Guide to Good Lab Practice – The Basics

Version 1.2

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1.0 Introduction

The laboratory is a complex environment so good laboratory practice is essential if laboratories are to be safe places in which to work. This simple guide is intended to provide you with some basic information on what good practice requires when working in a laboratory. It is not intended to replace or be a substitute for other training and supervision to develop good understanding on the behaviours of substances and materials which should lead to being able to handle those substances and materials using good and safe techniques.

Everyone has a responsibility for safety. The UK regulatory framework places the responsibility for managing risks on those who create and work with those risks.

2.0 Responsibilities

Everyone has responsibility to themselves and others to know and understand what they are doing to assess risks, to use suitable control measures – to gain competence which supports their activities and roles. The H&S Executive definition of a competent person is "A competent person is someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly". Part of gaining the required knowledge and experience is knowing your limitations and asking questions when presented with a task you do not fully understand. For instance, you have been asked to prepare some dilute acid solutions. Would you know the correct safe method to carry out this task? Below are some very basic responsibilities as they relate to working in laboratories. More comprehensive information can be found in the Leadership and management of health and safety at the University of Warwick document.

2.1 Principal Investigators

Accountable for assessing and addressing risks associated with their research. This includes the introduction of new chemicals, equipment and people to the workspace. They need to ensure that those working for them are competent for the research work they carry out by ensuring they receive sufficient information, adequate instruction, training and supervision and by ensuring lab rules are developed and followed for the areas under their control.

2.2 Researchers

Researchers need to work safely and comply with relevant legislation and follow controls outlined in the relevant risk assessments, University, departmental and lab rules, this includes the purchasing or introduction of chemicals. The must ensure suitable risk assessments are developed to control significant risk and must read and understand other local departmental arrangements, including materials in local information and induction booklets.

2.3 Technical Support / Experimental Officers / Facilities Management

Are not responsible for research activity. Their role is to ensure that the facilities and equipment are fully operational and to monitor that equipment is only used by competent staff and students. They will organise repairs when necessary.

2.4 Visitors, contractors and non-laboratory personnel

The university operates a 'permit' system to grant access to visitors and contractors. The PI or their nominated person is responsible for ensuring that only authorised persons gain access to their research areas. The visitor / contractor must abide by the local rules.

3.0 General Laboratory Safety

There are many categories of hazards that might be encountered in a laboratory setting, and situations can change frequently. Even after you have identified and controlled all current risks, it is vital that you remain open to the possibility that new unexpected dangers can arise. Ensure your assessment covers chemicals (chemicals being used and chemicals that could be created from the work you will be performing), flammable solvents, biological reagents, gases, equipment being used, others working in the space, lifting and handling etc. Review the controls measures regularly to ensure they remain adequate for risks encountered / being created.

3.1 Before entering the laboratory

- Familiarise yourself with the local rules. These will normally be in the form of a notice board at the entrance to or at designated points within the lab which indicates the basic minimum requirements. This can include details of PPE requirements, specific access requirements e.g. no pace makers etc. Ensure you follow these rules at all times.
- The Safety Data Sheet (SDS) for any materials you are required to handle. Pay particular attention to the sections on handling and storage; exposure controls and accidental release (spillage). There is Guidance on how to interpret Safety Data Sheets on the H&S website.
- The location of safety and emergency equipment such as fire extinguishers, hand wash basin, eye wash and shower, first aid and spill response kits, fire alarm activation points, telephone and emergency exits.
- Emergency spill response procedures for the materials you will handle, emergency reporting procedures and telephone numbers.
- The location of designated and alternative escape routes.
- Any first aid measures which are specific to the chemical you are working with e.g. phenol.

3.2 During laboratory work

3.2.1 Good Laboratory Practice- Principles

- Follow Departmental and local Laboratory Rules at all times.
- Use protective equipment as directed and remove before leaving the laboratory
- Wear your fastened lab coat when your risk assessment requires it (required in all labs handling chemicals & biologicals)
- Where directed by the Safety Data Sheet and/or directed by your risk assessment, wear appropriate gloves when handling materials and replace if damaged. NB: Nitrile may not always be appropriate and breakthrough times must be adhered to.
- Never pipette by mouth, use pipette fillers.
- Tie back long hair
- Remove gloves before leaving the lab and do not touch your face when wearing gloves
- Cover any cuts and grazes with waterproof plasters
- Use appropriate eye protection when directed (all chemical laboratories are classed as eye protection zones, the lab noticeboard will provide this information)
- Wear ‘sensible’ shoes in the laboratory – not open-toed sandals or flip flops
- Never eat, drink, smoke or apply cosmetics in the laboratory

