



Safe Science: Be Protected!

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SCIENCE TEACHER SAFETY TRAINING!

I. Why Should Safety Training Be Required for Science Teachers?

Science education is a changing landscape! Changes over the past ten years alone have been both evolutionary and revolutionary – Science Education Standards, new required assessments, science teacher certification issues, science teacher shortages and retirements, molecular approach to Biology, etc. These changes and issues range from curriculum/instruction, professional development, personnel and facilities.

With the advent of increased hands-on science, new facilities and a major turnover in the teaching workforce, laboratory safety is once again in for forefront. Elementary teachers and Science teachers are being asked to increase laboratory work, activities and field opportunities in primary and secondary grade levels. With these changes comes an added professional and legal responsibility. The challenges of this approach to “doing” science are best met by through safety training and enforcement.

From local to national government agencies, expectations have been raised requiring laboratory safety information and training for science teachers, science supervisors/technicians and science paraprofessionals/assistants.

II. What Information Is Required?

In the States, most public school teachers are under the federal or state General Industry Occupational Safety and Health Administration’s (OSHA) safety standard 1910.1450 *Occupational Exposure to Hazardous Chemicals in laboratories* or the laboratory standard. In the few remaining states (Delaware, Georgia, Massachusetts, North Dakota and Texas), most health and safety divisions have similar expectations but do not require a Chemical Hygiene Plan. Federal jurisdiction does cover all private schools on this Standard.

OSHA states that “The employer shall provide employees with information and training to ensure that they are apprised of the hazards of chemicals present in their work area.” The Standard provides both general contents required for adoption and “Appendices” which are noted as “non-mandatory.”

Required General Information for Employees Must Include:

- A. **Contents of the laboratory standard:**
1. Scope and Application;
 2. Definitions;

3. Permissible Exposure Limits -PEL(Exceeding of Exposure Limits);
4. Employee Exposure Determination (Monitoring and Notification);
5. Chemical Hygiene Plan (General components);
6. Employee Information and Training (Providing Information);
7. Medical Consultation and Medical Examinations (Getting Medical Attention);
8. Hazard Identification (Providing Labels and MSDS);
9. Use of Respirators (Maintaining Exposure Below PELs);
10. Recordkeeping (Records Relative to Exposure and Consultations/ Examinations)
11. Effective Dates.

B. "Appendices" of the Laboratory Standard Include:

1. The National Research Council Recommendations concerning Chemical Hygiene In Laboratories – including
 - a. General Principles -
 - i. Minimizing All Chemical Exposures;
 - ii. Avoiding Underestimated Risk;
 - iii. Providing Adequate Ventilation;
 - iv. Instituting a Chemical Hygiene Program;
 - v. Observing PELs and TLVs.
 - b. Responsibilities
 - i. Chief Executive Officer (Superintendent);
 - ii. Supervisor;
 - iii. Chemical Hygiene Officer.
 - c. The Laboratory Facility
 - i. Design;
 - ii. Maintenance;
 - iii. Usage;
 - iv. Ventilation.
 - d. Components of Chemical Hygiene Plan
 - i. Basic Rules and Procedures;
 - ii. Chemical Procurement, Distribution and Storage;
 - iii. Environmental Monitoring;
 - iv. Housekeeping, Maintenance and Inspections.
 - v. Medical program
 - vi. Personal Protective Apparel and Equipment;
 - vii. Records;
 - viii. Signs and Labels;
 - ix. Spills and Accidents;
 - x. Training and Information;
 - xi. Waste disposal.
 - e. General Procedures for Working with Chemicals
 - i. General Rules for All Laboratory Work with Chemicals;
 - ii. Allergens and Embryotoxins;
 - iii. Chemicals of Moderate Chronic or High Acute Toxicity;
 - iv. Chemicals of High Chronic Toxicity;
 - v. Animal Work with Chemicals of High Chronic Toxicity.

- f. Safety Recommendations.
- g. Material Safety Data Sheets.
- 2. General Principles for Work with Laboratory Chemicals;
- 3. Chemical Hygiene Responsibilities;
- 4. The laboratory Facility;
- 5. Components of the Chemical Hygiene Plan;
- 6. Basic Rules and Procedures for Working with Chemicals;
- 7. Safety Recommendations;
- 8. References.
- C. Location and Availability of the Chemical Hygiene Plan;
- D. Permissible Exposure Limits for Applicable Hazardous Chemicals;
- E. Signs and Symptoms Associated with Exposures;
- F. Location and availability of reference materials on hazards, safe handling, storage and disposal of hazardous chemicals used in the lab, including but not limited to Material Safety Data Sheets.

III. **What Training Is Required?**

In addition to providing information and resources, employee training is also required.

Training must include the following items:

- A. Physical and health hazards of hazardous chemicals in the work area;
- B. How employees can protect themselves;
- C. Methods and observations used to detect the presence or release of hazardous chemicals;
- D. Details of the employer's written Chemical Hygiene Plan.

IV. **When Must Employee Information and Training Take Place?**

Information is required upon the time of the employee's initial assignment where hazardous chemicals are present and prior to assignments involving new exposure situations. Refresher information and training is determined by the employer.

However, it must be remembered that OSHA only provides the absolute minimum for information and training. As licensed professionals, teachers and supervisors/technicians are expected to have information and training on a regular basis. Suggestions include a standing monthly department meeting agenda item of safety, safety audits, safety committees, safety instruction notation in daily lesson plans, and more. Should an accident occur, the teacher/supervisor will be required to show a good faith effort relative to safety training and information for other employees and students. With a state teaching license, teachers and supervisors are held to a high professional standard in courts of law.

