



Inspection of CLS Facilities equipped with Oxygen Depletion Monitors

Jan/Feb 2011

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1. The logs for recording weekly checks on Oxygen Depletion Monitors are not being filled in as directed, i.e. weekly, in the following facilities: CIRRU; NMR; X-Ray Crystallography; CL3 Suite WTB 1; EM; Cryodepository; WTB LN2 Dispensing Room. This was originally flagged in 2003 in an internal inspection report and several reminders have been issued by email to LN2 Facility Managers since this date but to no avail.

Action:

- i. More frequent inspections – monthly, to begin with - will be carried out by the H&SWG and reports will be issued to the facility manager and person ultimately responsible for the facility.
 - ii. In areas where it is difficult to get access to the monitor's sensor in order to carry out the weekly check, a canister of 18% O₂ test gas fitted with the appropriate regulator should be used. The regulator has a length of flexible tubing attached which can be easily directed at the sensor. Facility managers to arrange with LG, if required.
 - iii. The monitors in the NMR facilities located at ceiling height are particularly difficult to test. In this instance, the flexible tubing on the test gas regulator should be attached to a rigid support, allowing the operation to be done using one hand and from a lower height on the requisite ladder (tubing extends for about 60cm). Recalibration should only be done when absolutely necessary, i.e. the monitor fails to respond to the test gas or a new sensor is installed. It requires the use of both hands, therefore, should not be conducted when working up a ladder. The high level monitors should be taken down to ground level for recalibration and sensor/battery replacement. To do this safely they must be mounted and connected in a way that will allow them to be removed using one hand, keeping the other hand free to grip the ladder. The cable on top of the monitor must be easy to disconnect, i.e. screws kept loose, and the wall bracket should detach without the need for a screwdriver, i.e. screw heads sit proud from the wall and are smaller than the holes in the bracket. LG to liaise with NMR Facility staff.
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2. At the time of the inspection, neither extract fan in the Cryodepository facility was running. Normally, one fan should always be running to provide good ventilation at all times. When a critically low oxygen depletion alarm is triggered the second fan should activate to provide additional ventilation. Neither fan activated when the alarm sounded. This was reported to E&B immediately and has been rectified. The BMS system should have picked up the fault but failed to do so. This stresses the importance of frequently and consistently checking the oxygen depletion monitor, the two repeater units it is connected to and the emergency ventilation. Note: there is also a safety cut-off valve on the LN₂ supply line which should activate when the critically low alarm sounds. The reminder email sent on 30/6/10 specifically asked the Stores Manager to ensure this monitor was checked weekly but no reference was made to the repeaters, ventilation system or safety cut-off valve.

Action:

- i. The log for this facility should be modified to show that the monitor, both repeaters, the ventilation system and the safety cut-off valve have been checked and are functioning as expected. LG to produce a log sheet. Stores Manager to ensure it is completed each week.
 - ii. Other actions are as in item 1.
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3. Repeaters 490 (GL1.232, NMR) and 102 (GL1-07, Stores) were not operational.

Action:

- i. Facility Managers will be reminded to report faulty repeater units immediately by email to LG.
 - ii. LG to arrange for E&B/CLS Workshop to attempt repairs in the first instance and call upon Quantum only if the problem cannot be rectified in-house.
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4. The 2003 inspection report highlighted the inadequate ventilation in the WTB LN₂ Dispensing room and the H&SWG have raised this on a number of occasions since but no remedial action has been taken. The problem is compounded by the current low level extract system being frequently obstructed by LN₂ tanks (see photo 1 in the appendix). The CLS E&B Liaison Officer/Building Coordinator was to

look into getting an additional extract fan installed in the door leading from the dispensing room to the supply tanks (photo 2) but this was never progressed. In addition to inadequate ventilation:

- As indicated in item 1, there is no evidence to suggest that the oxygen depletion monitor is being regularly tested.
- As indicated in item 3, the repeater unit in the corridor was not functioning and this had not been addressed.
- When the inspector activated the oxygen depletion alarm the facility door was wedged open and Stores personnel were within earshot but no one came to investigate. This suggests warning alarms are routinely ignored.
- There is no automatic safety cut-off valve on the LN2 supply line.
- There are no windows or viewing panels to allow people within the room to be seen from the corridor. The room door is wedged open during dispensing but it is not clear as to whether all users of the facility wedge the door open each time they enter.
- At the time of the inspection the room was overcrowded with LN2 vessels (photo 3).
- The PPE Inspection Record was last filled in on 13/6/2005.
- The two most recent employees have not signed the risk assessment signature sheet.
- The old Oxygen Monitor Testing & Maintenance Record is still in the safety folder and last entry is dated 13/6/2005.
- The Training Record section of the safety folder is blank (photo 4).
- The old safety folder is still present and full of outdated documentation.
- The safety documentation pinned to the notice board needs to be renewed (photo 5).

Action:

- i. College Secretary and Stores Manager to discuss and formally respond with an action plan.

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5. Formal training records exist for the Cryodepository - 89 personnel trained to date - and this covers what to do in the event of an oxygen depletion alarm. However, there are no formal records for other facilities. The Cryogenics Safety Training slide show and quiz were developed to address this, with a view to having all users of liquid nitrogen run through the slide show and submit answers to the quiz via the H&S web site. However, CLS IT Support has been unable to create an on-line form for submitting answers to the quiz, thus far. It should be noted that the on-line training is additional to, and not a substitute for, one to one practical training delivered by a competent, experienced LN2 user. How we ensure consistency in the standard and recording of this practical training is still to be determined.

Action:

- i. LG to consult with IT Support with regard to getting the on-line form on the H&S web site and fully functional and report back to the College Secretary.
- ii. Once this is done, users of the LN2 dispensing room will be given 1 month to complete and submit the quiz. The security code on the door to the facility will be changed when the month is up and only those who have submitted a completed quiz will be given the new code. In addition to this, all lab personnel will be emailed and informed that viewing of the slide show and submission of the completed quiz is mandatory for all liquid nitrogen users. An item relating to this will be added to the Basic H&S Training Checklist to flag the requirement up to all new starts.
- iii. LG will collate and maintain the training records and report annual statistics to the CLS H&S Management Committee meeting.
- iv. Delivery and recording of practical training to be discussed with Lab Managers then the H&S Management Committee.

6. Additional Observations/Issues:

- i. Stores Manager relayed important information regarding regular maintenance of pressurised liquid nitrogen vessels on 9/2/11: BOC may soon refuse to fill pressure vessels if we cannot prove that they are subject to regular maintenance carried out by a competent person/organisation. This includes purpose built pressure vessels and smaller tanks adapted with a liquid withdrawal head of any size. LG has emailed all the relevant individuals to ascertain how many LN2 pressure vessels we have and which ones are/are not subject to regular maintenance. The obvious solution would be to get BOC to maintain all LN2 pressure vessels. LG to compile inventory and hand over to Stores Manager who will discuss further with BOC and obtain a quote for consideration by the Research School Services Manager and College Secretary.

- ii. The pressure relief valve on the new CSI Cryodepository tank makes an extremely loud noise when venting, to the point where it is painful on the ears. There is also a constant LN2 gas leak at the point where the hose for this tank joins the main supply line. These issues have been reported to the Stores Manager and Research School Services Manager for action.
- iii. A worker in the EM lab mentioned in passing that the oxygen depletion monitor in 1.45b alarms frequently and “has never worked”. LG checked the monitor and found it to be functioning as expected, as it was after the sensor and battery were replaced at the end of 2009. This suggests that the monitor is not faulty but alarming in response to O2 levels falling to $\leq 19\%$ during certain procedures. This, in turn, suggests that the current ventilation system may not be adequate. EM Facility Manager to liaise with CLS H&S and carry out further investigation.

Appendix

Photo 1



Photo 2



Photo 3



Photo 4

School of Life Sciences

Health & Safety Training Record

Name of Trainee: _____

Name of Trainer: _____

Title of Procedure: _____

Details of H&S training given (Continue on separate sheet if necessary):

Date of Final Completion: _____

Signature of Trainee: _____

Signature of Trainer: _____

Health & Safety Training Record, Version 1, 10/3/03

Photo 5