- Never manipulate contact lenses in the laboratory, except in an emergency
- Wash hands before leaving the laboratory and apply a suitable hand moisturiser
- Keep work area clean and tidy – including fume cupboards and microbiological safety cabinets
- Keep personal items in the storage area provided, not on benches, lab floors or in gangways
- The risk assessment must determine whether chemical reactions are carried out in fume cupboards or whether work with biological agents is carried out in a microbiological safety cabinets

3.2.2 Use of Fume Cupboards

- All chemical reactions assessed as posing a risk to the users and others in the space must be carried out in a fume cupboard
- Keep the interior tidy. Do Not block the rear air vents
- Keep reactions / work and chemicals at least 15 cm inside the front of the cupboard
- Large pieces of equipment restrict air flow, use lab jacks to maintain dynamic flows
- Wear appropriate PPE as determined by risk assessment
- Keep the sash down as far as comfortable while working
- Do not put your head into the cupboard while working
- Ensure lightweight items such as tissues, disposable gloves and filter papers are not drawn into the ducts
- Only items which are required for the current experiment should be available. All other items should be removed to their appropriate storage location.
- Keep sash closed when not actively working in the cupboard
- Always close the sash at night
- Perform Daily 'User' checks. These include checking:
    - Sash is running smoothly and the auto-descend operates (where fitted)
    - Air flow is good – check indicator on cupboard
    - Lights working
    - Fire Trace pressure gauge in the 'green' (where installed)

There are other routine checks required which need to be documented in the 'Log Book'. Further details can be found on the Health and Safety website. All fume cupboards must be tested by a competent person at least once in 14 months and date of last test readily visible on the fume cupboard. Do not use a fume cupboard where more than 14 months has lapsed.

3.2.3 Use of Microbiological Safety Cabinets (MSC's)

Any work with a biological agent that poses an airborne infection risk must be conducted in an MSC. Before you start work, turn the MSC on, remove the night door and allow the airflows to stabilise for 5 minutes.

Correct MSC function is dependent on airflows within the cabinet not being disrupted

- Keep clutter to a minimum
- Keep centrifuges, etc. out
- Do not use Bunsen burners
- Keep grilles at the front, back and sides clear
- Keep lab doors shut

- Do not use if the airflow alarm sounds
- Clean down the work surface frequently, and especially after you have spilt anything on it
- Leave the MSC empty when finished

MSCs must always be tested by a competent engineer for correct function in any 14 month period (as a minimum). The date of last test must visible.

3.3 Before leaving the laboratory

- Perform a safety check at the end of each experiment and before leaving the lab.
- Isolate services / supplies as necessary.
- Return unused materials, equipment and apparatus to their correct storage locations.
- Dispose of all waste appropriately using the correct waste streams. Where necessary label materials and ensure the SDS is available. Departments will have local waste management arrangements which must be followed.
- Remove defective or damaged equipment immediately, and arrange to have it repaired or replaced via departmental procedures
- Decontaminate any equipment or work areas that may have been in contact with hazardous materials
- Leave behind protective clothing (lab coats, gloves, etc.) and wash hands thoroughly before leaving the laboratory
- Where required, display 'Continuous Running' and/or 'Overnight Reaction' cards for on-going experiments
- Close the door and ensure the laboratory is secure if you are the last one to leave

3.4 Other laboratory hazards

As well as the hazards presented by chemicals and biological agents in use in a laboratory, there are other hazards which also need to be considered:-

3.4.1 Glassware

The most common laboratory incidents, involve handling glassware. The resulting injuries can be cuts, burns and even poisoning when cut by contaminated glassware. These can be avoided by following a few simple rules when handling glassware and ensuring the correct type of glass is used for the activity. Ensure you have received proper instructions before you use glass equipment designed for specialised tasks.

Here are few safety rules:

- Wear appropriate gloves when handling glassware, ensure they offer grip and cut resistance.
- Store glassware carefully so as not to damage it or yourself.
- When inserting tubing into the side arm of a flask, condenser etc., grease or wet the tubing. (Acetone works well on vinyl tubing). Ensure the tubing is the correct diameter.
- When removing the tubing from glassware, do not attempt to pull it off.
- Lay the glass item on the lab bench (if possible). Cut the tubing near the end of the glass. Always cut away from your body
- Next, slice the tubing lengthwise and slide the material off the glass connection.
- Substitute plastic connections for glass whenever possible to decrease the risk of injury.
- Use glassware for vacuum work that is designed for that purpose.

