DEPARTMENT OF CHEMISTRY

"Inspiring the future"

SAFETY HANDBOOK

Departmental Safety Policy and Codes of Practice

2022 – 2024

Document Reference: HSE-UCL-CHEM-17 Version: 1.0 Date of Issue: 14th June 2023

INTRODUCTION

This document contains the safety code of practice that applies in the Chemistry Department, and is complementary to the UCL Departmental Statement on Safety Policy, which can be found here:

https://www.ucl.ac.uk/safety-services/policies/2022/jan/health-and-safety-policy

There is a procedure available which covers in detail the arrangements in the UCL Department of Chemistry for meeting the UCL Health and Safety Policy, which is reviewed annually

The practical basis of safety hinges on a good code of working practice in matters such as handling, storing and disposing of chemicals, room tidiness, provision and use of protective equipment and above all the intelligent recognition of the risks involved in what you are doing. The section on Assessment of Risks describes the general procedure for the assessment of risks and for the adoption of a code of practice for safe working that must be followed by every person who works in the Christopher Ingold Laboratories (CIB), the Kathleen Lonsdale Building (KLB) and Roberts Building.

The remainder of the document comprises notes, under headings arranged alphabetically, which aim to provide the basis of a code of practice for safe working. The notes will need to be supplemented from time to time to include experimental procedures which they do not yet cover, and any comments should be sent to the Departmental Safety Officer (DSO).

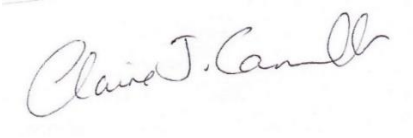
Membership of the Committee

See Safety Committee terms of reference later in this document

Professor Claire Carmalt	Head of Department (HoD) & Chair of the Committee
Dr Robert Wilson	Departmental Safety Officer (DSO)
Mr Alan Philcox	Technical Services Safety Representative
Mr Crosby Medley	Technical Services Safety Representative
Mr Jesel Gohil	Technical Services Safety Representative
Mr Joe Nolan	Building Manager/Senior Fire Marshal (FEM)
Dr Michael Parkes	Departmental Laser Supervisor
Professor Andrea Sella	Sustainability Officer
Dr Caroline Knapp	Deputy Safety Officer/Inorganic & Materials Section Representative
Dr Helen Allan	Organic Section Representative
Dr Kris Page	Inorganic & Materials Section Representative
Dr Vicky Hilborne	Teaching Committee Representative
Professor Tom Sheppard	KLB Safety Representative
Dr Thomas Ashton	KLB Safety Representative
Ms Louise McSeveny	Committee Secretary
Ms Rachel Fairfax	Safety Services Representative
Ms Irida Gaikwad	Safety Services Representative
Dr Kersti Karu	Mass Spec Service
Mr David Ladd	IT Officer/Union Representative

STATEMENT BY THE HEAD OF DEPARTMENT

This Code of Practice has my authority and all persons who work in the Chemistry Department must abide by it



Professor Claire J. Carmalt
Head of Department

EMERGENCY PROCEDURES

FIRE

Break fire alarm glass and leave department via central staircase or emergency exits to fire escapes.

ACCIDENT/INCIDENT OR "NEAR MISS"

Go to the Safety Services page and follow the link to 'report an incident' or use the following link https://www.ucl.ac.uk/safety-services/

The system records incidents and notifies key people so the incident can be investigated.

MAJOR INJURY

Dial 222 and request an ambulance

MINOR INJURY

Contact a first aider (below) and treat within the department, or escort to UCH A&E Department, 235 Euston Road (tel. 0845 155 5000)

FIRST AIDERS

Please note the list of first aiders is subject to change. Up to date lists can be found by the lifts.

