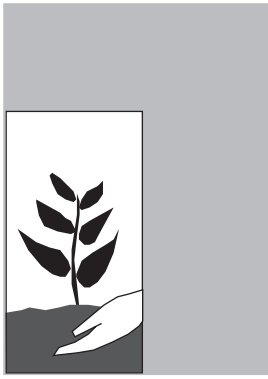
Managing health and safety in science departments

Peter Borrows



Developing a health and safety policy, using it to help define training needs and then monitoring its implementation are key to successful management of safety in science departments

Heads of department are required to manage their departments. Managing health and safety is a part of this task. Unlike most management tasks, however, health and safety operates in a tight legal framework and there can be very serious penalties if, unusually, anything goes wrong.

Any discussion of health and safety in a school science context leads rapidly to a discussion about the health and safety of pupils. However, in British law the principle obligation is towards staff – the legislation is the Health and Safety at Work Act and its main purpose is the protection of those at work, that is employees. Once you adjust the figures to allow for different reporting requirements for accidents to employees and others (i.e. pupils), there are almost as many serious accidents to school staff (all staff – teachers, technicians, cleaners, cooks, etc.) as to pupils. Given that there are far more pupils than staff in most schools, the accident rate to staff is worryingly high. The statistics do not allow us to work out how many involve science teachers or technicians but anecdotal evidence suggests that very few do. Even so, heads of department need to think as much about the safety of technicians and teachers as about that of pupils.

ABSTRACT
Based on the author's experience of running courses for teachers and technicians, this article discusses strategies for managing health and safety within science departments. The importance of risk assessment for both pupil activities and those carried out by technicians is emphasised, as is the need for guidance on the conduct of practical work by both teachers and pupils. The value of departmental health and safety policies and the importance of monitoring the implementation of such policies is discussed. The role of training is stressed as is the need for security.

Risk assessment

One of the key strategies in health and safety legislation is the concept of risk assessment (see, for example, Tawney, 1992). 'Risk assessment' is used in two distinct ways, to signify:

- a thinking process;
- the written outcome of that process.

An important aspect of managing health and safety is making sure that all the relevant hazards are identified, the risks from them assessed and, if necessary, controlled and the 'significant findings' suitably recorded. Risk assessment in many schools tends to focus on the curriculum – the risks faced by pupils. However, it is very important not to ignore the risks faced by teachers and technicians. Over 40% of the accidents to staff in schools involve manual handling injuries and manual handling is a major part of the job of most technicians. They carry chemicals, equipment and piles of books through heavy fire doors, along crowded corridors, up and down stairs, across bumpy playgrounds and into bag-strewn teaching laboratories.

The first step in risk assessment involves identifying the hazard, that is anything with the potential to cause harm. Hazards include some chemicals, electricity delivering high currents or the act of carrying a heavy tray upstairs or over uneven ground. The second step is to assess the risk from that hazard by asking the following questions:

- How likely is it that harm will actually be caused?
- What is the chance of something going wrong?
- How serious would any injury be?
- How many people could be affected?

Finally, it is necessary to decide on appropriate control measures to reduce the risk. In the case of chemicals, the risk may be reduced by using a dilute solution rather than a concentrated one, by handling a lumpy solid rather than a fine powder or by using a fume cupboard. Risks of electric shock are reduced by designing equipment in such a way that it is impossible to touch any conductor which is live at a potential above about 40 V. The risks from transporting heavy items around the school may be reduced by having duplicate sets, by avoiding times when corridors are crowded with pupils and by using trolleys and hoists.

In practice, for most likely science activities, schools do not need to go through the whole procedure: it has been done for them already. Most education employers have adopted some or all of the texts listed at the end of this article as the basis for model (or general) risk assessments. The science department then needs to consult such texts and consider whether any modification is necessary for the special circumstances of its own pupils and teachers. A school with a number of teachers from overseas, who have little experience of practical work, might well decide that an activity normally regarded as acceptable would be unsafe in their context. An activity where it is important not to use more than 1 g of chemical might be safe when carried out by a higher-attaining set of pupils, but the school might decide to issue pre-weighed quantities to a lower-attaining set.

