CLEAPSS BULLETIN 133

For technicians and teachers of Science and Design & Technology **Autumn 2008**

CLEAPSS *Supporting practical science & technology - in schools & colleges*

Circulation list: Science and D & T				

Happy New Year!

Welcome to the start of the 2008-9 academic year! It looks like being a busy one with the introduction of new and updated courses at post-16 and KS3. Don't forget that CLEAPSS has lots of information on teaching students about risk - take a look at the *Student Safety Sheets* on the CLEAPSS *Science Publications CD -ROM*. CLEAPSS has also been busy this summer – this bulletin includes just a few of the things we think you need to know about. Look on our website for more details and updates.

HSE at the 2008 CLEAPSS Safety Conference

One of the main speakers at this year's Safety Conference for Local Authority officers was Lorraine Shepherd of the Health and Work Division of the HSE. Lorraine spoke authoritatively on the subject of *sensible* risk management, which is currently a particular focus for the HSE. Among the points that Lorraine made were:

- Children need risk in their lives. If we don't provide it they will go out and find it.
- Children should not avoid risk.
- Properly managed science experiments do not pose significant risks to children.
- Health & safety is about saving lives and stopping people from becoming injured or sick at work.
- Don't concentrate on trivial risks. Health & Safety law does not require action for trivial risks (see the Management Regs ACOP para 13 (a) – *insignificant risks can usually be ignored as can risk arising from routine activities associated with life in general*).
- Generic risk assessment has to be adopted and adapted to suit local circumstances.

These are all points that we support and which form the basis of our work with schools. A main message remains much as it did the last time an HSE officer spoke at our conference. Because it is well managed, school science is safe (so too is school design & technology). The use of generic (or model) risk assessments, modified to meet local circumstances, involves teachers and technicians in thinking how best to prepare for practical work and to teach pupils safely and effectively. Risks are ever present in all of our lives. In schools, by focusing on *real* risks and not those which are routine or trivial, staff can concentrate on helping pupils learn and not be diverted into unnecessary paperwork.

And so say all of us!

School science accommodation - guidelines for excellence!

Concerns remain about the quality of some of the building and refurbishment work of school science departments taking place as part of the *Building Schools for the Future* programme. CLEAPSS has worked with the Royal Society of Chemistry (RSC) to produce a charter of key principles to inform managers in school science departments and encourage school heads, governors and others to provide, and insist on, high quality science accommodation. The charter can be found at **www.rsc.org/AboutUs/News/PressReleases/2008/LabGuidelines.asp**

Managing Ionising Radiations Update

Please ensure that the person in charge of your science department's radioactive materials is aware of this news item.

CLEAPSS guide **L93** *Managing Ionising Radiations and Radioactive Substances* has been revised. The revision was funded by the DCSF and the guide is now publicly available (see below).

A significant reason for the update is that changes in legislation over the summer mean that the Department for Children, Schools and Families (DCSF) is relinquishing its long-standing role of issuing approval letters to individual schools for the acquisition and use of radioactive materials.

Schools must still comply with appropriate environmental and health and safety legislation. In particular, the *Ionising Radiations Regulations* 1999, which require the employer to consult, and usually appoint, a Radiation Protection Adviser (RPA). The DCSF has asked CLEAPSS to be proactive in ensuring schools' employers are aware of this continuing legal requirement and, where necessary, to offer employers appropriate help to find a qualified RPA.

Other changes in the guide include:

- The renaming of the science department's Radiation Protection Supervisor (RPS) to *RPS (schools)*.
- The renaming of Local Rules to *Standard operating procedures (and contingency plans)* when using radioactive sources.
- A change of the DCSF Category C holding to a slightly more flexible *Standard School Holding* of radioactive materials.
- Additional information on suitable instrumentation for carrying out leak tests and contamination checks.
- Model risk assessments for a wider range of radioactive sources.

