

SCHOOL OF PHYSICAL AND GEOGRAPHICAL SCIENCES

Safety Handbook for Chemistry and Forensic Science Undergraduates



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School of Physical and Geographical Sciences

Safety Handbook for Chemistry and Forensic Science Undergraduates

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Introduction

This handbook is a summary of the main aspects of safety policy within the School of Physical and Geographical Sciences that apply to undergraduate students taking Chemistry modules. 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 Departmental Safety Advisor or his deputy.

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

- 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.

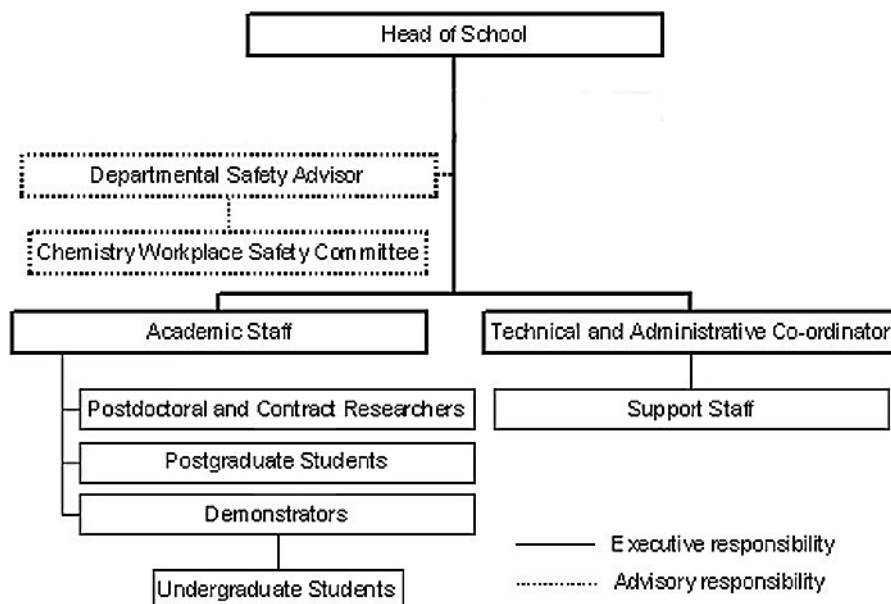
Failure to observe any of the above points may result in legal action being taken against you by Health and Safety Executive inspectors.

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 Laboratory

The chain of responsibility within the School may be represented as follows:



Lennard-Jones Laboratories Workplace Safety Committee

The composition of this committee is as follows:

- Head of School
- Departmental Safety Advisor
- Technical and Administrative Co-ordinator
- Departmental Radiation Protection Advisor
- Departmental Laser Safety Advisor
- Representative of the AUT
- Representative of the MSF
- Postgraduate Students Representative
- Undergraduate Students Representative

The committee normally meets four times a year to discuss any safety matter 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.

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 within the Lennard-Jones Laboratories.

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 a discussion concerning safety matters with P1/T1 and P3/T3 students.

Departmental Inspection Team

The Departmental Inspection Team is responsible for inspecting all parts of the Lennard-Jones Laboratories at regular intervals. Any safety defect 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 or 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 Laboratories, 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 problem has been satisfactorily resolved:

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 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 to your locker after use (having first cleaned it adequately). Return any borrowed equipment to the laboratory technicians immediately after use.

- **LEAVE ALL BAGS, COATS, ETC., OUTSIDE THE LABORATORY.**

Designated cloakrooms and areas are provided within the Lennard-Jones Laboratories; please consult a demonstrator for more information on these facilities.

- **MAKE SURE THAT THE FLOOR BETWEEN THE BENCHES IS CLEAR, THAT LOCKER DOORS ARE KEPT SHUT AND THAT ALL EXITS FROM THE LABORATORY YOU ARE IN ARE UNOBSTRUCTED.**

- **MAKE SURE THAT YOUR EXPERIMENT DOES NOT CONSTITUTE A RISK TO OTHER STUDENTS OR STAFF.**

If you are working with a dangerous material (normally in a fume cupboard) let other students working nearby know about this.

- **NEVER PIPETTE BY MOUTH.**
- **DO NOT RETURN UNUSED MATERIAL TO THE STOCK BOTTLE FROM WHERE IT WAS ORIGINALLY OBTAINED.**

Treat such unused material as waste.

