

**SCHOOL OF PHYSICAL & GEOGRAPHICAL  
SCIENCES**

**Safety Handbook  
for  
Undergraduates**

**PHYSICS & ASTROPHYSICS  
2013-2014**



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# School of Physical & Geographical Sciences

## Safety Handbook for Undergraduates

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Appendix 1: Undergraduate Laboratory Code of Practice

## Introduction

This handbook is a summary of the main aspects of safety policy within the School of Chemistry and Physics that apply to undergraduate students of Physics. Further details of the University Safety Policy and safe practices are dealt with elsewhere.

All undergraduates are required to be familiar with the contents of this handbook and with the University Safety Policy. They will be required to sign a declaration stating that they have read and understood this document and attended a safety discussion led by the School Safety Advisor or a member of Physics academic staff acting on his behalf.

## General Safety Policy within the School

It is the policy of the School of Physical and Geographical Sciences to fully implement the University Safety Policy in all aspects that are applicable to the School, particularly those aspects that govern laboratory work.

In particular the School is responsible

- for ensuring (so far as is reasonably practical) that the design, construction, operation and maintenance of experimental equipment is safe and without risk to health;
- for providing suitable information and instruction for undergraduates in respect of the safe handling, storage and disposal of toxic substances and safe operation of equipment in order to ensure (so far as is reasonably practicable) the health and safety of all members of the School and all other persons who may be affected;
- for establishing appropriate emergency procedures within the School; and
- for establishing a mechanism for consultation with undergraduates in respect of matters of health and safety.

## **Legal aspects of safety**

You are reminded that under the Health and Safety at Work Act 1974 it is your responsibility while working in the Lennard-Jones Laboratories Building

- to take reasonable care for the health and safety of yourself and of other persons who may be affected by your acts or omissions;
- as regards any duty or requirement imposed on the School by or under any of the relevant statutory provisions, to co-operate so far as is necessary to enable that duty or requirement to be performed or complied with; and
- not to interfere with or misuse anything provided in the interests of health, safety or welfare.

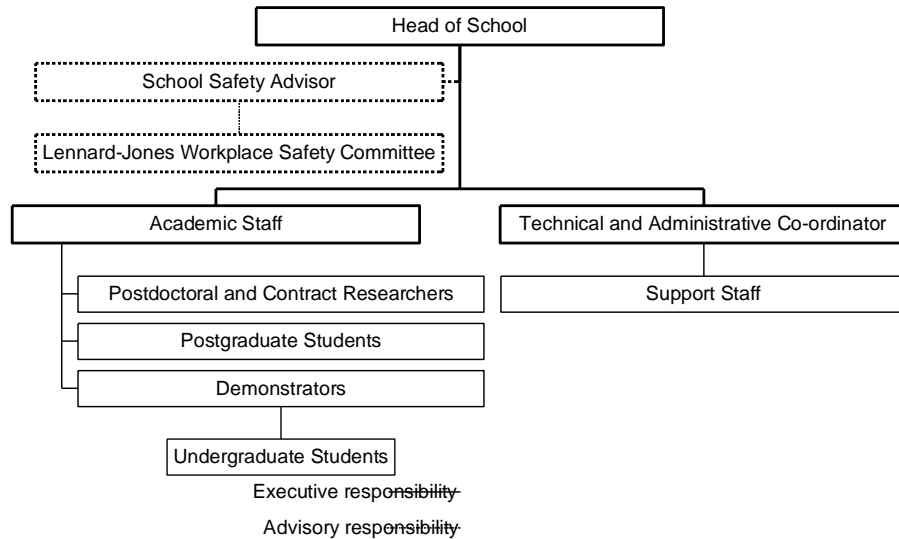
**Failure to observe any of the above points may result in legal action being taken against you by Health and Safety Executive inspectors.**

All work in the School is subject to the Control of Substances Hazardous to Health (COSHH) regulations. In particular, all experiments and processes which involve the use of chemicals must be accompanied by a completed COSHH risk assessment form. This form must be attached to any apparatus that you are using. The COSHH risk assessment form will be covered in more detail in later sections of this handbook.

