Chemical Safety Guidance

February 2020

Safe Chemical Practice (SCP)

for the prevention and control of exposure to laboratory chemicals

Occupational Health and Safety Service
HSD019C (rev7)

UNIVERSITY OF CAMBRIDGE

Contents:

Safe Chemical Practice (SCP)

1. Introduction

1.1 Preventing exposure to chemicals in the laboratory can be achieved by using good laboratory technique, sound equipment and also by paying careful attention to personal hygiene. This guidance defines the minimum standard that must be met in order to prevent or control exposure to all chemicals in laboratories. It is not directly aimed at any other situation, but many of the principles would still apply. It should be read in conjunction with the University Safety Policy as well as University Guidance, departmental safety policies and local rules.

1.2 **Chemicals may only be used by individuals with a sufficient level of training and competence and/or with an appropriate level of supervision for the chemicals being used and the tasks being undertaken.**

1.3 The hazards associated with the chemicals and techniques used must be assessed **before** any experimental work is undertaken. The risks to health and safety must be formally assessed in writing and appropriate precautions/controls implemented. Before commencing work, make sure you understand the information and instructions arising from the risk assessment and the implications of any Workplace Exposure Limits (WELs).

1.4 Do not commence any work for which a risk assessment has not been under taken. **If in doubt, ask.**

2. Responsibilities

2.1 Each individual in the laboratory is responsible for his or her own safety and for the safety of others affected by their work.

This includes responsibility for:

- assessing the chemical and process hazards and planning and carrying out the experiment safely
- the safe storage of chemicals used (see Storage Guidance document)
- ensuring all chemicals are entered into the University chemical inventory system
- emergency procedures to be taken in the event of an accident
- the ultimate safe and appropriate disposal of all substances involved
- observing good personal hygiene practices
- observing out of hours working procedures, if applicable

2.2 Overall responsibility for laboratory safety rests with the research and/or laboratory supervisor, Principle Investigator and ultimately, the Head of Department / Institution.

3. General

3.1 Do not attempt to use an unfamiliar experimental technique without having first gained further information, and if necessary, have it demonstrated to you. **If in doubt, ask**.

3.2 Read and observe all container label warnings and follow any precautions indicated.

3.3 Read the Safety Data Sheets (SDSs) for the chemicals being used

3.4 Read and be familiar with the risk assessment for the experiment

3.5 Substitution with safer substances should always be considered – always use the least toxic, least flammable chemical compatible with the procedure.

3.6 The scale of any experimental procedure should be as small as is reasonably practicable. **Scaling-up should not be undertaken without reassessing the risks**.

3.7 Work that requires personal control should never be left unattended.

3.8 Work that is to continue unattended overnight must have an 'out of hours' authorisation displayed in accordance with University guidance and Departmental policies. Emergency instructions should be displayed adjacent to any unattended work.

4. Techniques

4.1 Good housekeeping is vital and is intimately related to safety. Lack of good housekeeping reduces work efficiency and may result in accidents.

Always ensure:

- access to emergency equipment, showers (where provided should be tested weekly), eyewash stations, fire extinguishers, fire exits etc is never blocked or obstructed
- all gangways and exits are kept clear of chemicals, equipment and debris. Bicycles or other spurious items are not permitted in laboratories under any circumstances
- benches and work areas are kept tidy and free of unnecessary substances and equipment and are cleaned as soon as practicable after use
- all contaminated surfaces and equipment are cleaned without delay
- experimental equipment is secured and carefully laid out e.g. no trailing leads
- all chemicals and equipment are placed in their designated storage areas after use. In particular flammable solvent bottles must be returned to their cupboards.
- chemical containers are properly and clearly labelled with their full names.
- labels which are fading, falling off or deteriorating, are promptly replaced, note: the chemical inventory system can print GHS compliant labels.
- chemical containers should also be regularly checked for container integrity, rusty and degraded containers should be replaced in particular UV (sunlight) degrades and embrittles plastic

4.2 Gas flames and compressed gas supplies should be shut off when not in use, on leaving the laboratory and at the end of the day. Flames from items of equipment such as atomic absorption spectrometers should be vented using local exhaust fume hoods.