Such decisions need to be recorded. There is little point in making this record on a risk assessment form, which will remain, unread, in a filing cabinet until the next visit of Ofsted. Most schools these days have a detailed scheme of work, either their own or a commercially-produced scheme. This is the document that teachers will use to plan the next day's lessons. This is the place where the 'significant findings of risk assessment' should be recorded. There needs to be some degree of judgement as to what is recorded. It is not helpful to obscure vital information in a mass of trivia, although what is trivial when teaching A-level students may be very significant when teaching younger pupils. In the latter case, it may well be necessary to put comments such as '*Remind the class how to heat a test-tube of liquid safely*'. The Health and Safety Executive (HSE) has made it clear that comments such as 'See *Hazcard 91*' are not sufficient. After all, teachers are unlikely to take *Hazcards* home with them to plan the lesson. A few key points need to be extracted, interpreted, perhaps adapted and written down, for example: '*1 M sodium hydroxide is corrosive. Insist on eye protection throughout, including setting up and clearing away. Do not issue teat pipettes to those classes where there are behaviour problems*.'

Risk assessment is sometimes seen as limiting what teachers can do but it can be empowering. In the 1980s, many LEAs banned cheek-cell sampling as an activity in their schools. However, when risk assessment became well-established, first through the COSHH Regulations 1988 and later the Management of Health and Safety at Work Regulations 1992, most LEAs rescinded their bans, allowing cheek-cell sampling if a suitable risk assessment is carried out. There are safe procedures but these are only safe if teachers and pupils implement them. The risk assessment, therefore, has to determine the extent to which teachers can be trusted to know and understand the procedures and pupils can reasonably be trusted to implement them. Schools with a large turnover of staff, or teachers in charge of classes with seriously disturbed pupils, might well decide that cheek-cell sampling is inappropriate. On the other hand, many schools would feel they could implement the procedures safely and they are no longer penalised by a blanket ban.

It is always important to consider the staff and pupils involved. When extracting chlorophyll prior to testing leaves for starch, an experienced teacher may well be able to insist that pupils turn off their Bunsen burners before ethanol is issued to the class and understand the reasons for doing so. The less-experienced newcomer, however, may have neither the understanding nor the class control. The experienced teacher – and thus the scheme of work – should set a good example by specifying hot water from a kettle or water bath, thus avoiding the need for Bunsen burners.

Technicians should be involved in thinking through the activities they carry out in the prep room and the hazards and risks involved. Again, the outcomes should be recorded. Examples might include the following:

- Technicians must not carry out hazardous work (e.g. diluting concentrated acids) when they are alone.

- Trolleys are to be used for moving equipment whenever practicable.
- Equipment and chemicals must not be moved through corridors crowded with children.
- If fire doors are held open to allow the safe transport of chemicals and equipment, the wedge/hook must be removed as soon as practicable afterwards.
- Before preparing solutions, check the relevant CLEAPSS *Recipe card(s)* or *Hazcard(s).*
- Step-ladders must be used when reaching objects on high shelves.
- When washing up test-tubes, etc., which may be contaminated with hazardous and/or fuming chemicals, wear protective gloves and eye protection. Consider using a fume cupboard, especially where the contents are uncertain.

Departmental health and safety policies

Whether or not your employer requires one, it is in the best interests of a head of department to have a science department health and safety policy: it is a useful management tool. Such a policy is the department's way of saying this is how we organise ourselves for health and safety. In effect, it summarises the decisions made over time and, by its organisation, prompts decisions to be made in areas where the position is unclear. A policy might cover such topics as:

- how health and safety lines of communication work;
- procedures for risk assessment;
- procedures for dealing with various possible emergencies (chemical and microbiological spills, fires, etc.);
- the agreed view on security and locking laboratories;
- general guidelines for teachers and pupils carrying out practical work;
- how new and/or inexperienced staff are supervised;
- what training will be provided by whom, for whom and when;
- what safety checks will be carried out (e.g. on fume cupboards or radioactive sources), by whom and when;
- routines for technicians moving items around the department without risk of injury to themselves and others;
- how implementation of the policy is to be monitored and its success reviewed;
- generally, who does what, when and how.