**All rules made for our total compliance with these regulations must be observed at all times.**

## Responsibility for Safety within the Lennard-Jones Laboratories Building

The chain of responsibility may be represented as follows:



### Lennard-Jones Workplace Safety Committee

The composition of this committee is as follows:

- (a) Head of School
- (b) Departmental Safety Advisor
- (c) Technical and Administrative Co-ordinator
- (d) Departmental Radiation Protection Advisor
- (e) Departmental Laser Safety Advisor
- (f) Representative of the AUT
- (g) Representative of the MSF
- (h) Postgraduate Students Representatives
- (i) Undergraduate Students Representatives
- (j) Should a disability officer be included.

The committee normally meets three times a year to discuss any safety matters brought before it and to advise the Head of School on action to be taken. A list of the current members of the Committee is posted on most notice boards around the Lennard-Jones Laboratories Building.

### **Departmental Safety Advisor**

The Departmental Safety Advisor is a member of the School staff appointed by the Head of School to advise him or her on a day-to-day basis of action to be taken in respect of any safety matter.

In particular the Departmental Safety Advisor is responsible for:

- discussing and, if necessary, investigating any safety matter brought to him by any member of the School (academic staff, technician or student),
- advising, where possible, staff and students on safety measures to be taken with new experiments,
- investigating accidents and dangerous occurrences within the School
- providing general safety information, and
- leading discussions concerning safety matters with students.

### **School Inspection Team**

The School Inspection Team is responsible for inspecting all parts of the Lennard-Jones Building at regular intervals. Any safety deficiency that is observed is recorded and those most directly concerned with the problem are asked to rectify it. The team consists of at least two members of the Workplace Safety Committee.

## Responsibilities of Students

Your principal responsibilities may be summarised as follows:

### YOU MUST

- co-operate in observing all regulations provided for your safety.

### YOU MUST NOT

- interfere with any safety equipment provided,
- expose yourself or others to hazards as a result of deliberate carelessness,
- remove any material or equipment from the laboratories without prior permission from a member of academic staff, support staff, or a demonstrator,
- work in a laboratory **AT ANY TIME** unless a demonstrator or a member of staff is present,
- bring visitors into the laboratories **AT ANY TIME**.

**Any violation of the above rules will be regarded as a very serious matter.**

### YOU SHOULD ALWAYS

- when preparing for a laboratory period consider all of the safety aspects of any experiments that you will be concerned with, and
- report to a demonstrator any safety problem that you observe.

If you are unhappy about some aspect of safety within the Lennard-Jones Building, a sequence of five lines of action is open to you. As a general rule it is most speedy and effective to deal with a problem by using an informal approach; start with 1 and move down the list if you do not feel that the



1. discuss the problem with a demonstrator,
2. discuss the problem with the member of staff in charge of the laboratory,
3. discuss the problem with the Departmental Safety Advisor,
4. ask your student representative to bring the problem to the attention of the next Lennard-Jones Workplace Safety Committee meeting, or
5. ask your Students' Union representative to bring the problem to a University Safety Committee meeting.

If you must resort to using actions **4** or **5** it would be helpful to all concerned if you could put the matter in writing and hand a copy to the Departmental Safety Advisor.

### **General Aspects of Safety**

- **ALWAYS WORK TIDILY.** An untidy bench is not only a safety hazard but it may also prevent you from obtaining results of suitable accuracy. Always return equipment after use.
- **LEAVE ALL COATS, ETC., OUTSIDE THE LABORATORY.** Coat hooks are provided within the Lennard-Jones Laboratories, at the very top of the main stairs, opposite LJ 1.25 (Library). Do not leave valuables with your coat.
- **IN PHYSICS TEACHING LABORATORIES, BAGS MAY BE STORED UNDER THE BENCHES PROVIDED THAT THE BAGS ARE SMALL AND THAT STRAPS AND HANDLES DO NOT CLUTTER THE FLOOR SPACE AROUND THE BENCHES OR OBSTRUCT SEATS AND FEET.** Otherwise, bags must be stored with coats at the very top of the main stairs.
- **MAKE SURE THAT THE FLOOR BETWEEN THE BENCHES IS CLEAR, AND THAT ALL EXITS FROM THE LABORATORY ARE UNOBSTRUCTED.**