4.3 Always carry containers of substances correctly. Winchesters should be transported in Winchester carriers which have been checked for integrity prior to use and are capable of containing spillage. All strong acids and alkalis should be carried in secondary containers. The correct handling equipment should be used to transport and manipulate cans and drums. Large bottles must never be held or carried by the neck or cap only.

4.4 Work must be performed cleanly with the minimum of spilling and splashing in order to limit contamination. Suitable dispensing aids must be used and substances handled over spill trays, where appropriate. All spills must be safely cleaned up as soon as possible.

4.5 Inhalation of vapours or skin contact with any hazardous substance is to be avoided. Exposure to gases and vapours should be limited by covering vessels, prompt replacement of caps and stoppers to bottles and by handling of hazardous volatile, gaseous or dusty substances in closed systems, in fume cupboards or under local extraction.

4.6 Puncture wounds should be prevented by the correct use and disposal of sharp instruments. Needles should be stored appropriately when not in use and should not be left lying around. Do not use broken or damaged glassware.

4.7 **Sharps and broken glass must only be disposed of in designated 'sharps bins'**

5. Use of Fume Cupboards

For more detailed information on the use of fume cupboards refer to the University Guidance.

5.1 Check that the fume cupboard is suitable for the purpose, has been tested within the last 14 months and is fully operational prior to using (legal requirements of the COSHH Regulations).

5.2 Work with the sash as low as practicable, wherever possible keep the sash between your face and the work. **The sash must be fully lowered when the fume cupboard is left unattended.**

5.3 Care should be exercised when using equipment / apparatus in a fume cupboard so as not to interrupt the airflow. **A 150 mm 'equipment / work free zone' should be left at the front, immediately behind the sash**. Large equipment should be raised on legs to allow air to pass beneath it. Burners upset air currents and should be avoided. Fume cupboards should not be used for storage of chemicals and equipment. **Never block / reduce the airflow to the gap under the back baffle, this is the principle route of air flow and control.**

5.4 **Fume cupboards must be used for substances that are toxic by inhalation.** e.g. substances allocated the old Risk phrase R23 or the Hazard statement H331 under the UN Globally Harmonised System (GHS).

5.5 All operations that are liable to produce hazardous or obnoxious concentrations of gas or vapours **must** be performed in a fume cupboard.

5.6 Fume cupboards should not be used as disposal routes for toxic, noxious or flammable waste gases or vapours. Where possible, any significant amount of noxious effluent should be removed as part of the experiment, e.g. by scrubbing, chemical absorption, refluxing etc.

5.7 Remember that fume cupboards do not provide total containment. For work that requires total containment such as handling significant amounts of carcinogens, a glove box, glove bag or similar device must be used wherever practicable.

5.8 The glass in the sash is rarely designed as a blast screen. Appropriate precautions, such as blast shields etc should be used where an experiment carries a potential explosion risk.

Handling explosive or energetic substances will require additional precautions!

5.9 The materials used in the construction of the fume cupboard should be compatible with the substances handled. Special consideration must be given to fume cupboards in which hydrofluoric or perchloric acids, or gross quantities (in excess of 2.5 litres) of any acid, are to be used. (see specific guidance on hydrofluoric and perchloric acids).

6. Personal Protection

Using Personal Protective Equipment (laboratory coat, safety glasses and gloves) is not a substitute for other 'engineering' control measures. The purpose of Personal Protective Equipment (PPE) is normally to prevent accidental exposure of an individual to hazardous substances. PPE only protects the wearer; others may be exposed if not also wearing the same level of PPE. It is important to always match the type of PPE and level of protection to the particular substance being used and how it is used i.e. how the risk could arise.

Remember Should PPE fail it always 'fails to danger', potentially exposing the wearer to the hazard.

6.1 Clean, fastened laboratory coats or overalls (**fastened with pop studs, not buttons**) must be worn in laboratories where hazardous substances are being used. Wherever possible they should be of a 'high cotton' material (65% minimum cotton and 35% maximum polyester), thereby providing a reasonable degree of fire resistance. However 'high cotton' lab coats are not 'fire proof' and a higher degree of fire resistance is available from coats specifically made for this purpose. The use of special 'fire resistant' laboratory coats would only usually be where the need is specifically identified in the risk assessment. Laboratory coats should be professionally laundered regularly and whenever they become contaminated. However laundering special 'fire resistant' laboratory coats may impair their ability to resist fire. **Laboratory coats must not be worn outside the work area/laboratory**, such as in refreshment areas, libraries, offices etc.