3.4.2 Heating devices

- Ensure all equipment is fit for purpose and maintained.
- Portable electrical equipment will display a sticker to indicate when it was last checked for electrical safety.
- Carry out a pre-use check and test any safety devices before using and don't use any equipment that is damaged.
- Heating devices can include: hotplates, tube & box furnaces, hot-air guns, oil baths etc.
- Improper use of any one of these could result in fire or burns to the user.
- Always turn off the equipment when no longer required.

3.4.3 Vacuum systems

- Familiarise yourself with the operations of the vacuum system.
- Make sure you have the correct types of vessel / glassware for the level of vacuum being created.
- Ensure that glassware is plastic coated / meshed or that there is a physical barrier between you and the glass. NB: the sash of the fume cupboard may provide this protection.
- Always use a trap on the suction line to prevent liquids from being drawn into the pump.
- If gases or vapours are being drawn through the pump, a cold trap should be used in the suction line to prevent contamination of the pump oil.
- Place a tray under the pump to catch any oil drips.

3.4.5 Gases - Compressed gas cylinders

You must be trained to handle cylinders and how to attach the correct regulator before handing any gas cylinder.

- The gases contained in the cylinder can present a range of hazards, toxic, corrosive, asphyxiant, oxygen enrichment etc.
- The space in which they are used may need specialist monitoring systems.
- Ensure any risk assessments for the space are adhered to and your risk assessment of the activity covers these materials where necessary.

3.4.6 Gases – Cryogenic Liquids

You must be trained to handle cryogenic liquid gases

- The typical cryogenic liquids in use at the University are Liquid Nitrogen and Liquid Helium.
- The hazards associated with the handling and use of cryogenic liquids are:
    - Asphyxiation due to oxygen depletion
    - Cold Burns
    - Cold effect on the lungs
    - Ice-plug formation leading to high velocity ejection or container explosion
    - Explosion of container due to rapid expansion

- The space in which they are used must have specialist monitoring systems. Always check the oxygen level on the monitoring panel before entering the laboratory. DO NOT enter any space where there is a visible or audible alarm.
- Ensure any risk assessment for the space is adhered to and your risk assessment of the activity covers these materials where necessary.

3.4.7 Other laboratory equipment

- All laboratory equipment including instrumentation should be captured in relevant risk assessments.
- The manufacturer's safety and technical information and the user manual should be consulted to aid the development of these assessments as it will provide information on the system requirements, details of any known hazards and how to operate the equipment safely. However, the user manual will not be able to answer many specific questions regarding the use of the equipment in its actual environment or the substances and materials being used in the equipment. Hence, the risk assessment needs to cover these and will also help to identify any specific training requirements for the users.
- Full details on the requirements for work equipment can be found on the Health and Safety web pages
- There may be other laboratory hazards such as biological reagents, extremes of temperature, volatile materials. All these hazards need to be covered by your assessment for the activity you are planning.

4.0 Risk Assessment

Risk is a part of everyday life and you are not expected to eliminate all risks. What you must do is make sure you know about the significant risks and the things you need to do to manage them to an acceptable level. Generally, you need to do everything 'reasonably practicable'. This means balancing the level of risk against the measures needed to control the real risk in terms of money, time or trouble. However, you do not need to take action if it would be grossly disproportionate to the level of risk.

Therefore, assessments need to be carried out for the hazards likely to be encountered which need to determine how likely it is that harm will occur; i.e. the level of risk, and the controls that are required to mitigate those risks. You also need to consider foreseeable emergencies and actions that need to be taken – e.g. spillage, loss of power or other services and gas leak.

For the purposes of this guidance we are focusing on chemical safety assessments, as required under the 'Control of Substances Hazardous to Health regulations' (COSHH) and 'Dangerous Substance's & Explosive Atmosphere Regulations' (DSEAR). However, a specific COSHH and/or DSEAR assessment is not always necessary, the risk assessment for the activity which will include other significant risks may be sufficient providing the control measures identified adequately control the risk.