- **MAKE SURE THAT YOUR EXPERIMENT DOES NOT CONSTITUTE A SIGNIFICANT RISK TO OTHER STUDENTS OR STAFF.** If you are working with high voltages or a dangerous material (normally in a fume cupboard) let other students working nearby know about this.
- **NEVER PIPETTE BY MOUTH, TASTE ANY CHEMICAL SAMPLE OR DELIBERATELY INHALE ANY CHEMICAL VAPOUR.** Many organic liquids and some inorganic liquids (e.g. mercury) are highly toxic by skin absorption, ingestion or inhalation; they should never be inhaled. If in doubt, don't sniff! Skin contact with most reagents should be avoided; aside from the obvious hazards some can cause allergic contact eczema.
- **NEVER HEAT FLAMMABLE SOLVENTS WITH A NAKED FLAME.** Many organic solvents are volatile and highly flammable; obviously, such solvents must never be heated in open vessels over a naked flame. Appropriate precautions should be taken, such as heating the solvents in a water bath or using an isomantle.
- **CONSULT A DEMONSTRATOR BEFORE WORKING WITH ANY HIGHLY TOXIC OR HAZARDOUS SUBSTANCE.**
- **ALWAYS READ THE INSTRUCTIONS PROVIDED.** Many pieces of equipment are provided with detailed instructions as to their correct use. You must not use such equipment without first having read and understood the instructions.
- **IF THERE ARE NO INSTRUCTIONS AVAILABLE, ALWAYS ASK A DEMONSTRATOR.** Where equipment is not provided with instructions you must discuss the operating procedure with a demonstrator before commencing the work.
- **BE ALERT TO YOUR SURROUNDINGS.** In the interests of safety, as well as for academic reasons, you should always take an interest in the experiments going on around you.

## Protective Clothing and Workwear - Physics Laboratories

- **YOU MUST WEAR A LAB COAT IF YOU ARE GOING TO USE CORROSIVE CHEMICALS** (cotton or cotton/polyester but not nylon). This will not only protect your clothing but is also easily removed if you get burning solvent or some other dangerous material on it.
- **YOU MUST WEAR SUITABLE EYE PROTECTION IF YOU ARE GOING TO POUR OR USE LIQUID NITROGEN OR CORROSIVE CHEMICALS**  
This will normally be the safety spectacles provided. However, if you are working with corrosive or other dangerous materials goggles or a face shield may be necessary; these may be obtained from the preparation room.
- **IF NECESSARY, WEAR GLOVES.**  
Students must wear suitable protective gloves when handling liquid nitrogen or material that is corrosive or dangerous by skin adsorption or capable of causing allergic reaction. If you believe that you are particularly prone to allergic reaction you must wear appropriate gloves at all times.
- **KEEP YOUR HAIR UNDER CONTROL AND OUT OF THE WAY.**  
Long hair is not only a fire hazard but it may also catch in equipment such as soldering irons. Even relatively short hair can be a significant hazard.
- **YOU MUST NOT EAT, DRINK OR SMOKE IN ANY LABORATORY; SMOKING IS FORBIDDEN IN THE LENNARD-JONES BUILDING**  
In addition to the fire hazard involved with smoking, inhalation of chlorinated vapour through a lit cigarette may produce dangerous quantities of phosgene. Always wash your hands before leaving the laboratory and certainly before eating, drinking or using the toilet.

## Hazard and Risk Assessment

The purpose of an assessment of the hazards and risks associated with an experiment is not intended to produce a fear of experimental work; rather, it will enable you to carry out experiments in a safe manner and handle hazardous materials with confidence. It is the School's responsibility to provide suitable safety advice at all times. However, it is an important part of your scientific education to learn to assess the dangers in an experiment and what steps are necessary to make any equipment safe. An experiment that is unsafe is often ill-conceived in other ways as well.

