOC, e.g. on operation of 500l tanks in WTB Stores, must be recorded and a copy retained by the person responsible.</p>	<p>L Grayson ASAP</p> <p>Person responsible As of now</p>
<p><b>3. Personal Protective Equipment (PPE)</b></p> <p>In most areas PPE was available, but in several instances it was found to be inadequate or damaged. At least one pair of gloves must be available at all times, preferably two pairs if there are several vessels/users. Gloves must be specifically designed for cryogenic handling (gloves are available from WTB Stores and most general lab suppliers). Damaged gloves must be discarded and replaced immediately. Face shields must be used in preference to safety glasses or goggles. At least one face shield must be available at all times, preferably two if there are several vessels/users. They must be kept clean and stored so as to prevent damage and scratching of the visor (e.g. on a hanging hook). Damaged visors must be repaired or replaced immediately (visors are inexpensive and available from most general lab suppliers). A cryo-apron should be provided in facilities where frequent, large volume dispensing is undertaken. PPE should be checked once every three months and simple tick-box record kept.</p> <p>A standard PPE inspection record will be provided.</p>	<p>Person responsible ASAP</p> <p>L Grayson Oct 2003</p>
<p><b>4. Signage</b></p> <p>In the majority of areas, signage was not considered adequate. The following signage is recommended:</p> <ul style="list-style-type: none"> <li>• “Wear face shield” - essential;</li> <li>• “Hand protection must be worn” - essential;</li> <li>• “Do not immerse (gloved) hands in liquid phase” – only when immersion is possible, e.g. where wide-necked cell freezers are in use;</li> <li>• “Risk of explosion” – only when this is a real possibility, e.g. where storage tubes/vials are being removed from cell freezers;</li> <li>• “Risk of asphyxiation” - where large volume dispensing is carried out or a large volume spill could occur;</li> <li>• “No entry to cleaners” – at the entrance to restricted access facilities;</li> <li>• “Lone working prohibited” – if dictated by the risk assessment (i.e. if asphyxiation risk exists);</li> <li>• “Use special tool for rack removal” – where required.</li> </ul> <p>Standard signs will be purchased/produced and made available to all facilities upon request.</p> <p>The person responsible is required to determine which signs apply to their facility and ensure they are prominently displayed.</p>	<p>L Grayson Oct 2003</p> <p>Person responsible End 2003</p>
<p><b>5. Standard Operating and Emergency Procedures</b></p> <p>Several areas had standard operating procedures (SOPs) on display, but none had a clearly displayed emergency procedure inclusive of emergency contact information. In some areas SOPs were out of out-of-date, not clearly displayed or simply non-existent.</p> <p>Generic SOPs will be updated by the H&amp;SWG and issued to all facilities. A standard emergency procedure will be drafted, and include a section for emergency contact details.</p>	<p>L Grayson Oct 2003</p>

<p>The person responsible will be required to customise the generic SOPs and emergency procedure to suit their facility and ensure the completed documents are clearly displayed.</p>	<p>Person responsible End 2003</p>
<p><b>6. Transport in Lifts</b> Each facility has a different style of sign for warning personnel not to enter lifts containing LN<sub>2</sub> vessels. A standard sign will be issued. No facility had a specific SOP for transport in lifts. This issue will be addressed along with the generic SOPs.</p>	<p>L Grayson Oct 2003</p>
<p><b>7. Secure Storage</b> Not achieved in every area inspected. Secure storage requirements must be clearly stated and adhered to. Large volume (&gt;50l) pressurised dispensing vessels must be stored in a locked, adequately ventilated facility, to which only authorised persons may gain access. Smaller volume dewars (≤50l), including those fitted with a liquid withdrawal device, and all cell freezers must be stored in areas where undergraduate students and members of the public do not have access. Where this is not reasonably practicable, the vessel must be secured in some way so as to prevent access to the contents or unauthorised dispensing, e.g. secure locking mechanism on lid or house in a secure storage cage.</p>	<p>Person responsible ASAP</p>
<p><b>8. Ventilation</b> In general, ventilation was considered adequate; however, in certain areas, it was difficult to ascertain without further investigation. Stores staff felt that ventilation in the LN<sub>2</sub> dispensing room was inadequate, considering the volume dispensed and the confined space.  The Stores issue must be investigated.  Where good ventilation is important there should be some mechanism to indicate partial or complete failure and it should be regularly checked by E&amp;B. Floor level ventilation grilles must be kept free from obstruction, dust and debris.</p>	<p>D Gardiner ASAP Person responsible ASAP</p>