Christopher Ingold Building	**Kathleen Lonsdale Building**
Basement	**Second Floor**
(M) Michael Parkes (LG32), Ext. 24592	(M) Thomas Ashton (223, Ext 34312)
Ground Floor	(F) Phyllida Britton (230, 020 7679 3451)
(M) Tony Field (Stores G27, Ext: 27450)	(M) Mikesh Patel (230, 020 7679 3451)
First Floor	
(F) Cally Haynes (108, Ext: 27457)	**West End Second Floor**
(M) Steve Price (124J, Ext 24606)	(F) Kerstin Sander (208A, Ext. 32344)
Second Floor	
(M) Crosby Medley (201/208, Ext: 24660 or 24689)	
(F) Claire Gacki (201/229, Ext: 24660)	
(M) Martyn Towner (201/229, Ext: 24660)	
(M) Michael Parkes (205, Ext 24639)	
Third Floor	
(F) Caroline Knapp (308/309, Ext 24658)	
Fourth Floor	
(F) Caroline Knapp (455, Ext 21497)	
(M) Matt Powner (408, Ext: 24524)	

FIRE EVACUATION MARSHALS

Christopher Ingold Building		Kathleen Lonsdale Building	
Basement		**Second Floor**	
Kersti Karu	24605	Helen Allan	
		Thomas Sheppard	32467
		Scott Woodley	30315
Ground			
Tony Fields	27450		
Rebecca Ingle	53723		
Louise Price	27583		
1st Floor			
Dave Ladd	24626		
Dewi Lewis	24779		
Jadranka Butorac	24650		
Helena Wong	53732 or 24643		
Mike Parkes	24639		
Hannah Shalloe	53731 or 24643		
2nd Floor			
Alan Philcox	21500		
Dave Webb	53727 or 24661		
Mike Porter	24710		
Claire Gacki	53729 or 24660		
Crosby Medley	53730 or 24660		
3rd Floor			
Jeremy Cockcroft	25802		
Chris Blackman	24703		
Rob Palgrave	27527		
4th Floor			
Jim Anderson	25585		
Matt Powner	24542		
Gemma-Louise Davies	27524		

SENIOR EVACUATION MARSHALS

Joe Nolan	CIB	24627
Crosby Medley	CIB	53730
Thomas Sheppard	KLB	32467 (Second Floor, Third Floor)

UCL Health and Safety Provision

Listed below are UCL services. In most instances, issues should be addressed through departmental procedures and personnel in the first instance.

Hazardous Waste Disposal Service: Estates Customer Service Desk	30000
Safety Services:	https://www.ucl.ac.uk/safety-services/ Go to URL www.ucl.ac.uk/estates/safety-ucl
General safety enquiries or questions Occupational Health	32802
Fire safety enquiries or issues	fire@ucl.ac.uk
Questions or problems relating to RiskNET tools	risknet.help@ucl.ac.uk
Enquiries about safety training courses	safetytraining@ucl.ac.uk
Advice about transporting dangerous goods	dangerousgoods@ucl.ac.uk

Contents:

1 ACCESS TO AND USE OF BUILDING

The Christopher Ingold Building and the Kathleen Lonsdale Building are open between 08:00 and 18:00, Monday to Friday. Outside of these hours' access is by use of a keycard (UCL ID Card), which operates the lock on the designated out-of-hours door.

Out-of-hours access to the Chemistry Department must be recorded in the books located in reception (CIB) or the second-floor lobby (KLB). If you are already in the department at 18:00, you must sign the out-of-hours book if you intend to stay later.

Undergraduates, taught postgraduates and visitors are allowed access to the department only between 08:00 and 18:00, Monday to Friday.

Nobody is allowed in the department for any reason between the hours of 00:00 and 06:00.

It is important to remember that working out of hours, there is less support in the building, including first aiders and fire marshals, and activities done should be of lower risk profile.

Any type of risk-assessed work is permitted in the Chemistry Department between 07:00 and 21:30, Monday to Sunday (except when College is closed at Christmas, Easter and on Bank Holidays), subject to the constraint that experimental work must not be attempted unless at least one other worker is in the same laboratory, or within earshot, and will be so for the duration of the experiment. Use of liquid nitrogen or any energetic process (energetic reactions or pressurised equipment) must never be undertaken unless other people are present!