COSHH risk assessments are provided in the Physics teaching laboratories for solder flux fumes, soldering polyurethane-insulated wire, and organic solvents for cleaning. You must take note of these. Copies are provided. If you intend to use any other hazardous substances, you will be required to complete a COSHH risk assessment form before beginning the task; blank pro forma's and copies of correctly completed forms will usually be available from the support staff. The member of staff responsible for the particular laboratory class must sign the form. Finalists will also be required to produce a written hazard and risk assessment for their projects and to discuss this with their supervisor. These assessments should include details concerning

- safe handling procedures,
- the safe exposure limits of substances to be used and whether these are likely to be exceeded in the normal operation of the experiment,
- safe disposal procedures, and
- what to do if there is some mishap in the experiment.

All of the above details will usually be covered by a COSHH risk assessment. Three copies of the COSHH risk assessment form must be completed. One copy must be located near to your experiment in a secure position. A second copy must be handed to the technician or member of staff responsible for your laboratory (in the case of research projects, the second copy must be handed to your supervisor). The third copy must be deposited in Safety Resource Room, located off the foyer of the Lennard-Jones Laboratories building.

EU legislation has led to the introduction of standard Risk (R) and Safety (S) phrases to describe concisely the properties of hazardous materials. All hazardous products are marked with R and S numbers corresponding to one or more of the assigned Risk and Safety Phrases. This information can be found on the product labelling and is repeated in the product description as listed in any catalogue. For definitions of the EU Risk and Safety phrases, please refer to the Safety Handbook for Chemistry Students.

Other references that may aid hazard and risk assessments:

1. C. R. C. Handbook of Chemistry and Physics; (several editions available).
2. The Merck Index; (several editions available).
3. N. Irving Sax, "Dangerous Properties of Industrial Materials", 6th edition, Van Nostrand Reingold.
4. "Toxic and Hazardous Industrial Chemicals Safety Manual", I. T. I.
5. Sigma-Aldrich Materials Safety Data Sheets on CD-ROM; this is located in the Stores and access is governed by the Stores opening times.
6. Bretherick, "Handbook of Reactive Chemical Hazards", 3rd edition, 1979.

Most of these are available in the laboratories.

## Emergency Procedures

### FIRE

The Lennard-Jones Building Fire Drill follows at the end of this handbook.

- Make sure that you are familiar with the General University "Instructions in case of Fire" (posted on doors and on the laboratory walls) and with the more detailed Lennard-Jones Building Evacuation Procedures (contained in the Fire Drill at the end of this handbook).
- The Lennard-Jones Building has two alarm systems; you must familiarise yourself with these alarms and note the following instructions:

**THE FIRE ALARM IS A CONTINUOUSLY SOUNDING SIREN.**

**The entire building MUST be evacuated if the siren sounds.**

- Make sure that you are familiar with the operation of the fire extinguishers; **YOU MUST** attend one of the University's Extinguisher Demonstration events. Avoid holding the extinguisher nozzle too close to the flame. Only use an extinguisher when appropriate; some fires can be made worse by the indiscriminate use of an extinguisher. Quite often, turning off Bunsen flames and using a fire blanket may be more appropriate. Using water on an immiscible solvent fire is dangerous.

## INJURY

- If you get any toxic or corrosive material on yourself the best general procedure is to wash it off immediately with copious amounts of water. Make sure that you know the location of the emergency showers. Always seek first aid help.
- If you receive any burns or cut yourself or swallow any material which is at all toxic (this could be virtually anything in the laboratory) you must seek first aid help immediately. Make sure that you know the location of the first-aiders and the eye baths.

The current first-aiders are:

Phil Callaghan	LJ 1.09	Tel.33853
Vicki Cartwright	LJ 1.60	Tel.37180
Amy Cowles	LJ 1.60	Tel.37180
Monica Heaney	LJ0.16	Tel.33033
John Staniforth	LJ0.04A	

This list is repeated on signs posted on all doors within the building and on the teaching laboratory walls.

- If you have an allergic reaction to any material or feel unwell in any way during lab hours see a demonstrator immediately. If this happens out of hours go to the Accident and Emergency Unit at your local hospital (North Staffordshire Royal Infirmary or Leighton Hospital) and tell them where you were working, what chemicals you were using and who was in charge.