- **DO NOT APPLY EXCESSIVE FORCE TO DISASSEMBLE GLASS JOINTS.**

If you have to apply any force to glassware wrap a piece of towelling around your hand. Cuts resulting from shattering glass during this type of operation are the most common type of accident in any Chemistry laboratory.

- **NEVER TASTE ANY CHEMICAL SAMPLE.**
- **DO NOT 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 a heating mantle.

- **CONSULT A DEMONSTRATOR BEFORE WORKING WITH ANY HIGHLY TOXIC OR HAZARDOUS SUBSTANCE.**

If you need to work with highly toxic or hazardous substances (e.g. cyanide or large volumes of flammable solvent), a demonstrator or member of staff must be consulted beforehand to ensure that adequate precautions are taken.

- **ALWAYS READ THE INSTRUCTIONS PROVIDED.**

Many pieces of equipment (e.g. spectrophotometers, chromatographs, etc.) 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 THE 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

- **YOU MUST ALWAYS WEAR A LAB COAT**

The coat must be made from 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 ALWAYS WEAR SUITABLE EYE PROTECTION.**

This will normally be the safety spectacles issued to you. 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 technicians.

- **IF NECESSARY, WEAR GLOVES.**

Students must wear suitable protective gloves when handling material that is corrosive or dangerous by skin adsorption or capable of causing allergic reaction. Gloves must also be worn when washing equipment that may contain such material. If you believe that you are particularly prone to allergic reactions you must wear gloves at all times.

Gloves must be carefully washed with soap and water immediately after any contamination. They must not be worn if they show signs of deterioration or contamination.

Some gloves may be permeable to common solvents and other reagents. As a result you should seek advice from a technician concerning the most suitable type of glove to use whenever you are to handle dangerous material.

Added protection may be obtained by wearing disposable gloves instead of non-disposable gloves. This will help to prevent the problems associated with inadequate decontamination.

When leaving the laboratory you should remove your gloves and wash your hands. Gloves should not be worn when using the computers in the analytical laboratories.

- **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 stirrer motors and rotary evaporators. Even relatively short hair can be a significant hazard.

- **YOU MUST NOT EAT, DRINK OR SMOKE IN ANY LABORATORY**

In addition to the fire and health hazards associated 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.

- **YOU MUST WEAR SUITABLE CLOTHING WHEN IN THE LABORATORY.**

You need to have legs and feet covered at all times (no tights, leggings, shorts, skirts, ballet pumps, or sandals). If you know that you have a laboratory session, wear suitable clothing; you will be refused entry to a laboratory class if your clothing does not offer suitable protection.

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 chemical education that you must learn to assess the dangers in an experiment and what steps are

necessary to make any equipment safe. An experiment that is unsafe is conceived in other ways as well.

You will be required to complete a COSHH risk assessment form before beginning any experiment; copies of correctly completed forms will usually be available in the laboratory for reference. A member of staff or demonstrator 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.

Normally, 1st and 2nd year students will only be required to complete one copy of the form and include this in their practical report. Experiments left out of designated lab session must have three copies of the COSHH risk assessment form. 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. The third copy must be deposited in the Safety Room, located off the foyer of the Lennard-Jones Laboratories (opposite the reception).

EC 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 labelling and is repeated in the product description as listed in any catalogue.

In a typical example of a product description in a catalogue, the R and S numbers are listed as the last item of the product description. They may be listed as individual numbers or, more often, as combinations of several R and S phrases that, when combined, describe succinctly the potential risk and safety measures which must be taken when handling the substance. It is obvious that R and S numbers can be an invaluable aid when completing COSHH risk assessments. Simply find the material to be used in a catalogue (Aldrich, Lancaster, *etc.*), locate the R and S numbers associated with the material in the product description and determine the corresponding Risk and Safety Phrases which describe the material. A complete listing of the EC Risk and Safety Phrases appears in Appendix 1.

Other references that may aid hazard and risk assessments are available from the technicians:

1. C. R. C. Handbook of Chemistry and Physics.
2. The Merck Index .

Also, much safety information is available on the Internet. Look for the MSDS sheets provided by the chemical manufacturers and suppliers on their web sites. The best place to start is the Sigma Aldrich web site:

<http://www.sigmaaldrich.com/>

Emergency Procedures

FIRE

The Lennard-Jones Laboratories Fire Drill follows at the end of this handbook page 31.

- 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 Laboratories Evacuation Procedures (contained in the Fire Drill at the end of this handbook).
- The Lennard-Jones Laboratories 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.

THE EMERGENCY FIRST AID BELL IS AN INTERMITTENTLY RINGING BELL.