DCSF guidelines on school use of radioactive materials can be accessed at **www.teachernet.gov.uk/wholeschool/healthandsafety/other/radioactive/**. To access the 2008 edition of guide **L93**, go to **www.cleapss.org.uk/download/L93.pdf**

REACH - a brief update

You may remember in *Bulletin* 132 we told about the new EU regulation relating to chemicals called REACH. Just to let you know that we are continuing to work on your behalf and that we have recently taken part in one of the first consultation processes about specific chemicals. We'll keep you posted!

Inside this issue

The Nital Incident

A college has been fined £14,000 after it failed to ensure adequate training and supervision of a welding lecturer who suffered severe acid burns to the arms and face when nitric(V) acid suddenly gushed out of the bottle as he was preparing to make nital. The lecturer required two separate skin grafts and an operation on his right hand.

The HSE found that the college had not provided the lecturer with adequate training to prepare this reagent. In court, criticism was made of *"the lack of line management"* leading to the incident and the *"lack of control over the purchase, storage and use of dangerous chemicals"*.

Nital is a solution of concentrated (~70% w/w) nitric(V) acid in ethanol. It is used for the routine etching of steels and to reveal the microstructure of welds. Many recipes suggest using a 15% solution of nitric(V) acid in ethanol. CLEAPSS advises that, for educational purposes, a 2% solution of the acid in ethanol is suitable.

The cause of this incident will probably never be known. The lecturer had made the solution before. He was making a fresh batch, wearing gloves but no eye protection. When he opened the 3-year old bottle of nitric(V) acid, he noticed a ripple effect on the surface. At that moment, as he stooped to read the instructions to see if this was supposed to happen, the sudden eruption of acid occurred. He was lucky not to lose his eyesight.

Urgent action for colleges and schools

- Immediate inspection to check if nital solution is present in D&T, welding and engineering departments. If so, what is the concentration?
- Any existing stored nital solutions should be disposed of immediately by adding slowly to a bucket of water. Sodium carbonate (washing soda) can then be added neutralise the acid. The treated solution can then be poured down the foul water drain.
- The use of any nital solution over 2% should be challenged. A 2% solution appears to be adequate, even though it may take longer to etch the weld.
- An assessment of the expertise of staff in preparing and using this hazardous solution should take place.
- A minimum volume of a 2% nital solution should be prepared just before use. The bottle should be labelled HIGHLY FLAMMABLE and IRRITANT. It is better if the preparation is carried out in the science department who will have fume cupboards and suitable PPE. Once used, the solution should be disposed of (see above).
- Concentrated nitric(V) acid should be stored in a locked cupboard or secure chemical store (ideally in the science department).
- Industrial denatured alcohol (ethanol) should be stored in a secure flammables cabinet.

Flammables cabinets

CLEAPSS recently came across some new, and quite expensive, flammables cabinets being imported from Germany for sale to schools in the UK.

The cabinets certainly appear to be effective and well-built but we believe they are of a higher specification than is really needed. In addition, the cost (from £1250 for an under-bench cabinets to £1850 for a taller, wider version) is more than many departments could realistically afford. Indeed, buying flammable cabinets at this price might actually limit the quantity of chemicals that can be purchased to be stored in the cabinet!

Also of concern is the accompanying advertising literature. This suggests that there have been *"major changes on internal solvent storage"*. This is not true, at least not in the recent past. Despite the advertising material suggesting otherwise, the traditional metal flammables cupboard continues to meet required construction standards. In addition, the HSE suggests that *"where standards go beyond minimum performance requirements of UK health and safety legislation, it is to be emphasised that their implementation in the UK is not a legal requirement"*.

As always, buy the best equipment you can afford but know what you are buying and why, and be cautious about advertising claims.

Problems with silicon tetrachloride

We have received reports of a number of incidents with this chemical although, fortunately, no serious injuries have occurred. Silicon tetrachloride is a volatile liquid (bpt 58 °C) that reacts with water to produce hydrogen chloride gas and silicon(IV) oxide. During storage, the oxide effectively cements the stopper to the bottle and there is an increase in pressure inside the bottle.

Occasionally, the bottles explode - often on return to school in September after a hot summer. When trying to force open a bottle (on one particular occasion a technology technician used a wrench to remove the bottle top!), teachers and technicians have been showered in the liquid that gushes out.