The reasons for suggesting some of the above items are developed further in this article. ASE INSET Services, CLEAPSS and SSERC all offer courses for heads of department on managing safety, the culmination of which is the development of, and discussion about the content of, a health and safety policy.

It is important to involve the department in the development of any such policy so that the staff – teachers and technicians – have some ownership of and commitment to it. I find that, on our courses, the proportion of technicians who state that their school has a departmental health and safety policy is always smaller than the proportion of heads of department who do so. At the least this suggests a serious communication failure and an ineffective policy. How can staff implement a policy of which they are unaware? The proportion of newly qualified teachers who are aware of the existence of a departmental policy, let alone its content, is even smaller. Yet surely that should be a vital part of the induction of new staff?

Health and safety training

Once a policy is in place, it becomes easier to define who needs what training. If the policy states that the department uses CLEAPSS *Hazcards* and similar publications as model risk assessments, do teachers and technicians really understand the significance of this? A useful resource for all science department health and safety training is the ASE INSET Pack, *Safe and exciting science* (1999).

On the whole, schools are not very good at the (health and safety) induction of new staff, although this is a requirement of the Management of Health and Safety at Work Regulations 1999. Although there are no statistics, there is some anecdotal evidence to suggest that a significant proportion of accidents involve new staff in their first few months in the job. Consider a new young teacher. Until faced with a year 11 class, has she/he ever dropped sodium into water? Until encouraged by the class, has she/he ever considered how large a piece of sodium may safely be dropped into water? *Safeguards in the school laboratory* (ASE, 1996) is brief enough to be read

from cover to cover by all new staff and will alert them to likely problems.

There needs to be a system that identifies the hazardous activities and then flags them up to ensure that those involved receive adequate training before carrying out the activity. Strategies for doing this might include:

- a note in the scheme of work – '*Only to be carried out by those on the approved list*';
- labels on bottles or equipment – '*Only to be issued to staff who have had the relevant training*';
- a comment in the technicians' notes – '*Check with the head of department before supplying this experiment*'.

To prevent lessons being forgotten, any such training is probably better provided on a drip-feed, need-to-know basis, rather than as one big bang at the beginning.

Guidelines for practical work

Most schools have laboratory rules for pupils. These often have an emphasis on discipline matters, for example:

- the stupidity of horseplay in the laboratory;
- the dangers of unauthorised experiments;
- the risks of stealing chemicals.

Sometimes it can be effective for such rules to be agreed by negotiation with the pupils themselves.

Although most pupils accept that schools need to have such rules about discipline (even if they don't obey them!), they often don't see that there needs to be guidance on the safe conduct of practical work. In effect, pupils are too trusting. They do not believe that teachers would suggest carrying out activities that might be really dangerous. However, the way in which pupils carry out their practical work does have an impact on their health and safety and perhaps schools would be better advised to drop the term 'rules' and instead call it 'Practical guidance for pupils' health and safety'. Such guidance might include:

- wear eye protection whenever the risk assessment requires it;
- eye protection worn on the forehead does not protect the eyes;
- stand up when carrying out practical work involving reacting chemicals or heating substances;
- tie or pin back long hair, ties and scarves.

It would probably be even more counter-productive to suggest safety 'rules' for teachers. Nevertheless, there does need to be guidance for teachers on carrying out practical work. This might include, for example:

- cluttered floors lead to accidents;
- demonstrations should be conducted with pupils at least two metres away;
- if the risk assessment requires safety screens, these should be sufficient in number and of a suitable design to protect both the pupils and the teacher/demonstrator;
- if the risk assessment requires eye protection to be worn, this must be worn by teachers, pupils and any visitors to the classroom;
- do not turn a 'blind eye' to pupils not wearing eye protection;
- do not deviate from the agreed scheme of work without consulting your employer's risk assessments and colleagues.