6.2 Footwear that adequately covers the feet and offers protection against spillages and falling objects should be worn at all times in the laboratory. **Shoes or sandals with open toes should not be worn in any laboratory.**

6.3 **Eye protection** (safety glasses, chemical resistant goggles or face shield) **must be worn in the laboratory where the risk assessment indicates their use** and/or in areas where the handling of chemicals is the predominant work. It is expected that in most laboratories where hazardous chemicals are handled the use of eye protection would be mandatory.

Safety glasses to British Standard (BS166) must be worn whenever handling hazardous chemical liquids.

Ordinary spectacles do <u>not</u> provide adequate protection!

Face shields alone may not provide adequate protection against liquid splashes.

Ensure visitors are provided with and wear eye protection as required.

6.4 **Loose** clothing, especially **loose** sleeves, ties, **loose** scarves etc and **loose** jewellery should not be worn in the laboratory. Dependent upon the risk assessment it may also be necessary to wear appropriate clothing to cover the legs.

6.5 Long hair should be tied back at all times in a laboratory or workshop (NB: fatalities have been known to occur where long hair was become entangled in rotating machine parts).

6.6 Appropriate gloves should be worn when handling substances that may be absorbed through the skin or that are corrosive, harmful, irritant or otherwise damaging to the skin. Check individual chemical breakthrough times on manufacturer's websites before selecting gloves. Longer sleeved gloves should be worn if the wrists and arms are also at risk of contact with the substance. (see Glove Guidance document on the Safety office website)

6.7 Gloves should be checked before use for punctures, tears etc and should be replaced periodically. Do not wear gloves outside the laboratory (see also 7.6).

Disposable single-use gloves are just that and must not be reused.

7. Hygiene

7.1 Personal clothing and baggage should not be taken into the laboratory (especially not food and drink). Where provided, lockers must be used to store personal belongings.

7.2 Avoid directly or indirectly transferring contamination to the mouth.

- do not eat, drink, smoke, chew gum, apply cosmetics, take medication or bite nails in areas where chemicals are used or kept
- do not pipette by mouth – use a pipetting aid
- do not lick labels or chew pens or pencils
- do not blow into gloves prior to putting them on
- gloves should be removed using the 'surgical technique' to avoid contamination of hands

7.3 All food and drink for human consumption must be excluded from any area of the laboratory unless for experimental purposes only (in which case they must be labelled as such i.e. 'NOT for FOOD USE'). For further details refer to the University Eating and Drinking Policy.

7.4 All laboratories should have dedicated hand-washing facilities – including soap and paper towels.

Whilst undertaking chemical operations, the hands should be washed:

- Regularly (remembering that washing too much can damage the skin)
- immediately if contaminated by a chemical
- always before leaving the laboratory
- **before** and after using the toilet

7.5 Avoid the use of solvents for washing skin. Solvents remove the natural protective oils from the skin and can cause irritation and inflammation in some cases. Washing with solvent may facilitate absorption of toxic chemicals (DMSO is particularly bad in this respect).

7.6 Do not touch doorknobs, light switches, telephones, keyboards or other such communal items with gloved hands.

7.7 Transport samples between laboratories in an appropriate container and use a bare glove free hand(s) for opening doors etc.

7.8 Avoid inhalation of chemicals. Do not 'sniff/smell' to test chemicals.

7.9 Cuts and grazes to the skin should be adequately covered by suitable dressings.

7.10 Laboratory coats should be kept in appropriate clean storage when not in use (ie: coat hooks adjacent to work area) and be regularly laundered.

8. Storage and Disposal

8.1 Only keep the minimum stock of substances necessary for the work at hand in the laboratory.

8.2 Storage in the laboratory should be in properly designated areas.

8.3 Chemicals not in use should be returned promptly to their correct storage enclosures/cabinets, **particularly flammable liquids** (See University Storage Guidance).

8.4 Light sensitive substances (e.g. chlorinated solvents) should be stored in amber-coloured bottles away from the light.