CLEAPSS advice is that if the bottle top does not *freely* unscrew, then **DO NOT** attempt to open it. Instead, carefully place the bottle in another container (even a strong plastic bag) with soda lime and have it removed by an authorised waste contractor.

If you do have any bottles in your store at the moment, the senior chemistry teacher and the technician should check them. Wear a face shield and chemical resistant gloves and work in a fume cupboard with the sash down when attempting to open the bottle! Refer to CLEAPSS *Hazcard* 86 for more information.

Silicon tetrachloride is used, for example, to demonstrate the change in properties of the chlorides of the elements in Period 3.

Since teachers will use only a small amount of silicon tetrachloride each year, a 100 cm^3 bottle could potentially last for 15 to 20 years. The problem is that many bottle tops seize up after just a few years, so it would be more sensible to prepare small volumes of the liquid *in situ* as and when it is needed.

One preparation method is described in the first edition (1970) of the *Nuffield Advanced Science: Chemistry* book. The preparation is quite lengthy and complicated and must be carried out in a fume cupboard. CLEAPSS can provide further information on request.

Remember, remember …

This is the time of year when we receive lots of calls to the ***Helpline*** about fireworks. Teachers and technicians ask if they can set off firework rockets, make and demonstrate gunpowder or other 'explosive' mixtures and if pupils can make 'home-made' sparklers. CLEAPSS would urge caution and we have produced a new guidance leaflet, **PS81** *Fireworks and explosives*. This document sets out the legal and ethical issues involved as well as providing information and ideas for some exciting practical activities that *can* be carried out in school science laboratories.

PS81 is available on the CLEAPSS website. In addition, the following websites also provide helpful guidance about firework safety:

www.hse.gov.uk/explosives/fireworks/
www.berr.gov.uk/fireworks/index.htm
www.fireworksafety.co.uk

The *Art of Practical Science* and other news about CLEAPSS courses

The very first CLEAPSS summer residential course took place in July and proved to be a great success. The delegates spent three days getting 'hands-on' experience of a wide range of experiments and practical techniques - including eyeball dissection, handling radioactives, chromatography, working with gases and a brief, but enthralling session on glassworking! Here are just a few of the quotes.

"...the course has been very useful and very enjoyable."

"...I needed to be shown some experiments to gain the confidence ..."

" ...now need to practice but am confident I now have the knowledge of what to do."

CLEAPSS is very grateful to Scientific & Chemical Supplies Ltd (and especially to Hilary Cable) for their support for this event and thanks must also go to Data Harvest for the evening datalogging session.

We have been updating some of our courses and you'll notice that some of the titles will change. First Chemical Handling will become *Chemical Safety for Technicians* whilst Second Chemical Handling becomes *Practical Skills and Techniques in Chemistry.*

Tips for Technicians

Demonstrating digestion

Here's an interesting variation on a well-known experiment to demonstrate how the gut allows digested food to be absorbed but not undigested food.

1% solutions of each of starch, glucose, casein and glycine are made up and then mixed together. Some of this mixture is then pipetted (or syringed) into a length of Visking tubing that has been soaked in water, to make it flexible, and knotted at one end. The open end is then knotted and the 'sausage' is suspended in a beaker of distilled water and left for about 1 hour.

Samples of the solutions are then taken from (a) the Visking tubing and (b) the water surrounding the tubing in the beaker. The samples are tested for the presence of starch (with iodine), glucose (using Benedict's reagent), protein (Biuret reagent) and amino acid (using a 0.1% ninhydrin solution with warming). Positive results are, of course, found for all four substances in the 'food' mixture in the Visking tubing but only the presence of glucose and amino acid can be detected in the solution in the beaker. A little patience is needed for the blue colour of ninhydrin to develop.

Making a pH indicator

This is an interesting twist on another old favourite - making pH indicator using root vegetable crisps instead of the raw vegetable. The pigment from beetroot crisps can easily be extracted by placing a couple of crisps into a small beaker and adding a little hot water from a kettle. After a few minutes the coloured liquid can be poured off leaving the crisps behind. The indicator solution is red in dilute acid and turns yellow in alkali. The colour change is reversible. This method is quicker and less messy than the raw vegetable method and a small packet contains sufficient crisps for several experiments. Your pupils could investigate the pigments that can be extracted from other root vegetable crisps (e.g. carrot) too.