5.0 Control of Substances Hazardous To Health Regulations (COSHH)

5.1 Why controlling potentially hazardous materials matters

Using chemicals or other substances at work can put people's health at risk; the University needs to ensure that work is carried out in a manner which is sufficiently controlled to prevent ill health.

5.2 What are substances hazardous to health?

- Anything harmful by inhalation, ingestion or by skin contact
- Anything carrying a warning label indicating toxic, harmful, corrosive or irritant

- Substantial quantities of dust
- Biological agents including cell lines, animals, insects etc.
- All of the above are covered by COSHH and requires a specific assessment of the activity involving the use of hazardous substances. Essential information about hazardous substances is available on the Safety Data Sheet Use this information to help with the assessment. Click for help with SDS Sheets.

5.3 What an Assessment Requires

5.3.1 Step 1: Assess the Risks

Identify the hazardous substances and the reactivity, fire and explosion, health and environmental hazards – use the information provided on the safety data sheet. Always consider the use of a less hazardous alternative where possible, or consider an alternative method which does not require hazardous substances.

5.3.2 Step 2: Precautions

Most of our use of hazardous substances are in laboratories. For most uses, standard precautions (including the use of engineering controls (LEVs), safe handling practices, and appropriate laboratory PPE) if they are applied in full, will ensure adequate control. Details of standard precautions can be found in appendix 1

Sometimes it will not be possible to work within the conditions of standard precautions, or there will be a special reason why they are not fully applicable. Examples are: use of a substance with special first aid requirements such as cyanides or hydrofluoric acid. In these cases and for all uses of respiratory sensitisers (asthmagens) or carcinogens, mutagens and teratogens, a specific assessment is required.

5.3.3 Step 3: Prevent or adequately control exposure

COSHH is not a paper exercise – the purpose of COSHH assessment is to ensure that the right precautions are identified and implemented. The COSHH Regulations require, so far as is reasonably practicable, that you prevent exposure to substances hazardous to health. You should consider the general principles of prevention – The 'Hierarchy of Hazard Control' when carrying out your assessment. The hierarchy is listed below, in order of decreasing effectiveness:

- Elimination – do the task another way without the use of substacnes or don't do the task
- Substitution – use a less hazardous material, substitute powders for pellets
- Engineering – e.g. local exhaust ventilation (LEV) fume cupboards
- Administration – following procedure, training and instruction
- Personal protective equipment – where adequate control cannot be achieved by any other means – e.g. lab coat, safety spectacles and normally used in conjunction with other control measures.

Workplace exposure limits (WEL's) are assigned to a large number of hazardous substances. The document EH40 needs to be consulted to establish whether the substances to be used have been assigned a WEL. WELs are concentrations of hazardous substances in the air, averaged over a specified period of time, referred to as a time-weighted average (TWA). Two time periods are generally used: Long-term (8 hours); and Short-term (15 minutes)

Short-term exposure limits (STELs) are set to help prevent effects such as eye irritation, which may occur following exposure for a few minutes.

Where a WEL has been assigned, **it must not be exceeded** and the activity must be assessed. The assessment must also consider how the substances can have an effect on the body, i.e. routes of entry – is it inhaled,

absorbed through skin, ingested or injected and therefore adequate control measures are required to mitigate the risk. Section 8 on the SDS also provides information on workplace exposure limits.

Substances identified as causing asthma or cancer, because no safe threshold exists, a stricter standard than "adequate control" applies. The obligation is to avoid or reduce exposure so far as is reasonably practicable. These substances include laboratory animal excreta/secreta as well as all substances with the warning on the container "may cause allergy or asthma symptoms or breathing difficulties if inhaled".

Details of work with asthmagens and carcinogens should be given to Occupational Health.

In cases of doubt, the Health and Safety Services can support atmospheric measurements to check levels. Consideration also needs to be given to your colleagues - the effect of your activity on them, and the effect of their activity on you and your work.

5.3.4 **Step 4: Ensure that control measures are used and maintained**

The University is required to see that control measures and safe systems of work are actually used. This is why it is necessary to provide information, training and supervision (Section 5.3.6). Principle Investigators / Supervisors should monitor that all work is properly assessed i.e. that either the use of standard precautions is recorded or there is a specific assessment and that the controls assessed as necessary are actually implemented. Individuals are required to use control measures and safe systems of work, and to report any defects. Controls should be maintained. Local exhaust ventilation is tested annually by the University. Respiratory protection (RPE) other than disposables requires a monthly check. A record should be kept with the equipment showing: name of department; particulars of the equipment, with distinguishing number or description; date of monthly examination and initials of the person carrying out the check; condition of the equipment and filter including any defect found; for air-fed equipment, details of pressure and flow rate.