This alarm tells first aiders that someone urgently requires first aid.

The building DOES NOT have to be evacuated when this bell sounds.

- You are not expected to attempt to tackle a fire. In the event of a fire you should alert a member of staff and leave the laboratory.
- 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. Avoid holding the extinguisher nozzle too close to the flame.

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 aid boxes and the eye baths.

The current first aiders are (2013-2014):

| | |
|---------------------|---------|
| Phil Callaghan | LJ1.09 |
| Victoria Cartwright | LJ1.60b |
| Amy Cowles | LJ1.60b |
| Monica Heaney | LJ0.16 |
| Dr. John Staniforth | LJ0.04a |
| Nicola Jervis | LJ1.84 |

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

- See a demonstrator immediately if you have an allergic reaction to any material or feel unwell in any way during laboratory hours. If this happens out of hours go to the Accident and Emergency Unit at your local hospital (University Hospital of North Staffordshire (City General Hospital) 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

The 'Unattended experiments' section of a COSHH form (as well as the rest of the form) must be completed for any experiment that needs to be left unattended between laboratory sessions. This form must be signed by a member of staff. Do not forget that three copies of the COSHH form will be required (see page 11).

Distillations and Work with Reduced Pressures

All distillations under reduced pressure should be carried out in a fume cupboard wherever possible and suitably shielded: seek advice from a demonstrator on the correct method of shielding. All glassware, especially rotary evaporator flasks, to be used in reduced pressure distillations should be checked for cracks before use. Do not use flat bottomed flasks or conical flasks unless they are specially designed for vacuum work. When carrying out any distillation or reflux operation, always make sure that the condenser system is operating correctly before heating.

Vacuum manifolds should not be left open to the atmosphere when liquid nitrogen cooling traps are still in position around the condensing apparatus.

Disposal of Waste

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

- mercury - return waste to the mercury residue bottle
- liquid nitrogen – simply allow this 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.

Some Examples of Dangerous Materials

- **Liquid Bromine**

Wear gloves and goggles and work in a fume cupboard. If you do spill any bromine on yourself wash it off immediately with water followed by aqueous sodium thiosulphate solution.

- **Cyanides**

Undergraduates should not normally use cyanides in their work. The departmental safety advisor must be consulted beforehand to ensure that

adequate precautions are followed. Cyanides must not be allowed to come into contact with acid. Dispose of residues to a special, labelled residue bottle. Wash your hands thoroughly after use.

- **Sodium**

Before using sodium for the first time you must have instruction in its safe use. Sodium must not come into contact with your hands and must on no account be allowed to come into contact with water. The technician will dispose of sodium residues.

- **Compressed gases**

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

- **Fuming nitric and sulphuric acids**

These must be used in a fume cupboard. Wear protective gloves and goggles.

Electrical Safety

- **YOU MUST NOT CARRY OUT ANY REPAIRS OR ALTERATIONS OF ELECTRICAL EQUIPMENT.**

Defective equipment should be returned immediately to the technician.

- **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 communal equipment, e.g. stirrers, hotplates, heating mantles etc., should be examined 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 the equipment is being used in a fume cupboard and is more likely to be exposed to spillages of water and corrosive chemicals. The electrical controls (rheostats, speed regulators, etc.) should also be raised clear of the bench top and located out of the way of possible spillages. Wiring must not be allowed to become entangled with rubber tubing carrying water or to trail through the drainage troughs.

- **Each piece of electrical equipment should display a safety test date. Any item whose test date has expired must be given to a technician.**

Water

Care must be taken to ensure that all water taps are 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.

Each high pressure water pump consumes water at a rate of up to ten litres per minute; it is essential, therefore, that they should be used only for the minimum time necessary.

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 UNLESS INSTRUCTED TO DO SO.**

In the event of a fault in the water supply notify the technician immediately. Dripping 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 or oven without the approval (and, if necessary, the signature) of a member of the academic or support staff.

The drying ovens must only be used for evaporating water or solvent. No sealed vessel may be placed in such ovens. Contact a technician if you wish to alter the temperature of an oven. 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 or support staff or a demonstrator before using a furnace.

Flammable Solvents

All bottles of over 500 cm³ 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 research project supervisor or the member of staff in charge of the other laboratory.

YOU MUST NOT SET UP AN EXPERIMENT IN A LABORATORY OTHER THAN THE TEACHING LABORATORY UNLESS A MEMBER OF STAFF OR A DEMONSTRATOR IS PRESENT.