Any scheme of work, as part of its development, should have gone through a risk assessment procedure. Often, this will have involved consulting the model risk assessments listed at the end of this article. If it is a commercially published scheme the publisher may have had a safety check carried out. ASE, CLEAPSS and SSERC have jointly produced guidance for publishers (2001). However, it is unwise for schools to assume all procedures suggested in commercial material are safe: there might not have been a check; there may have been changes after the reader saw the draft or comments might have been misinterpreted or ignored.

It is very tempting for the more creative teachers to deviate from the agreed scheme of work. This can be welcome, but only if the substitute work undergoes rigorous risk assessment. We heard recently of a school where the scheme of work involved comparing different solid fuels – paper, wood, coal, etc. As the class made good progress, the teacher decided to add some further fuels of his own, including paraffin and ethanol. The inevitable happened. A pupil poured some ethanol into a still-hot tin lid (possibly containing smouldering paper). It ignited, producing a sheet of flame, and the teacher suffered first-degree burns to his face. It had been a spur-of-the-moment decision to use ethanol. Any risk assessment would have identified the likely problems with a highly

flammable liquid in open vessels near naked flames. There should be an absolute ban on novel activities until the employer's model risk assessments have been consulted and the proposals discussed with colleagues.

Fortunately, such accidents are very rare. However, most of the small number of serious accidents that occur, do so during teacher demonstrations. That should not be too surprising: teachers will naturally demonstrate the more hazardous experiments. However, when doing so, they may not give their full attention to something that they know to be dangerous; perhaps they are concerned about pupils chatting in the back row, or they are rushing to set homework and finish before the bell goes. Whatever the reason, there should be a safe distance between pupils and the experiment, as they will be unable to jump out of the way if they are all crowded together.

Security

There have been many reported cases of pupils stealing items, usually chemicals, from schools and then injuring themselves and others as a result. In such cases, some schools might be in a very weak position. Although it might seem common sense to say that if pupils steal something and are then injured it is their own fault, this is not how British law sees it. Under the Health and Safety at Work Act, there is a general duty of care. Science departments with lax security may be in breach of that duty and could be prosecuted. Parents would also have a good case if they sued for damages in the civil courts.

The Management of Health and Safety at Work Regulations 1999 refer to danger areas. Although they do not refer to schools or laboratories, it would be my interpretation that most laboratories in most schools would have to be classed as danger areas. There may be equipment awaiting collection or ready for the next lesson, or that pool of water the pupils are flicking at each other might actually be sulphuric acid. If school laboratories are danger areas, it follows automatically that access must be restricted to those with suitable training. This certainly means that pupils should never be allowed unsupervised in such rooms. Even supervision by non-scientists is open to question, although it might be possible to provide brief training for cover teachers. For example, they might be given a laminated sheet with a few rules on it, such as:

- Never leave the class unsupervised in the laboratory.
- Make sure the door is locked at the end of the lesson.
- Don't let pupils fiddle with the gas taps.
- Don't let pupils interfere with the chemicals or equipment on the side benches.

Monitoring

There is no point in having a health and safety policy if nobody implements it. Indeed, following an accident, one school was prosecuted because, although there was a perfectly adequate (whole-school) policy on paper, in practice nobody was implementing it – and nobody was checking whether anybody was implementing it. An important part of the head of department's role is to monitor what is happening on health and safety and the departmental policy is a useful yardstick by which to judge implementation. Monitoring is not easy, given the workload of most heads of department. Strategies that have been successfully used include the following.