Chemical stocklists

Don't waste time or money producing or buying your own stocklist. CLEAPSS e-document **L233** *Chemicals stocklist* is ideal for helping you sort out your chemical store. The stocklist is available in various formats, all customisable, but the most useful is probably the Excel spreadsheet. Take a look at the CD-ROM and get organised!

Making equipment - any ideas?

We get lots of ideas sent in (e.g. for the 'Tips' box) for equipment that technicians can make themselves to save science departments' precious funds! CLEAPSS has decided that we should collect all the ideas together in a new guide. So ...we would like to invite technicians to send us information about any item of equipment they have made themselves for the science department or prep room.

Please send your ideas, along with digital photographs, diagrams, information on where to buy items and construction instructions, to Chris.Peel@cleapss.org.uk. Please remember to include *your* name as well as the name and address of your school. For any ideas that are included in the new guide we'll send you a gift voucher.

Pin spanners for microscope maintenance

The pin spanners required to dismantle some coarse focus microscope mechanisms as described in the *Laboratory Handbook* (and the *Microscope Maintenance* course) are no longer available.

Farnell supply an alternative with a different catalogue number which is 137-9083. The description is "adjustable pin face spanner 7-40 mm with 2 mm pins". The pin spanners can be found on the Farnell website by entering the code 1379083 into the 'Product Search' box. Don't forget you will need *two* pin spanners.

Contact details for Farnell in the UK are: Farnell, Canal Road, Leeds LS12 2TU. Tel: 08447 11 11 11. Website: **www.farnell.co.uk**

CLEAPSS Courses

Details of CLEAPSS courses, up to the February half-term 2009, are listed below. Courses marked with an asterisk* are *primarily* aimed at teachers.

Courses are open to anyone willing to travel. Contact us (ask for Alison or Caroline) for an application form or for information on how to book a place.

***For more detailed and up-to-date information about courses please check our website**. Information is also given on the website about the items participants may need to bring with them. **If courses of interest are not being held in your area, please contact us - we may be able to organise something**.*

Course	September	October	November	December / January	February
Basic Chemical & General Skills	London	Brentwood	Gloucestershire	London	Southampton
Basic Physics Skills		Brentwood	London		Keele, Southampton
Making Simple Science Equipment			Bristol	Salford	Wirral
Microscope Maintenance	Ormskirk	Southampton			
Running a Prep Room	Chester	Southampton	London, Dorset	Leicester	
Working with Glass		Dorset, Birkenhead	Southampton	Durham	Gloucestershire
Chemical Handling I (see p2)		London	Southampton, Telford, Surrey	Leicester, Keele, London	Bristol
Chemical Handling II (see p2)		London, Warwick, Bristol	Ipswich		
Fume Cupboard Monitoring			CLEAPSS		Devon
Biology Safety			London		
Microbiology	London	Bristol	Southampton		London
Physics Training	London		Southampton		
Electrical Inspection & Testing	Hertfordshire (2), Southend		Eastbourne	Sheffield, Leicester, Birmingham	
*Radiation Protection Supervisors	Wirral	Kent, Oxfordshire		Leicester, Bolton	
Health & Safety (Technicians)	Pembroke, Essex, London	Norwich, Southampton	Truro	Essex, Birmingham, Keele, London	Lincoln
*Health & Safety (Teachers)	Barking, Barnet	Wigan			
*Health & Safety Management	London	Norwich	Essex, London	Keele, Staffs	
*Safe-Exciting Classrm Chemistry		Southampton	Sheffield		Bristol
*Surely it's banned[A]/Micro Chemistry[B]			Wirral[A+B]	Southampton[B], Sheffield[B]	Devon[A], Keele[B]
ASE 2009 Annual Conference				**Reading**	
The D&T Technician					
D&T Workshop Maintenance					
*H & S Management in D&T		Norwich			