Appendix 1

EC Risk and Safety Phrases

Hazardous products are marked with R and S numbers as assigned to the Risk and Safety phrases under EC legislation.

Indication of Particular Risks

| | |
|-----|--|
| R1 | Explosive when dry. |
| R2 | Risk of explosion by shock, friction, fire or other sources of ignition. |
| R3 | Extreme risk of explosion by shock, friction, fire or other sources of ignition. |
| R4 | Forms very sensitive explosive metallic compounds. |
| R5 | Heating may cause an explosion. |
| R6 | Explosive with or without contact with air. |
| R7 | May cause fire. |
| R8 | Contact with combustible material may cause fire. |
| R9 | Explosive when mixed with combustible material. |
| R10 | Flammable. |
| R11 | Highly flammable. |
| R12 | Extremely flammable. |
| R14 | Reacts violently with water. |
| R15 | Contact with water liberates extremely flammable gases. |
| R16 | Explosive when mixed with oxidising substances. |
| R17 | Spontaneously flammable in air. |
| R18 | In use, may form flammable/explosive vapour-air mixture. |
| R19 | May form explosive peroxides. |
| R20 | Harmful by inhalation. |
| R21 | Harmful in contact with skin. |
| R22 | Harmful if swallowed. |

| | |
|-----|---|
| R23 | Toxic by inhalation. |
| R24 | Toxic in contact with skin. |
| R25 | Toxic if swallowed. |
| R26 | Very toxic by inhalation. |
| R27 | Very toxic in contact with skin. |
| R28 | Very toxic if swallowed. |
| R29 | Contact with water liberates toxic gas. |
| R30 | Can become highly flammable in use. |
| R31 | Contact with acids liberates toxic gas. |
| R32 | Contact with acids liberates very toxic gas. |
| R33 | Danger of cumulative effects. |
| R34 | Causes burns. |
| R35 | Causes severe burns. |
| R36 | Irritating to eyes. |
| R37 | Irritating to respiratory system. |
| R38 | Irritating to skin. |
| R39 | Danger of very serious irreversible effects. |
| R40 | Possible risk of irreversible effects. |
| R41 | Risk of serious damage to eyes. |
| R42 | May cause sensitisation by inhalation. |
| R43 | May cause sensitisation by skin contact. |
| R44 | Risk of explosion if heated under confinement. |
| R45 | May cause cancer. |
| R46 | May cause heritable genetic damage. |
| R48 | Danger of serious damage to health by prolonged exposure. |
| R49 | May cause cancer by inhalation. |
| R50 | Very toxic to aquatic organisms. |
| R51 | Toxic to aquatic organisms. |

| | |
|-----|---|
| R52 | Harmful to aquatic organisms. |
| R53 | May cause long-term adverse effects in the aquatic environment. |
| R54 | Toxic to flora. |
| R55 | Toxic to fauna. |
| R56 | Toxic to soil organisms. |
| R57 | Toxic to bees. |
| R58 | May cause long-term adverse effects in the environment. |
| R59 | Dangerous for the ozone layer. |
| R60 | May impair fertility. |
| R61 | May cause harm to the unborn child. |
| R62 | Possible risk of impaired fertility. |
| R63 | Possible risk of harm to the unborn child. |
| R64 | May cause harm to breastfed babies. |
| R65 | Harmful: may cause lung damage if swallowed. |
| R66 | Repeated exposure may cause skin dryness or cracking. |
| R67 | Vapours may cause drowsiness and dizziness. |
| R68 | Possible risk of irreversible effects. |

Combination of Particular Risks

| | |
|-----------|---|
| R14/15 | Reacts violently with water liberating extremely flammable gases. |
| R15/29 | Contact with water liberates toxic, extremely flammable gases. |
| R20/21 | Harmful by inhalation and in contact with skin. |
| R20/21/22 | Harmful by inhalation, in contact with skin and if swallowed. |
| R20/22 | Harmful by inhalation and if swallowed. |
| R21/22 | Harmful in contact with skin and if swallowed. |
| R23/24 | Toxic by inhalation and in contact with skin. |
| R23/24/25 | Toxic by inhalation, in contact with skin and if swallowed. |