## SPILLAGES

- If you spill any toxic material (e.g. mercury, concentrated acids or alkali) notify the technician immediately. Do not attempt to clean up the spillage yourself.

## Fume Cupboards

All experiments involving toxic vapours must be carried out in a fume cupboard. Modern fume cupboards have a balanced flow of air, a failure warning system and a maximum sash opening. Some fume cupboards are labelled with face velocities for various openings; for all work within any fume cupboard a face velocity of 100 ft/min is recommended. You must work with the sash as low as practicable at all times. Do not put your head unnecessarily inside the fume cupboard when making adjustments to equipment.

## Unattended Experiments

A completed COSHH form that also includes the unattended experiment form must accompany any experiment that needs to be left unattended between laboratory periods. This form must be signed by a demonstrator, or member of staff (your supervisor in the case of the final year projects) and the laboratory technician. Do not forget that three copies of the COSHH form will be required (see earlier section).

## Disposal of Waste

The following are examples of materials that must never be put down the sink:

- mercury - return to mercury residue bottle,
- liquid nitrogen - allow to evaporate,
- non-aqueous solvents - each laboratory is equipped with waste solvent containers. Do not mix halogenated and non-halogenated waste solvents as some of these mixtures are dangerous and are expensive to dispose of.



Dilute aqueous solutions and suspensions of solids may be disposed of down the sink if they are relatively non-toxic. They must be washed down with copious amounts of water.

Harmless solids should be placed in a plastic bag. Ensure that the bag is closed firmly and put it in an appropriate container.

When you need to dispose of material not covered by the above categories you must seek advice from a demonstrator or technician as such material may need to be stored in a separate container. After you have decontaminated glassware *etc.* which has contained particularly toxic material leave it in the fume cupboard with a label giving your name, the date and the nature of the toxic material and ask the technician to countersign this.

## **Compressed Gases**

Before using any cylinder of compressed gas you must be instructed in its correct use by a demonstrator or laboratory technician.

## Electrical Safety

- **ALL MAINS-POWERED ELECTRICAL EQUIPMENT MUST CARRY AN UP-TO-DATE SAFETY CERTIFICATE** and should display a safety re-test date. If a test date has expired, the item must be returned for re-testing.
- **LIVE WORKING IS PROHIBITED EXCEPT BY APPROVED STAFF IN APPROVED LOCATIONS THAT HAVE THE APPROPRIATE SAFETY FACILITIES.** Live working means working on equipment where there are exposed conductors at voltages in excess of 50V AC or DC, or at lower voltages where large currents may flow. Live working is only permissible when there is no alternative and then only by specially trained and experienced staff using the required facilities.
- **YOU MUST NOT CARRY OUT ANY REPAIRS OR ALTERATIONS OF ELECTRICAL EQUIPMENT** and you may not remove equipment covers even for inspection or diagnosis. Defective equipment should be reported immediately to the technician.
- **IF YOU CONSTRUCT EQUIPMENT POWERED BY MAINS ELECTRICITY AS PART OF A PROJECT, IT MUST BE INSPECTED BY A TECHNICIAN BEFORE IT IS CONNECTED TO THE MAINS ELECTRICITY SUPPLY. IT MUST BE FULLY ENCLOSED AND MUST COMPLY WITH RELEVANT SAFETY STANDARDS.** Laboratory staff will advise on requirements for design and construction if required.
- **ELECTRICAL EQUIPMENT SHOULD NEVER BE TOUCHED WITH WET OR DAMP HANDS, NOR WHEN EITHER IT OR YOU ARE STANDING ON A DAMP SURFACE.**
- Before use, all wiring to portable equipment, e.g. soldering irons, etc., should be examined before use and if not in a safe condition the equipment should be returned immediately to the technician for repair.
- **WHEREVER POSSIBLE, KEEP ALL WIRING OFF THE BENCH TOP.** This is particularly important where a hot soldering iron is in use or there is

## Water

All water taps must be turned off when not in use, particularly overnight. Strict observation of this requirement is necessary to prevent flooding and also to reduce water consumption. Where apparatus is connected for long periods to a water supply the connections should be secured with hose clips or wire and the tubing regularly examined to ensure that it is in good condition. The lowest flow rate consistent with efficient cooling should be chosen.