Outside of these hours (and subject to the restriction between 00:00 and 06:00 mentioned above), members of the UCL Department of Chemistry are granted access ONLY in order to do written work at their own desk, to operate computer terminals and carry on activities such as pre-booked measurements on equipment such as the NMR spectrometers and X-ray diffractometers. No person outside of the UCL Department of Chemistry is allowed to enter the department and use any of the equipment at any time.

The following rules apply:

You must fill in the out-of-hours book on entry and departure.

Your supervisor must give permission for you to be in the building (research students only).

You must not admit anyone else to the building except for your own guests during normal working hours. No guests are allowed in the department out of normal working hours.

All guests must be hosted at all times and not allowed to wander or work alone in the department. Guests must not use any departmental equipment. All visitors must sign in on entry and sign out when they depart.

If it is foreseen that work has to be continued after 21:30 (e.g. collection of data), an extra risk assessment and protocol must be authorised by your supervisor and copied to the DSO. Nobody is permitted to work alone. Security must be informed by contacting Mark West (x 37321).

Working outside the permitted periods will result in disciplinary action, which could include removal of access to the department.

A UCL ID card is provided for the use of only the worker to whom it was issued – it may not be loaned to any other person nor used to admit another person to the department. Failure to observe any of the above will result in the withdrawal of your keycard.

2 ACCIDENTS AND INCIDENTS

All accidents and safety incidents must be reported. They should be recorded using the 'RiskNET' online reporting tool. By either going to the UCL Safety Service webpage and following the 'report an incident' link or by visiting:

LINK: https://ucl.oshens.com/AIR2/Incbook/incbook_tab_begin.aspx?First=1

An accident is an unexpected, undesired event which causes injury to a person or damage to the contents or fabric of the building. An incident is an unexpected, undesired event without the consequences i.e. no injury or damage, but which had the potential to do so. Whether one or the other occurs is often down to luck, so it is important that all accidents and incidents are reported and investigated - if an incident goes unreported (and no steps are taken to prevent recurrence) it may well become an accident the next time it happens!

Significant incidents should be reported to the DSO as soon as possible. Record details as images using a camera or mobile phone and add them the incident report or send them to the DSO.

For more information on incident reporting see the Safety Services website:

LINK: https://www.ucl.ac.uk/safety-services/

Undergraduates and visitors to the department

Accidents and incidents occurring to undergraduates in the Graham Laboratory or the Turner Laboratory should be recorded on the online system as above. Similarly, for accidents or incidents to a visitor in the department should be reported the same way.

3 ASSESSMENT OF RISKS

Before any work is carried out, all significant hazards involved must be identified necessary risk control measures to reduce the risk to an acceptable level must be put in place and if appropriate a standard operating procedure produced. The procedure for doing this is explained below.

Regulations require that, before the start of any research project, the risks involved must be assessed and a method for safe working must be written. It is the responsibility of the supervisor to ensure that workers are trained as necessary and follow the method.

The risks involved in the work carried out by support staff must be assessed by their line manager and an appropriate code of practice must be written, if necessary. It is the responsibility of the line manager to ensure staff are adequately trained and follow the code of practice.

ALL workers must carry out a "suitable and sufficient" risk assessment of their work before they may begin –the risk assessment for the project should be recorded on the RiskNET Risk Assessment tool, this risk assessment should then be supplemented by additional risk assessments in laboratory books where appropriate.

If all the work will be covered by the code of practice outlined in this document, completion of the risk assessment will be sufficient. If any operations will be carried out which are not covered (e.g. high-pressure hydrogenation, use of pathogens or work with very toxic substances) a

supplementary code of practice must be written and sent to the DSO. A template for doing this is shown in Appendix 5.

The use of the RiskNet Risk Assessment will generate an email to the supervisor or line manager (selected as 'approver') and work must not begin until receipt of this email has been

acknowledged by the supervisor to the worker or a notification that the assessment has been approved is received. Acknowledgement signifies agreement by the supervisor is satisfied that the precautions identified are sufficient and the people involved have the necessary skills and resources to safely undertake the activity. Staff who don't have a supervisor are responsible for their own answers to the risk assessment.