In addition, although the "Appendices" are considered "non-mandatory," their adoption and use is prudent practice. In both safety and litigation, prudent practice and accepted professional practice. Bottomline is – write and use all aspects of the Standard for a safer work environment!

V. **Final Word**

The purpose of this writing is to provide an example of how one country deals with the growing needs of science teacher training on safety. In the

states, if a teacher's employer is not doing or requiring safety training, it is the responsibility of the teacher/supervisor as an employee to ask for it. It is required, the law and an entitlement for employee protection and a safety working environment for all! All readers should know what their governments expect and require for their professional growth relative to safety training. Safety needs to be job 1!

LIVE LONG AND PROSPER SAFELY!

RESOURCES:

Occupational Safety and Health Administration: <http://www.osha.gov>

Flinn Scientific Inc.: <http://flinnsci.com>

A Response by Peter Borrows

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A Former Chair, ASE Safeguards in Science Committee, Director, CLEAPSS

I was saddened to read the article *Safe Science: Be Protected!* (*Science Education International*, 17 (2), June 2006, 137-140). The whole tone was very negative, very much "Don't trust the teacher to do this!", rather than "You could do this exciting bit of science, if you were careful, like this ...". The entire article is based on US experiences and does not acknowledge the possibility that others might have something to contribute.

The author extols the virtues of Material Safety Data Sheets (MSDS, called Safety Data Sheets in UK legislation) as a source of information on hazardous chemicals. However, these are written without knowing the end-user and paint a worst-case scenario. It may well be sensible to wear a dust mask if you have tons of chemical coming down a chute, but is plainly ludicrous if handling 0.5 g on a spatula. In assessing risks you need to take account not only of the nature of the hazard (TOXIC, CORROSIVE, etc), but also the likelihood of something going wrong in the context in which the hazardous material is being used and the likely seriousness of the consequences in that context. You have to get a sense of proportion. The information on MSDSs needs to be interpreted in the school science context, knowing the likely activities and scale of working. Apparently this is not done in the USA, but it certainly is done in the UK, where the CLEAPSS® *Hazcards*® and other publications¹ are available, on paper or electronically, to almost all schools (or, in Scotland, the SSERC² *Hazardous Chemicals Manual* and *Safetynet*). Whereas Ken Roy suggests, for example, that chemicals such as potassium and sodium should be removed and disposed of, I know that in 97% of schools in the UK³ teachers do

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1. Membership of CLEAPSS, and hence access to its publications, is available to educational establishments overseas. Contact CLEAPSS, Brunel University, Uxbridge, UB8 3PH, UK; tel +44 (0)1895 251496; fax +44 (0)1895 814372; e-mail science@cleapss.org.uk or visit the web site www.cleapss.org.uk.
 2. SSERC, 2 Pitreavie Court, Pitreavie Business Park, Dunfermline, Fife, KY11 8UB, UK; tel +44 (0)1383 626070; fax +44 (0)1383 842793; e-mail sts@sserc.co.uk or visit the web site www.sserc.org.uk.
 3. *Surely That's Banned? A Report for the Royal Society of Chemistry on the Understanding of Schools and Education Authorities of Chemicals and Procedures Thought to be Banned from Use in Schools*, CLEAPSS, 2005. Available at <http://www.rsc.org/Education/Policy/SurelyThatsBanned.asp>.

routinely demonstrate the reaction of potassium with water and do it without attracting the headlines Ken Roy reports.

Experiencing the reactions of the alkali metals with water is an essential part of the science education of young people. It provides a memorable introduction to the periodic table. Sure, you can watch it on videos, but VDUs – and especially video games – are so ubiquitous that nobody believes that what they see there is real any more. The preparations for using alkali metals, putting up safety screens and donning eye protection, carefully cutting a small piece, standing at a safe distance, all contribute to the drama of the situation. The teacher is happy to accede to the requests to “Do it again!” because, with careful questioning, s/he knows that there are many more observations that can be drawn out of this unique activity.

Of course the alkali metals are hazardous. So is eating; you might choke on a fish bone, you may be allergic to a component of the food, you might get food poisoning, you may become obese – but you don’t stop eating. You take care. So it is with the alkali metals. Teachers need information and training. In the UK, the Association for Science Education (ASE)⁴ and its predecessors have given a lead for sixty years. Its Safeguards in Science Committee recently published the 11th edition of *Safeguards in the School Laboratory*. Other ASE publications for secondary schools include *Topics in Safety*, *Safe and Exciting Science*, *Safety Reprints*, and there are training courses on *Safety Management for Heads of Science*, and *Health and Safety for Technicians*.

Science forms about 15% of the curriculum of most secondary-age students in the UK and yet only 2% of the reportable accidents to pupils in schools take place in science and most of these, despite needing to be reported because of a quirk in the law, lead to no injury at all. In fact, only about 0.8% of the significant injuries to pupils in schools occur in science and most of these are minor. Of course this is more than we want, so we need to do better, but this will be by providing high-quality information and good professional development, not by banning exciting activities. Most successful scientists thank a charismatic teacher for awakening their interest in the subject and a part of this includes exciting practical activities. Ken Roy’s defeatist attitude of wrapping children in cotton wool will do little to encourage young people to take up a career in science.

4. Association for Science Education, College Lane, Hatfield, Herts, AL10 9AA, UK; tel +44 (0)1707 283000; fax +44 (0)1707 266532; e-mail info@ase.org.uk or visit the web site www.ase.org.uk.