5.3.5 **Step 5: Prepare plans for accidents, incidents and emergencies**

In carrying out specific assessments, consider whether the emergency procedures in Appendix 1 – Standard Precautions and Section 7.0, are sufficient; expand if necessary.

5.3.6 **Step 6: Ensure individuals are properly informed, trained and supervised**

It is a departmental responsibility to ensure that individuals are properly trained, i.e. are competent to do work with substances which are hazardous to health. Records of training provided, and level of supervision required must be maintained. Individuals should know how to work safely and why they need to work safely. They should be given the necessary information about the individual substances they are working with, and should sign the acknowledgement on the specific assessment form. Supervisors should visit them regularly to check they are working safely.

5.3.7 **Step 7. Exposure Monitoring**

There are specific requirements to carry out exposure monitoring for certain substances e.g. hardwood dusts, lead, isocyanates. The extent of the monitoring needs to be determined in the risk assessment for the activity. Control measures should normally be sufficiently robust as to ensure a comfortable margin of safety and should not normally require exposure monitoring. There may be occasions where monitoring may be necessary to determine whether precautions are adequate. For advice on exposure monitoring, contact the Health and Safety Services.

Note: “Exposure monitoring” is different from the monitoring that safe systems of work are actually being used which is required in all cases (Section 5.3.3).

5.3.8 Step 8. Health Surveillance

The COSHH Regulations state: “Where it is appropriate for the protection of the health of his employees who are, or are liable to be, exposed to a substance hazardous to health, the employer shall ensure that such employees are under suitable health surveillance”.

The objectives of health surveillance are to detect early signs of adverse health effects, to help evaluate control measures and to collect data to evaluate hazards. Where control measures successfully reduce exposure to a level which prevents adverse health effects, no health surveillance is needed. A specific assessment is necessary before any decision with regard to the need for health surveillance; it should identify whether there is any risk of adverse health effects and if so who is at risk.

If it is thought health surveillance needs to be investigated (e.g. if working with a respiratory or skin sensitiser) please contact Occupational Health, sending a copy of the specific risk assessment and safety data sheets for the substances concerned.

5.4 Common misconceptions of COSHH

“**COSHH says you have to assess every substance hazardous to health**”. Wrong! COSHH says you have to assess every activity using substance hazardous to health. Getting the suppliers’ data sheet is not enough (although it’s a good start). You have to look at the actual use of the substance.

“**We’d better cover ourselves by overstating the precautions to be taken**” You might be making a rod for your own back. When the extent of the risk is unclear it may sometimes be easier to take strict precautions – e.g. working in a fume cupboard – rather than spend a long time researching an assessment; but NEVER state precautions which you don’t intend to follow

“**Most work uses standard precautions so it’s not a problem**”. Standard precautions are not a soft option. They are a set of strict precautions which apply when using a range of substances, some of them very hazardous. The precautions MUST be followed.

Regurgitating a Safety Data Sheet is NOT a COSHH assessment.

5.5 Dangerous Substances and Explosive Atmospheres Regulations (DSEAR)

Dangerous substances are any substances used or present at work that could, if not properly controlled, cause harm to people as a result of a fire or explosion or corrosion of metal. They can be found in nearly all workplaces and include such things as solvents, paints, varnishes, flammable gases, such as liquid petroleum gas (LPG), dusts from machining and sanding operations, dusts from foodstuffs e.g. flour, pressurised gases and substances corrosive to metal. These materials must be covered in assessment of both storage and use of hazardous materials as briefly mentioned in the COSHH section.

The storage and use volumes below are the maximum allowed in a laboratory space. If the work or storage requirements exceeded these volumes a DSEAR assessment will be required. Please contact the Health and Safety Services if you need further guidance.

- 50 litres of highly flammable liquid (Storage volume)

- 250 litres of flammable liquid (Storage volume)
- 500 ml working volume (on open bench)
- The above stored in any one laboratory, stored in a metal cabinet conforming to BSEN 14470-1:2004

Dust also needs to be considered with regard to DSEAR. Where there is evidence of significant dust deposit on surfaces and equipment which is a result of an activity, and not simply general build-up over time with little housekeeping, then the work process must be subject to a review to establish suitable mitigation / control measures. Please contact a Health and Safety Services if you need further guidance.