Risk assessment must be reviewed at least annually, if the nature of the project should change or if unforeseen new hazards should be encountered. Risk assessment should be reviewed following an accident or incident, which is covered by the risk assessment. Should the working environment around the equipment or area, which is risk assessed, change significantly, which introduces new hazard(s) or changes to severity/likelihood of established ones, a revised risk assessment should be written.

All research workers must check on a day-to-day basis that their work falls within the agreed code of practice. It is the responsibility of the supervisor to ensure that this is being done. Each research worker must write in a bound laboratory notebook an account of each experiment as it is being carried out. This must be dated, and every experiment must be preceded by a written record of the risk assessment and the code of practice which will be followed.

Every laboratory worker must record risk assessments in their lab book, the convention adopted is to record risk assessments on the left-hand page and experimental details on the right-hand page. Referencing an online risk assessment, on RiskNET, is acceptable.

(Bu3Sn)2O
A simple model of this is given below:

Preparation of Tributyl(allyloxy)tin.

$$(Bu_3Sn)_2O + 2CH_2{=}CHCH_2OH \xrightarrow[\text{reflux}]{\text{toluene}} 2Bu_3SnOCH_2CH{=}CH_2 + H_2O$$

HAZARDS	$(Bu_3Sn)_2O$	- Toxic, absorbed through skin
	Toluene	- Flammable, toxic
PRECAUTIONS	Work in fume cupboard; wear rubber gloves. Tin-containing residues to be kept in a labelled bottle in the fume chamber.	

Bis(tributyltin) oxide (5.96 g, 10.0 mmol) and allyl alcohol (1.17 g, 20.1 mmol) in toluene (15 cm3) were heated under a Dean and Stark water separator ……

It is the responsibility of supervisors to ensure that their research workers' notebooks are kept in this way and that the record would always stand up to outside scrutiny. This would be most important if an accident were to occur. Supervisors should check and countersign lab book risk assessments at least once a month and more often if the activity is higher hazard or the worker new to that activity.

If the supervisor is to be away from the department for longer than one day, it is his/her responsibility to appoint another member of staff who agrees to act as supervisor in his/her absence.

For demonstration lectures, where experiments are performed before an audience either in or away from the department, a special risk assessment must be completed and sent to the DSO and any other organiser of the event, prior to the demonstration being given.

See the UCL guidance on Risk Assessment and the Moodle Principles of Risk Assessment Course for more detail on general risk assessments.

4 BASIC FIRE SAFETY TRAINING

Fire Brigade regulations require that all members of the department including emeritus and short stay visitors have basic fire safety training and that a record of this training be kept.

Basic fire safety training has been incorporated in the online Moodle Fire Induction Training (which must be completed by all staff and visitors who work regularly in the department).

All staff, students and visitors should complete the online UCL Fire Safety course hosted by Fire Safety.

LINK: https://www.ucl.ac.uk/estates/safety-ucl/fire-safety/fire-training

All staff must complete a fire safety induction form TN-086 once training is complete. See link above for details of the TN-086 form.

5 BICYCLES

Bicycles must not be kept in laboratories, lobbies, corridors or other public areas.

6 CENTRIFUGES

All centrifuges must be fitted with a safety interlock which prevents the centrifuge from being opened while it is still in motion.

Centrifuges should be checked on an annual basis to ensure that they are still safe to operate (consult Mr Joe Nolan, Technical Support Group, or the manufacturer).

Centrifuges should always be used according to manufacturer's instructions or SOPs.

Where pathogens, human tissues, radioisotope labelled materials or highly toxic materials are used in centrifuges the tubes must be capped and care taken to avoid the production of aerosols.