| | |
|--------------|--|
| R23/25 | Toxic by inhalation and if swallowed. |
| R24/25 | Toxic in contact with skin and if swallowed. |
| R26/27 | Very toxic by inhalation and in contact with skin. |
| R26/27/28 | Very toxic by inhalation, in contact with skin and if swallowed. |
| R26/28 | Very toxic by inhalation and if swallowed. |
| R27/28 | Very toxic in contact with skin and if swallowed. |
| R36/37 | Irritating to eyes and respiratory system. |
| R36/37/38 | Irritating to eyes, respiratory system and skin. |
| R36/38 | Irritating to eyes and skin. |
| R37/38 | Irritating to respiratory system and skin. |
| R39/23 | Toxic: danger of very serious irreversible effects through inhalation. |
| R39/23/24 | Toxic: danger of very serious irreversible effects through inhalation and in contact with skin. |
| R39/23/24/25 | Toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed. |
| R39/23/25 | Toxic: danger of very serious irreversible effects through inhalation and if swallowed. |
| R39/24 | Toxic: danger of very serious irreversible effects in contact with skin. |
| R39/24/25 | Toxic: danger of very serious irreversible effects in contact with skin and if swallowed. |
| R39/25 | Toxic: danger of very serious irreversible effects if swallowed. |
| R39/26 | Very toxic: danger of very serious irreversible effects through inhalation. |
| R39/26/27 | Very toxic: danger of very serious irreversible effects through inhalation and in contact with skin. |
| R39/26/27/28 | Very toxic: danger of very serious irreversible effects through inhalation, in contact with skin and if swallowed. |
| R39/26/28 | Very toxic: danger of very serious irreversible effects through inhalation and if swallowed. |
| R39/27 | Very toxic: danger of very serious irreversible effects in contact with skin. |

| | |
|--------------|--|
| R39/27/28 | Very toxic: danger of very serious irreversible effects in contact with skin and if swallowed. |
| R39/28 | Very toxic: danger of very serious irreversible effects if swallowed. |
| R40/20 | Harmful: possible risk of irreversible effects through inhalation. |
| R40/20/21 | Harmful: possible risk of irreversible effects through inhalation and in contact with skin. |
| R40/20/21/22 | Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed. |
| R40/20/22 | Harmful: possible risk of irreversible effects through inhalation and if swallowed. |
| R40/21 | Harmful: possible risk of irreversible effects in contact with skin. |
| R40/21/22 | Harmful: possible risk of irreversible effects in contact with skin and if swallowed. |
| R40/22 | Harmful: possible risk of irreversible effects if swallowed. |
| R42/43 | May cause sensitisation by inhalation and skin contact. |
| R48/20 | Harmful: danger of serious damage to health by prolonged exposure through inhalation. |
| R48/20/21 | Harmful: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin. |
| R48/20/21/22 | Harmful: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. |
| R48/20/22 | Harmful: danger of serious damage to health by prolonged exposure through inhalation and if swallowed. |
| R48/21 | Harmful: danger of serious damage to health by prolonged exposure in contact with skin. |
| R48/21/22 | Harmful: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. |
| R48/22 | Harmful: danger of serious damage to health by prolonged exposure if swallowed. |
| R48/23 | Toxic: danger of serious damage to health by prolonged exposure through inhalation. |
| R48/23/24 | Toxic: danger of serious damage to health by prolonged exposure through inhalation and in contact with skin. |

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| R48/23/24/25 | Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with skin and if swallowed. |
| R48/23/25 | Toxic: danger of serious damage to health by prolonged exposure through inhalation and if swallowed. |
| R48/24 | Toxic: danger of serious damage to health by prolonged exposure in contact with skin. |
| R48/24/25 | Toxic: danger of serious damage to health by prolonged exposure in contact with skin and if swallowed. |
| R48/25 | Toxic: danger of serious damage to health by prolonged exposure if swallowed. |
| R50/53 | Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. |
| R51/53 | Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. |
| R52/53 | Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. |
| R68/20 | Harmful: possible risk of irreversible effects through inhalation. |
| R68/20/21 | Harmful: possible risk of irreversible effects through inhalation and in contact with skin. |
| R68/20/21/22 | Harmful: possible risk of irreversible effects through inhalation, in contact with skin and if swallowed. |
| R68/20/22 | Harmful: possible risk of irreversible effects through inhalation and if swallowed. |
| R68/21 | Harmful: possible risk of irreversible effects in contact with skin. |
| R68/21/22 | Harmful: possible risk of irreversible effects in contact with skin and if swallowed. |
| R68/22 | Harmful: possible risk of irreversible effects if swallowed. |