5.6 Biological and GM Risk Assessment

All work with any biological material*, anywhere on University premises, must be subject to risk assessment which must be submitted to the Genetic Modification & Biosafety Committee (GMBSC) for approval before the work starts. Risk assessments must be conducted using the current version of the appropriate form on the Health and Safety web pages.

The GMBSC will consider the suitability of all risk assessments of biological activities and will provide approval and confirmation of the assigned Containment Level.

The containment and control measures identified in risk assessments as being necessary to control the risks arising from a biological activity must be implemented and followed at all times. These must include all of the statutory measures set out in relevant legislation, unless a derogation from the regulations has been granted.

Risk assessments are subject to formal periodic review in line with the risk that the activities pose: CL1 activities must be reviewed every three years; CL2 activities must be reviewed every two years; CL3 activities are subject to annual review. Any risk assessment which no longer reflects the nature of the activity to which it relates must be reviewed immediately.

Work with ANY human material must also be approved by the Designated Individual for the University's licence under the Human Tissue Act, and may require ethical approval.

* Examples of biological materials include non-pathogenic biological agents (i.e. bacteria, viruses, fungi, protozoa and prions), human pathogens, animal pathogens, plant pathogens, animals, plants, products of animal origin, material of human origin and genetically modified versions of any of these.

6.0 Hazardous substances - storage, labelling & information

Poor or incorrect chemical storage practices can lead to inadvertent reactions between incompatible materials with the potential to cause harm, fire or even explosions. Unstable substances may form during chemical storage, or prolonged storage, and appropriate measures need to be taken to prevent this happening e.g. certain ethers, alcohols and aldehydes can form peroxides that can detonate during distillation.

Before ordering / purchasing or acquiring any hazardous substances, ensure there are suitable facilities and arrangements for their correct storage and for dealing with foreseeable emergencies such as spills. Always follow your departmental purchasing policy and arrangements.

Ensure all chemicals are stored by **hazard and compatibility** and in **appropriate cabinets** where necessary.

6.1 General Storage Guidelines

- Do not block access to emergency safety equipment such as fire extinguishers, eyewashes, showers, first aid kits or utility controls such as breaker boxes or gas shut-off valves
- Avoid blocking exits or normal paths of travel: keep hallways, walkways and stairs clear of chemicals, boxes, equipment and shelf projections
- Ensure that the weight of stored material does not exceed the load-bearing capacity of shelves, cabinets or floors
- Ensure that wall-mounted shelving has heavy-duty brackets and supports and is attached to studs or solid blocking. Regularly inspect clamps, supports, shelf brackets and other shelving hardware
- Arrange items so that they do not overhang or project beyond the edges of shelves or counter tops
- Do not stack materials so high that stability is compromised. Use a safety step or stepladder to access higher items; never stand on a stool or a chair
- Ensure chemical cupboard shelving is correctly installed

6.2 Chemical Storage

- Store hazardous chemicals in an area that is accessible only to authorised laboratory workers
- Minimise quantities and container sizes kept in the lab
- Review stocks on an annual (or more frequently as the SDS suggests) basis to ensure containers are not damaged
- Do not store chemicals in aisles, under sinks or on floors, desks or bench tops
- Store chemicals away from sources of heat (e.g., ovens or steam pipes) and direct sunlight
- Never stack bottles on top of each other
- Do not store chemicals above eye level/shoulder height
- Store larger containers on lower shelves
- Store liquids inside chemically-resistant secondary containers (such as trays or tubs) that are large enough to hold spills
- Store chemicals inside closable cabinets or on sturdy shelving that has edge guards to prevent containers from falling
- Ensure that chemicals cannot fall off the rear of shelves
- Store chemicals by hazard group and compatibility and not in alphabetical order
- Designate specific storage areas for each class of chemical, and return reagents to those locations after each use
- Store volatile toxic and odorous chemicals in a way that prevents release of vapours (e.g., inside closed secondary containers, ventilated cabinets, paraffin sealing)
- Store flammables requiring refrigeration in explosion-safe or lab-safe refrigerators
- Label reactive or unstable chemicals (e.g., ethers, picric acid) with the date of receipt, the date opened and date for disposal
- Inspect chemical containers weekly for signs of deterioration, changing physical form – colour, crystal build-up etc. and for label integrity
- Dispose of unwanted chemicals promptly through your department's Hazardous Waste stream
- Keep inventory records of chemicals, and update at least annually (stock check)

- Any materials that have been created, decanted or mixed must be labelled to reflect the hazards. It is good practice to include the date and your initials.