7 CHEMICAL HAZARDS

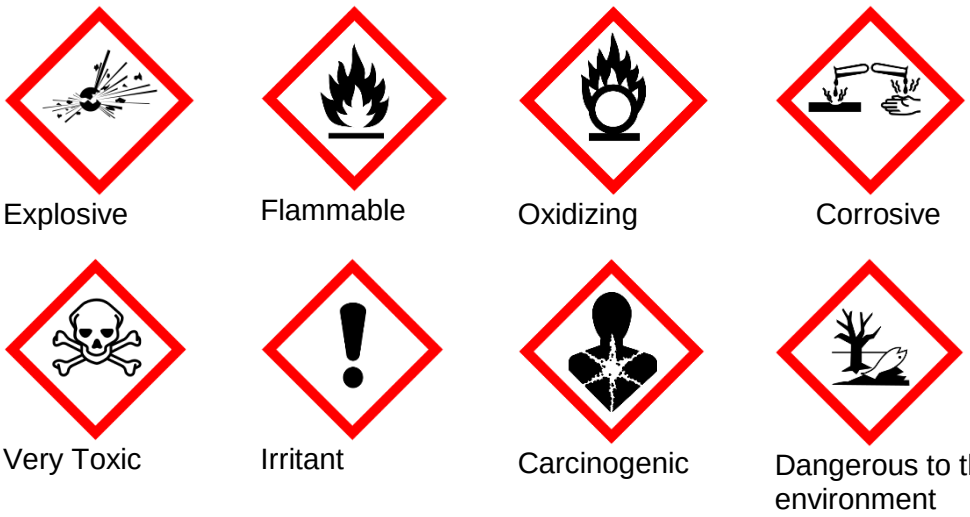
In writing a specific code of practice to cover the handling of very toxic or otherwise dangerous substances, the following points should be addressed:

- Details of the experiment.
- The hazards involved.
- Quantities involved – should be reasonable, considering the hazards involved.
- Safe storage of hazardous substances – a lockable cupboard marked POISON is necessary for S1 poisons.
- Precautions to protect the research worker. Personal protective equipment, primary and secondary lines of defence (e.g. fume chamber plus facemask) should be included.
- Precautions to protect others.
- Disposal of waste materials – safe methods should be detailed.
- Emergency procedures.

The department reserves the right not to allow use of certain compounds on safety grounds.

Globally Harmonized System of Classification and labelling of Chemicals (GHS).

Hazardous chemicals will be labelled with the following hazard labels:



The Sigma-Aldrich Library of Chemical Safety Data is available for reference in the General Office.

Safety data is also obtainable from the following websites:

LINK: www.sigmaaldrich.com
LINK: www.ilpi.com/msds

Chemical catalogues (e.g. Aldrich, Acros, VWR) list the hazardous properties of the compounds they provide, and some publish collections of this information.

Some common hazardous compounds are discussed below.

Explosives

Note under the Explosives Regulations (2014) a license is required to possess explosive materials with exemptions (see nitro compounds below).

The quantities used in experimental work must be kept to a minimum. Explosion of even 0.1 g of material can do serious damage. Safety screens and protective equipment must be used.

Quantities of explosive compounds should be kept below 100 mg, unless there is good reason to have more and the activity is thoroughly risk assessed using the form in Appendix 5.

Acetylene and Acetylides: Acetylene gas is explosive under high pressure and is supplied in cylinders in which it is dissolved in acetone adsorbed on kieselguhr. Advice should be sought if you wish to use such cylinders. Special gas regulators and flash-back arrestors are required. Terminal acetylenes (alkynes) form acetylide salts with heavy metals which are dangerously explosive and acetylene gas should not be allowed to come in contact with metallic copper or copper alloys.

Azides: Hydrazoic acid and many metal azides (excluding sodium azide) are very sensitive explosives. Silver azide may be formed in silvering solutions containing ammoniacal silver nitrate.

Azo and Diazo Compounds: Aza and diazo compounds are usually explosive and should be treated as such. Diazomethane, which is a yellow gas, is explosive as well as highly toxic.