<p><b>9. Dewars fitted with a Liquid Withdrawal Device</b> A few ≤50l dewars have been fitted, in-house, with a liquid withdrawal device to convert them into low pressure dispensing vessels. The liquid withdrawal device is fitted with a pressure gauge and relief valve. These modified vessels are not subject to regular testing by BOC, unlike the larger volume, purpose built pressure vessels. The H&amp;SWG were unsure as to whether these vessels are required to be regularly tested. Advice must be sought from Safety Services and/or the supplier of the liquid withdrawal device.  If testing is required, all relevant personnel must be notified and a testing program established.</p>	<p>L Grayson Oct 2003  I Blair End 2003</p>
<p><b>10. Manual Handling</b> Manual lifting of a 25l dewar was observed during the visit to WTB Stores.  To avoid manual lifting or tipping, all dewars should be kept on an appropriate tipping stand or, alternatively, fitted with a liquid withdrawal device and a roller base. Pressure vessels should come fitted with wheels or castors but, if not, they must be fixed to a suitable roller base. Cell freezers that require to be moved around should be on a roller base. Roller bases/stands must be robust, in good condition, provide a stable base and run smoothly. LN<sub>2</sub> vessels must not be carried up/down stairs. If it is not reasonably practicable to avoid manual lifting/tipping, e.g. in Stores during filling of cell freezers, the procedure must be risk assessed and correct manual handling technique adhered to.  WTB Stores staff pointed out the difficulties caused by the ramp and grating outside the loading when vessels are transported outside to be filled by the BOC tanker. The problems caused by the ramp and grating outside the WTB loading bay requires further, detailed investigation.</p>	<p>Person responsible End 2003  D Gardiner End 2003</p>
<p><b>11. Oxygen Depletion Monitors</b> Some are regularly tested, some are not.  All monitors must be tested and battery/sensor replaced in accordance with the manufacturer's recommendations. Records must be kept of all testing/replacement by the person responsible</p>	<p>Person responsible</p>

<p>for the LN<sub>2</sub> facility.</p> <p>Oxygen depletion monitors should not be disconnected or otherwise silenced during large volume dispensing. In areas where this is the norm, an investigation must be conducted to ascertain why it is necessary and how it can be avoided.</p>	<p>As of now</p> <p>Person responsible End 2003</p>
<p><b>12. Other Accessories</b></p> <p>All other accessories used in conjunction with LN<sub>2</sub> (e.g. storage vials/tubes, small volume flasks for temporary storage or transport) must be certified as suitable of the purpose. Pay particular attention as to whether vials/tubes are suitable for vapour or liquid phase storage. Shatterproof, plastic flasks should be used in preference to glass, vacuum type. Use of accessories must be covered in risk assessments and SOPs.</p>	<p>Person responsible As of now</p>
<p><b>13. Completion of Safety Services’ “Registration of Bulk Storage &amp; Dispensing Areas” Form</b></p> <p>Safety Services’ code of practice does not specify the exact volume limit above which this form must be completed. H&amp;SWG assume it to be 50 litres. Clarification must be sought and then the necessary forms completed and copied to Safety Services.</p>	<p>L Grayson Oct 2003</p>
<p><b>14. Maximum Oxygen Displacement Calculations</b></p> <p>H&amp;SWG were unsure as to if and when these calculations must be carried out. Clarification must be sought from Safety Services.</p> <p>If required, the person responsible will be expected to do the necessary calculation and submit the results to the H&amp;SWG.</p>	<p>L Grayson Oct 2003</p> <p>Person responsible End 2003</p>
<p><b>15. Awareness of Safety Services COP</b></p> <p>In many areas, there was a lack of awareness of the Safety Services COP, “Storage and Handling of Cryogenic Materials”, and the guidance contained therein. Status of the COP will be checked and, if still current, a copy will be issued to all facilities.</p>	<p>L Grayson Oct 2003</p>
<p><b>16. Special Considerations</b></p> <ul style="list-style-type: none"> <li>• In NMR facilities: liquid helium is used in conjunction with LN<sub>2</sub>; the filling process presents opportunity for a large volume spill; a quench incident could result in rapid boil-off of a large volume of cryogenic liquid. The risk assessment must consider all possible scenarios and prescribe adequate control and emergency procedures. Special training must be given by a senior, competent person.</li> <li>• Where auto-fill systems are in use they must be tested annually to ensure they are functioning as intended.</li> <li>• Manipulations carried out at the bench requiring dexterity not afforded by gloves and involving only small volumes of LN<sub>2</sub>, may be executed without gloves, providing workers are trained to work safely.</li> </ul>	<p>Person responsible ASAP</p>
<p>SIGNATURES &amp; DATE OF NEXT INSPECTION</p>	
<p>Signature of Inspector(s):</p>	
<p>Date of Next Inspection:</p>	