6.3 Flammable liquid storage cabinets

- Flammable liquids should be stored inside flammable storage cabinets. Only those flammables in use for the day should be outside the cabinet. Guidelines for cabinet use include:
    - Keep doors of the cabinet closed
    - Do not store other materials in these cabinets e.g. oxidisers, strong acids etc.

6.4 Handling and Transport

- Large bottles of acids, solvents, or other liquids are carried in an appropriate carrier.
- Small bottles should be carried one at a time with both hands, one on the neck of the bottle and the other underneath.
- Incompatible chemicals should not be transported in the same carrier
- Chemicals to be moved between sites should be in the original outer packaging or protected from breakage or damage in a secondary container with sufficient absorbent material to contain a spill

6.5 Safety Data Sheets (SDS)

SDS are key documents in the safe supply, handling and use of chemical and are the primary mechanism that suppliers and manufacturers use to communicate appropriate information regarding the safe use & storage of their products.

The data sheet should be arranged into 16 sections and has to provide certain information as prescribed under regulations. You may find that there are differences in how the information appears, but overall the information has to contain the 16 topics. The Health and Safety website provides you with guidance on how to interpret that information.

Important Note *– A safety data sheet does NOT constitute a risk assessment. It provides information for consideration when carrying out risk assessments. Risk assessment needs to take into account all the chemicals used and their interaction, not each chemical in isolation as well as the overall activity taking place. When referring to a data sheet focus on the headings rather than the section numbers*

6.6 Labelling

Labels are there to help identify hazardous chemicals, and explain what the hazards are and how to avoid them. Packaging is also important as it provides information on storage and disposal. Appendix 2 - CLP

7.0 First Aid & Emergency Procedures

- Familiarise yourself with the first aid and emergency procedures local to your department so that mishaps can be speedily contained.
- Find out who the first aiders are in your building.
- It is the responsibility of the injured person to report any injury or property damage.
- You can report any incidents via the online reporting page or to your line manager/supervisor who will report on your behalf.

7.1 First Aid

Where the substances being used have special first aid requirements (e.g. radiochemicals, cyanides, phenol etc.), those providing the first aid must know and understand the relevant treatments and be trained on how to administer safely. *Sections 4, 5 & 6 of the Safety Data Sheet provide further information.* It is the department's responsibility to ensure their first aiders are suitably trained.

7.1.1 - Wounds

Cleanse area with water as appropriate. Small cuts and scratches place sterile pad over wound and apply gentle pressure evenly with the opposite hand. If direct gentle pressure does not control bleeding, raise the area above the level of the heart. Apply dressing plaster as appropriate. If there is significant bleeding place sterile pad over wound and apply gentle pressure and call for a first aider immediately for help and advice.

7.1.2 – Thermal Burns

First degree burns are characterised by redness or discoloration of the skin, mild swelling and pain. These can be treated with a burns dressing or by rinsing or immersing in water for at least 10 minutes and seeking further medical treatment as needed. Second and third degree burns are characterised by red or scared skin with blisters (second degree), white or charred skin (third degree). Immediate first aid is to clean the area if possible and keep it dry and call for medical help immediately.

7.1.3 – Chemical Burns

If hazardous chemicals (**does not** include phenol, HF etc.) should come into contact with skin or eyes, follow the first aid procedures below.

- **Skin:** Remove garments as required and rinse the affected area with large quantities of water for at least 15 minutes (sink, shower, or hose).Do not apply burn ointments/spray to affected areas. Call for medical help without delay.
- **Eyes:** Rinse area of eyes, eyelids, and face thoroughly with lukewarm water for at least 15 minutes at the eye wash station and call for medical help without delay.

7.2 Emergency Procedures

NB – this is guidance only, your risk assessment must cover foreseeable emergency situations and the required actions. There needs to be appropriate procedures developed and suitable training provided when required.