The laboratory water supply is obtained from storage tanks and may be contaminated. **DO NOT DRINK THE WATER IN THE LABORATORY OR USE IT FOR WASHING OPEN WOUNDS.** Drinking water is obtainable from labelled taps in some rooms within the Lennard-Jones Building e.g. LJ 0.10 and LJ 1.21.

In the event of a fault in the water supply notify the technician immediately. Dripping water pump taps must also be reported.

## Laboratory Refrigerators

The only materials which may be stored in the refrigerators, are those which are unstable at room temperature, reaction mixtures, recrystallising solutions and NMR solvents. Permission must be sought before leaving any chemical in the refrigerator. All containers must be fitted with airtight covers and must be clearly labelled with the description of the contents, the name of the owner and the date. A COSHH form should also be completed and accompany the container. Unlabelled material will be removed and destroyed.

**FOODSTUFFS MUST NOT BE STORED IN THE REFRIGERATORS. NO MATERIAL MAY BE STORED IN THE ICE-MAKING MACHINE.**

## **Drying Cabinets, Ovens and Furnaces**

Chemicals must not be placed in a drying cabinet without the approval (and signature) of a member of the academic, or support staff.

The drying ovens must only be used for evaporating water. No sealed vessel may be placed in such ovens. If you wish to alter the temperature of an oven consult a technician. All vessels placed in an oven must be labelled in the usual way and must be accompanied by a COSHH form. You must consult a member of the academic staff, support staff or a demonstrator before using a furnace.

## **Flammable Solvents**

All bottles of over 500 cm<sup>3</sup> capacity containing flammable solvent must be carried in a suitable carrier and must be returned to a flame-proof cabinet immediately after use. When transferring flammable solvents from 2.5 litre bottles contained in the flame-proof cabinets you should transfer only the amount that you will require for your experiment and no more.

## **Experiments carried out in Other Laboratories**

If you need to carry out an experiment in a laboratory other than the teaching laboratory, you must obtain prior approval from your supervisor (finalists only) or the member of staff in charge of your laboratory, and the member of staff in charge of the other laboratory.

**YOU MUST NOT SET UP AN EXPERIMENT IN A LABORATORY OTHER THAN YOUR OWN UNLESS A DEMONSTRATOR IS PRESENT.**

## Solder Flux Fumes

### Asthma sufferers must pay careful attention to this warning

Solder used for the assembly of electronic circuits is usually multicore solder. The solder, a tin-lead alloy with a melting point of about 300 degrees Celsius, contains cores (threads) of flux. The flux melts just before the solder does and dissolves oxide and other contaminants on the metal surfaces to be joined. Fumes are given off in the process and from the hot iron afterwards. The traditional flux in multicore solder is *rosin*, also called *colophony*. Fumes from this flux are harmful to eyes and to lungs. Irritation by these fumes can precipitate an asthma attack. Continued exposure can cause sensitisation. Where possible, multicore solder containing alternative and less harmful fluxes is used in the teaching laboratories. However, these are less aggressive and in some situations there is no practical alternative to *rosin* flux.

Exposure to fumes is easily reduced to very low levels by means of the following precautions, which must be regarded as essential; these precautions are included in the C.O.S.H.H. assessment which is displayed in the laboratory.

1. Solder only in a well ventilated space. To avoid the accumulation of fumes, use a filter-fan unit to draw the fumes away from you and to absorb them in a charcoal filter. The best location for the filter-fan unit is on the bench behind the circuit board on which you are working and oriented so that the exhaust air blows away from other students working nearby.

2. Before parking the soldering iron in its holder, wipe the tip on the damp sponge provided in the holder. Most fumes are emitted from the solder left on the iron after a joint is made!

3. Avoid hunching over your work while soldering so that fumes do not rise into your face.

Polyurethane-insulated copper wire, when a soldering iron is used to burn off the insulation prior to soldering, also emits fumes that are toxic, and the same precautions must be adopted.