Indication of Safety Precautions Required

- S1 Keep locked up.
- S2 Keep out of the reach of children.
- S3 Keep in a cool place.
- S4 Keep away from living quarters.
- S5 Keep contents under...(appropriate liquid to be specified by the manufacturer).
- S6 Keep under...(inert gas to be specified by the manufacturer).
- S7 Keep container tightly closed.
- S8 Keep container dry.
- S9 Keep container in a well-ventilated place.
- S12 Do not keep the container sealed.
- S13 Keep away from food, drink and animal feedingstuffs.
- S14 Keep away from...(incompatible materials to be indicated by the manufacturer).
- S15 Keep away from heat.
- S16 Keep away from sources of ignition - No smoking.
- S17 Keep away from combustible material.
- S18 Handle and open container with care.
- S20 When using do not eat or drink.
- S21 When using do not smoke.
- S22 Do not breathe dust.
- S23 Do not breathe vapour.
- S24 Avoid contact with skin.
- S25 Avoid contact with eyes.
- S26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.
- S27 Take off immediately all contaminated clothing.
- S28 After contact with skin, wash immediately with plenty of soap-suds.

- S29 Do not empty into drains.
- S30 Never add water to this product.
- S33 Take precautionary measures against static discharges.
- S35 This material and its container must be disposed of in a safe way.
- S36 Wear suitable protective clothing.
- S37 Wear suitable gloves.
- S38 In case of insufficient ventilation, wear suitable respiratory equipment.
- S39 Wear eye/face protection.
- S40 To clean the floor and all objects contaminated by this material, use...(to be specified by the manufacturer).
- S41 In case of fire and/or explosion do not breathe fumes.
- S42 During fumigation/spraying wear suitable respiratory equipment.
- S43 In case of fire, use...(indicate in the space the precise type of fire-fighting equipment. If water increases the risk, add "Never use water").
- S45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
- S46 If swallowed, seek medical advice immediately and show this container or label.
- S47 Keep at temperature not exceeding...°C (to be specified by the manufacturer).
- S48 Keep wet with...(appropriate material to be specified by the manufacturer).
- S49 Keep only in the original container.
- S50 Do not mix with...(to be specified by the manufacturer).
- S51 Use only in well ventilated areas.
- S52 Not recommended for interior use on large surface areas.
- S53 Avoid exposure - obtain special instructions before use.
- S56 Dispose of this material and its container at hazardous or special waste collection point.
- S57 Use appropriate container to avoid environmental contamination.

- S59 Refer to manufacturer/supplier for information on recovery/recycling.
- S60 This material and its container must be disposed of as hazardous waste.
- S61 Avoid release to the environment. Refer to special instructions/Safety data sheets.
- S62 If swallowed, do not induce vomiting: seek medical advice immediately and show this container or label.
- S63 In case of accident by inhalation, remove casualty to fresh air and keep at rest.
- S64 If swallowed, rinse mouth with water (only if the person conscious).

Combination of Safety Precautions Required

- S1/2 Keep locked up and out of reach of children.
- S3/7 Keep container tightly closed in a cool place.
- S3/9/14 Keep in a cool, well ventilated place away from...(incompatible materials to be indicated by the manufacturer).
- S3/9/14/49 Keep only in the original container in a cool, well ventilated place away from...(incompatible materials to be indicated by the manufacturer).
- S3/9/49 Keep only in the original container in a cool, well ventilated place.
- S7/8 Keep container tightly closed and dry.
- S7/9 Keep container tightly closed and in a well ventilated place.
- S20/21 When using, do not eat, drink or smoke.
- S24/25 Avoid contact with skin and eyes.
- S29/56 Do not empty into drains, dispose of this material and its container at hazardous or special waste collection point.
- S36/37 Wear suitable protective clothing and gloves.
- S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.
- S36/39 Wear suitable protective clothing and eye/face protection.
- S37/39 Wear suitable gloves and eye/face protection.

S47/49

Keep only in the original container at a temperature not exceeding...°C(to be specified by the manufacturer).

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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,
- fire extinguishers and fire blankets, and
- emergency showers.

Fire Fighting Procedure

In the event of fire

- **DO NOT TAKE ANY PERSONAL RISKS.** Do not tackle the fire with an extinguisher unless trained to do so. Call for help and warn other 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 telephone, 999 from any other landline or mobile telephone), stating clearly that the fire is in the Lennard-Jones Laboratories 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.**

- Only 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. **This area will be the control point during the evacuation of the building.**
- Report any missing persons known to have been in the building to a Fire Marshall at the control point; all Fire Marshalls will be wearing reflective tabards and some will be stationed around the perimeter of the 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.**