8.5 Do not put or store substances, especially liquids:

- where they can be struck by doors, trolleys etc…
- on the floor, under benches etc…
- in direct sunlight, by windows etc…
- on or near other sources of heat, heating pipes, radiators etc…

8.6 Liquids or heavy containers/equipment must not be stored above average chest height.

8.7 Do not store chemically incompatible substances together, e.g. acids and cyanides; oxidising agents (e.g. nitric acid) and organic chemicals (e.g. solvents or acetic acid).

8.8 Surplus materials must not be allowed to accumulate in laboratories.

8.9 All waste must be adequately contained, clearly labelled and disposed of at the earliest opportunity in accordance with University guidance. The appropriate waste route **must** be identified **before** work starts. Where waste gives off vapours or fumes, the waste receptacle should be adequately ventilated.

8.10 Sharps and broken glass must be segregated from other waste and disposed of in appropriate, designated containers via an appropriate waste disposal route.

9. Flammable Liquids

9.1 Flammable, highly flammable liquids or extremely flammable liquids ie, liquids with a flash point of 60ºC or below (e.g. acetic acid, ethanol and ether respectively), referred to hereafter simply as 'flammable', should be stored in sealed containers in fire resisting enclosures/cabinets (see University Storage Guidance).

9.2 Total quantities of flammable liquid kept in a laboratory/workroom should be kept to a minimum and in any case, should not usually exceed 50 litres (see **University Storage guidance for larger volumes**). No more than 500 ml nominal capacity of flammable liquid should be kept on the open bench at anyone time, i.e., the minimum amount of flammable liquid needed to carry out work. This should be removed to a suitable store/cabinet when not in use or no longer required.

9.3 Flammable substances must be kept well away from sources of ignition including naked flames, electrical hot plates and non-flameproof equipment.

9.4 Care should be taken when heating substances with low auto-ignition temperatures in order to prevent overheating and fire.

9.5 Flammables must only be stored in refrigerators and freezers expressly designed for the purpose, ie, those which have all ignition sources removed (aka 'spark-proofed' or 'spark-free'). These are commercially available.
Note: 'spark-proofed' or 'spark-free' is not the same as 'ATEX' rated.

9.6 Bulk dispensing of flammable liquids must only be carried out in an appropriate, safe, well ventilated area by trained staff. Where it is absolutely necessary to carry it out in a laboratory it must be subject to appropriate local exhaust ventilation.

10. Emergency Procedures

Know at least TWO safe escape routes from the area

10.1 In case of fire, follow the emergency instructions as posted around the University.

10.2 For limited spillage without personal contamination – absorb liquids as appropriate, clean up solid spills without creating airborne contamination and seek the advice of your Supervisor and/or Departmental Safety Officer where necessary. Spill kits should be readily available where identified as potentially needed in your risk assessment.

10.3 Personal contamination:

- wash off with copious amounts of cold water, if appropriate.
- do not use aggressive soaps, detergents or scrubbing on the skin
- seek first aid assistance and obtain medical advice if here has been eye contact

10.4 Major release of gas or vapour

- if and only if safe to do so isolate the source, turn off gas valve(s) etc…
- isolate the 'affected area'
- evacuate the building following your departmental emergency procedures, ensuring that potential evacuation routes through the 'affected area' are **not** used.
- **sounding the fire alarm may not be appropriate as it could send people into the 'danger zone'** and do not activate the fire alarm if it is an as yet unignited flammable gas release

10.5 Failure of fume cupboard:

- if it is safe to do so stop the experiment
- if it is safe to do so, contain the substances involved, e.g. by covering open containers, replacing stoppers
- **Close the sash**
- if adequate containment cannot be maintained in the fume cupboard, open windows and evacuate the laboratory, or in the case significant quantities of very toxic substances, evacuate the building following emergency procedures, as above sounding the fire alarm may not be appropriate.
- report the incident to your Departmental Safety Officer

For further information, see the following guidance on the Safety Office website, including:

- HSD002C: Hazardous Substances
- HSD026C: Carcinogens, Mutagens and Reproductive Toxins
- HSD029C: Laboratory Ducted Fume Cupboards
- HSD018C: Disposal of Chemical Waste
- HSD051C: Safe Storage of Hazardous Chemicals
- HSD 168C: Glove Selection
- Etc…

Publication History:

Republished 2004
Reviewed with major changes 2007
Reviewed with minor changes 2014
Reviewed with minor changes 2016
Reviewed with minor changes 2018

Reviewed with minor changes 2020

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HSD019C (rev 7)