### **Avoidance of Hazard to Hearing when using headphones**

Some experiments require the use of headphones. Do not use high level (very loud) sound levels when using headphones as hearing may be damaged easily. Particular care is required when prototype equipment is being evaluated as switch operation and loose connections can give rise to very loud clicks and other very loud sounds. It is a good idea to develop the habit of wearing headphones partly off the ears except when careful listening is needed. In general, where the wearing of headphones is involved, switch on power supplies and turn the signal source or volume control down to minimum amplitude before connecting and wearing headphones. Raise the output level once the headphones are in position.

## Local Rules for the Use and Storage of Sealed Radioactive Sources

1. All sealed radioactive sources when not in use shall be kept in the two locked cupboards for radioactive sources.. Access to these cupboards is restricted to Laboratory Staff, Mr P. Callaghan, the School Radiation Protection Supervisor (DRPS), Dr R Jones.
  
2. Issue of radioactive sources to students shall only be carried out with the permission of the DRPS or deputy. The two categories of issue are:
  - (i) for the use in regularly held undergraduate laboratory classes and
  - (ii) irregular loan to members of University Staff on University business.
  
3. The appropriate and relevant radioactive source may be issued by the Laboratory Staff (as above) for the purpose of approved undergraduate classes (category (i)), subject to the restriction that the appropriate member of staff responsible for the conduct of the laboratory class is present. The Laboratory Staff will return the sources to the cupboard at the end of the laboratory class.
  
4. The Laboratory Staff may issue radioactive sources for category (ii) if the DRPS has given permission. A record of the loan of the source must be recorded in the loan book. The person borrowing the source must sign for the source and undertake to use it in a safe manner and to ensure that it is returned to the Laboratory Staff and that its return is recorded in the loan book.

## Guidelines for the Use of Sealed Radioactive Sources in Undergraduate Laboratories.

### General

- At the start of a laboratory session, the radioactive sources will be issued to the lecturer in charge of the laboratory class. This lecturer is then the “authorised” user of the sources and will take responsibility for usage of the sources during the laboratory session.
- The lecturer in charge will allocate the sources to the appropriate experiments, and will be responsible for ensuring that all sources are used responsibly and returned at the end of the session.
- Following issue of the sources to the lecturer, these sources should only be allocated to the experiment at the time they are needed and should be removed from the apparatus promptly at the end of the measurement. This is to ensure the minimum exposure to students in the laboratory. Students must inform the lecturer when they no longer require the source so that it can be removed from the apparatus.
- On issue and on return, sources should be visually inspected by the lecturer in charge to check for signs of damage.

### Use of the sources

- Exposure to ionising radiation must be kept as low as reasonably achievable. This may be achieved by considering the four variables:

<b>Source activity</b>	(use minimum activity necessary)
<b>Time</b>	(minimise the exposure time)
<b>Distance</b>	(maximise the distance from the source)
<b>Shielding</b>	(use adequate shielding for radiations concerned)

- Radioactive sources **must not** be directly handled. Tweezers must be used to pick up sources and boxes used to transport them.



- In general, only the lecturer, demonstrator or technician should handle the sources when they are in use during an experiment. Students may ONLY handle these sources when given specific permission to do so by the lecturer in charge. This will only be in very exceptional circumstances (e.g. final year project work)
- To avoid damage to the source holders (and thus avoiding damage to the source's seal which may result in contamination) the following procedures must be followed.
  1. Care must be taken in the handling of the sources. In particular, the active surface must not be scratched or otherwise disturbed.
  2. When using tweezers, the tweezers must come in contact *only* with a part of the source holder away from the location of the source itself (the source is normally located in a small spot in the centre of the holder).
  3. When placing sources into lead castles, care should be taken to ensure that the source surface does not scrape on the lead castle walls.
  4. If it becomes necessary to attach a source to some equipment through use of tape or other adhesive materials (e.g. Blue-Tack) then the adhesive material must not come in contact with the part of the source holder where the source is located. The adhesive material should be checked for contamination after use.
  5. If a source is dropped, then it must be considered to have been possibly damaged, and the lecturer in charge should be informed. **THE SOURCE MUST NOT BE PICKED UP OR APPROACHED UNTIL A CONTAMINATION CHECK HAS BEEN PERFORMED BY THE DRPS.**
  6. If damage to the integrity of the seal of the source is suspected, no matter how small the possibility, then the lecturer in charge must be informed immediately, and the area checked for contamination. The source will be checked by the DRPS, and will not be used again until this check has taken place.