- Regular discussion of health and safety at departmental meetings.
- Observing lessons, in whole or in part, formally or informally ('Just popped in to pick up a book').
- Talking to pupils and technicians and, of course, teachers.
- Checking paperwork – requisition sheets, records of radioactive source use, portable electrical appliance test sheets, etc.
- Hanging a 'Hazard Book' in the prep room and encouraging all teachers and technicians to make entries, whether it is about a cracked electrical socket, a near-miss in the prep room or the unsafe behaviour of a particular pupil. The head of department can write comments about action taken next to each entry or the entries can be discussed at departmental meetings.

If monitoring reveals that the policy is not being fully implemented, it is important for the head of department to take action. Turning a blind eye to known problems is tantamount to condoning the transgression and perhaps conniving at a breach of the law. Some problems will be beyond the powers of the head of department to deal with. Under the Health and Safety at Work Act, there is a duty on employees to inform their employer of unsafe situations, whether this is a broken fume cupboard or pupils who are so disturbed

that they cannot be trusted in a laboratory. Usually, such reports will go to the head of department's line manager, perhaps the headteacher. It would be prudent for this to be in writing, with a copy kept.

Conclusions

Reading this article is not a substitute for attending a training course on the management of health and safety. It does not cover all possible issues. For example, there is no discussion about what procedures should be in place to deal with various emergencies. There are a number of bulleted lists. The items are examples only, none of the lists is complete. But discussion within departmental meetings (and involving both teachers and technicians) will expand the lists and lead to a developing and shared understanding of health and safety. That must be the aim of effective management of health and safety.

Acknowledgements

Thanks are due to the many teachers and technicians on courses that I have run, whose discussions, comments and questions have contributed much to my understanding of the management of health and safety in school science departments.

References

ASE (1999) *Safe and exciting science: a pack of training activities on health and safety for science departments in secondary schools and colleges and for initial teacher training*. Hatfield: ASE.

ASE, CLEAPSS, SSERC (2001) *Health and safety checks on science texts: guidance for publishers, authors and readers*. Hatfield/Uxbridge/Edinburgh: ASE/CLEAPSS/SSERC.

Tawney, D. (1992) Assessment of risk and school science. *School Science Review*, **74**(267), 7–14. Also included in ASE (2000) *Safety reprints*. Hatfield: ASE.

Sources of advice and publications

ASE (Association for Science Education), College Lane, Hatfield, Herts AL10 9AA; tel 01707 283000; fax 01707 266532; e-mail info@ase.org.uk; website www.ase.org.uk.

CLEAPSS School Science Service, Brunel University, Uxbridge, UB8 3PH; tel 01895 251496; fax 01895 814372; e-mail science@cleapss.org.uk; website www.cleapss.org.uk.

SSERC, St Mary's Building, 23 Holyrood Road, Edinburgh EH8 8AE; tel 0131 558 8180; fax 0131 558 8191; e-mail sts@sserc.org.uk; website www.sserc.org.uk.

Texts commonly used as model (general) risk assessments

ASE (2001) *Topics in safety*. 3rd edn. Hatfield: ASE.

ASE (1996) *Safeguards in the school laboratory*. 10th edn. Hatfield: ASE.

CLEAPSS (1995, or 1998/2000 updates) *Hazcards*. Uxbridge: CLEAPSS.

CLEAPSS (1999) *Recipe cards*. Uxbridge: CLEAPSS.

CLEAPSS (1999) *Shorter handbook*. Uxbridge: CLEAPSS.

CLEAPSS (2001) *Laboratory handbook.* Uxbridge: CLEAPSS (or CD-ROM).

DfEE (1996) *Safety in science education.* London: HMSO.

SSERC (2002) *Hazardous chemicals,: an interactive manual*, *CD2*. Edinburgh: SSERC.

Peter Borrows is Director of the CLEAPSS School Science Service and was Chair for 21 years (and is still a member!) of the ASE's Safeguards in Science Committee. He was a teacher for over 20 years, including 10 years as head of science in a large inner London comprehensive school. He was also a science adviser for 10 years before moving to his present post.