7.2.1 Spills

Many spills in the laboratory can be prevented and the development and implementation of good laboratory practices will significantly reduce the likelihood of spills. Each department which stores and/or handles hazardous microorganisms or chemicals must have in place suitable and sufficient emergency plans and procedures for dealing with the spillage of these organisms and chemicals. If a spillage has occurred, there are four basic principles which can be applied to any type of spill which will aid the emergency response: 1) What have you spilt? 2) What is its concentration? 3) What volume have you spilt? and 4) Location of the spill. Depending on the answers to these questions will depend on how you have to deal with the spill e.g. spilling 10ml broth which has just been inoculated with a single colony of hazard group 2 *Escherichia coli* will be dealt with differently to a 10ml broth containing an overnight culture of *E. coli*. Spilling 100mL of 0.1M acetic acid will be dealt with differently to spilling 100mL of 2M acetic acid etc.

7.2.2 Chemical

Ensure spill kits suitable for the substances being handled are available. The risk assessment for the activity needs to cover spillage (where appropriate). Training must be provided to those who treat/manage spills. A Spills Response team may be available in the department, ensure you are aware of how to contact them in the event of an emergency. Do not attempt to clean up the materials unless told to do so.

7.2.2.1 Solvents

For minor spillage of volatile solvents in a fume cupboard, close sash, ensure extraction is working and leave to allow material to dissipate.

Larger spills, ensure the lab is evacuated. Inform the senior person for the space. No entry to the space will be allowed unit the space has been cleared of the solvent.

7.2.2.2 Other liquid spills

Ensure appropriate spills kit and suitable PPE are available. Only trained staff to use kit. Staff must leave area of spill and allow the spillage team to deal with the spill.

Significant spills need to be reported to the Health and Safety Services in the same manner as all other accidents/incidents

7.2.2.3 Dry Spills

Chemicals in a powder form may pose additional hazards and therefore further control measures may be required when dealing with a powder spill. Things to consider include the use of RPE and PPE, whether ventilation systems may need to be turned off whilst dealing with the spill etc. Key to remember is that powder spills should never be swept up using a dust pan and brush, standard vacuum etc. The powder must be covered with wet absorbent material to absorb/dissolve the powder. Continue to “damp-down” until there is no visible powder left and the spill can be dealt with as for wet spills.

7.2.3 Biological

Small spills on the bench can be wiped up with a paper towel and then the area sprayed down with a suitable disinfectant.

Larger spills should be treated by the application of a granular or powdered disinfectant before being cleared up and suitably disposed in the correct waste stream.

Spillages at containment level 2 or containment level 3 must be treated in accordance with the rules defined in the local code of practice for the space and risk assessment for the activity.

7.2.4 Fire

- Ensure the risk of fire is covered in your activity risk assessment (where necessary). When using flammable substances ensure the facility in which you are working is suitable for the activity.
- Know how to raise the fire alarm
- Know what action to take in the event of a fire alarm sounding and know where to assemble outside the building (Ensure you are familiar with your departments fire evacuation procedures)
- There is a Moodle course available which provides more detail on fire safety.

7.2.5 Loss of Power or other utilities

The effect of loss of electricity, water, gas or other services required to support your activity needs to be considered. Where the loss could pose a significant risk to the work, the space users or the space, then this must be captured in the risk assessment for the activity. Suitable controls to mitigate the risk need to be developed and followed as well as the actions to be taken in the event of foreseeable emergency situations.

7.2.6 Lone Working

Lone working is generally not allowed in a laboratory. (It is never allowed in undergraduate labs). Where lone working may be required, this must be in agreement with your supervisor and a suitable risk assessment must be in place. Departments will have their own 'lone working' arrangements and these must be communicated and followed.

APPENDIX 1 - CLP PICTOGRAMS

All hazardous substances will be labelled with the appropriate GHS pictogram. However, there may be some old material (pre 2015) and these may have the older style pictograms (CHiP)

	GHS Pictogram	**CHiP Pictogram** (Replaced by GHS in 2015)
Unstable, Explosive		
Flammable		
Oxidising		
Compressed Gas		There is no equivalent symbol
Corrosive		
Toxic		
Irritant		
Health Hazard		
Environmental Hazard		

APPENDIX 2 – SAFETY SIGNAGE

Safe Condition


Emergency Shower


Emergency Exit


Drinking Water


First Aid

Warning Signs


Compressed gas


Radiation hazard


Cryogenic hazard


Bio hazard


Toxic hazard


Magnetic hazard


Laser hazard

Prohibition Signs


No smoking


No access for people with active cardiac implants


No entry


No metals or watches

Mandatory Signs – must follow instruction


Eye protection must be worn


Respiratory Protection must be worn


Hand Protection must be worn