- Radioactive sources used in the laboratory should normally be in shielded containers (e.g. lead castles). For any unshielded source, notices must be used to define an exclusion area around the source. These can be obtained from the lecturer in charge or the technician.
- If a source (unshielded or shielded) is left unattended for an appreciable period (e.g. in project work), the advice of the School's Radiation Safety must be sought, and the written permission of the lecturer in charge must be obtained. Advisory notices and/or labels must be used to indicate the location and identity of the source. These can be obtained from the lecturer in charge or the technician. One such notice must be on the outside of the doors to the laboratory that can be seen by persons entering the laboratory.

# FIRE DRILL

## Equipment Location

Familiarise yourself with the location of

- the nearest fire exit route from your normal working area,
- fire alarm points,
- telephones (both internal and external lines),
- the First Aiders and the emergency first aid box,
- fire extinguishers and fire blankets, and
- emergency showers.

## Fire Fighting Procedure

In the event of fire

- **DO NOT TAKE ANY PERSONAL RISKS.** Only if the fire is small, tackle with an extinguisher and warn neighbouring workers.
- If it seems that the fire might get out of control, sound the fire alarm (alarm points are located on all main corridors and escape routes) and evacuate the building.
- Call for the fire brigade (dial 9-999 from an internal PAX telephone, 999 from an external telephone), stating clearly that the fire is in the Lennard-Jones Building at Keele University.
- Call 24 hour security in the Darwin Building (888) and state clearly where the fire is. Security personnel will guide the Fire Brigade to the building.

## Evacuation Procedure

- The fire doors on all main corridors are normally held open by magnetic catches connected to the Fire Alarm system. When the alarm is activated these doors are automatically released from the catches and will close slowly. The doors can still be opened manually to enable safe and rapid evacuation from the building.

- **DO NOT USE THE SERVICE LIFT IF THE FIRE ALARM SOUNDS.**
- If time permits, turn off all equipment and services and close all windows and doors behind you as you leave the building.

### **Assembly point**

- Assemble on the grassed area outside the front entrance of the Lennard-Jones Laboratories building. **This area will be the control point during the evacuation of the Lennard-Jones Laboratories building.**
- Report any missing persons known to have been in the Lennard-Jones Building to a Fire Marshall at the control point; all Fire Marshalls will be wearing reflective tabards and some will be stationed around the Lennard-Jones Building.
- The person responsible for raising the alarm must report to a Fire Marshall at the control point.
- Keep the access road opposite the main entrance doors clear at all times so that Fire Brigade appliances may approach the building without obstruction.
- Fire Marshalls and School staff will control all entrances to the building during the emergency. **Re-entry to the building will not be allowed until the Senior Fire Brigade Officer gives permission to do so.**

**Appendix 1****UNDERGRADUATE LABORATORY  
CODE OF PRACTICE**

1. No eating/drinking in the laboratory at any time
2. All bags and coats may be stored under the benches, provided they do not obstruct the floor between the benches, seat and feet.
3. Mobile phones and MP3 players must be turned off at all times.
4. No open toe shoes/sandals or high heels should be worn in the laboratory
5. All long hair must be tied back
6. Do not work in the laboratory unless a demonstrator or a member of staff is present.
7. Sign the attendance sheet at the start of the Lab session
8. Work areas must be left clean and tidy at the end of the session
9. All waste must be disposed of safely
10. If you need to work out of laboratory hours this must be approved by a lab technician. (Normal lab hours are 10.00-13.00 and 14.00-17.00)
11. You must read and comply with the guidelines in the Physics Safety Handbook

<b>Please sign below and hand into a Lab Technician</b>	
Student Name:	
Date:	Signature:

Technician name/Signature
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