Chlorates and Perchlorates: The alkali metal salts are not explosive, but salts of heavy metals, or salts of metals carrying organic ligands, or mixtures of perchloric acid with organic compounds may be sensitive to shock or heat. Perchloric acid and perchlorates are bought only on the signature of the DSO or Assistant DSO.

Ethers: Diethyl ether, dibutyl ether, diisopropyl ether, dioxan and tetrahydrofuran each react with aerobic oxygen to form peroxides which accumulate in the residues of a distillation and may then explode. Never leave partially filled bottles of these solvents for a long period. Never distil solutions of these solvents to near dryness. Dispose of the contents within one year after opening. The bottles of these solvents should be dated when opened for the first time. It is also good practice to date the bottles when first received as well.

Nitro Compounds: Nitro compounds such as trinitrobenzene and picric acid should be kept wet (desensitized). The complexes which picric acid forms with compounds such as aromatic amines and ammonia may be sensitive explosive when dry. Picric acid readily forms salts on contact with many metals (including copper, lead, mercury, zinc, nickel and iron) that are more sensitive explosives than picric acid itself when subjected to heat, friction, or impact.

Picric Acid, TNT and TNB are covered by the Explosives regulations. A licence must be obtained to make, use or store these materials except in quantities of less than 5g of desensitised material, where they are medical or veterinary products (within certain parameters) and where picric acid is in solution of less than 2%.

Peroxides: Concentrated aqueous hydrogen peroxide may decompose violently in the presence of some metal ions. Hydrogen peroxide forms explosive solutions or mixtures with many organic solvents, and the concentration of H2O2 in organic solvents should never be allowed to exceed 20% w/w.

Organic peroxides are potentially explosive, particularly when the ratio of C and H to O is low. These compounds should be handled on only a small scale. Benzoyl peroxide, which is used as an initiator for polymerisation and for brominations by N-bromosuccinimide, should be kept damp.

Highly Flammable Chemicals

The special danger here is from volatile solvents with low flash points (the lowest temperature at which the vapour will ignite). Safety carriers must be used for transporting Winchesters of solvents. Diethyl ether, pentane, and light petroleum b.p. 40-60°C are particularly hazardous, and their vapours can be ignited by a hotplate or heating mantle. There needs to be particular safety

considerations for storage of these low boiling solvents during very hot weather in the UK, bottles should be kept out of direct sunlight in appropriate solvent cabinets with the caps of the bottle loosened to allow pressure relief from any possible solvent vapour build-up, if the day-time laboratory temperatures are greater than 30°C. Carbon disulphide must be handled only in the fume cupboard: it is toxic, and the vapour can be ignited by a hot electric light bulb. Follow the usual precautions of not working alone, be aware of where the nearest fire extinguisher is kept, clearing the work area of anything else flammable, and giving the experiment your continuous undivided attention. When any highly flammable chemical is involved, the experiment should be performed in a fume cupboard where possible and no sources of ignition should be present. Provision made that the experiment will be safe should the chemical ignite, for instance the experiment should be contained in tray capable of containing the entire contents of the reaction equipment should it fail.

Finely divided metals, such as Raney nickel, may be pyrophoric or may cause adsorbed solvents to ignite. Raney nickel used with methanol commonly cause fires. This is a special hazard with finely divided metals, when carrying out catalytic hydrogenations and when disposing of the used catalyst.

Organometallic Compounds, such as butyllithium or trimethylaluminium, may ignite if they come in contact with air and should be handled only in the presence of a second person who is accustomed to handling them. Any person wishing to use tert-butyllithium which is pyrophoric in contact with air, must firstly be trained in its use by a person accustomed to handling it, have attended the Safety Techniques Lecture and completed an extra risk assessment for the Departmental Safety Officer. Any fires should be tackled with a dry powder extinguisher.

Sodium and Potassium metals react violently with water and are very common causes of fire. Disposal of such metals need to be completed by professional external contractors.

Highly Reactive Chemicals

A further variety of compounds are particularly corrosive or may react violently with other reagents. Protective gloves, as well as glasses and laboratory coats should be worn. If corrosive compounds come in contact with the skin, they should be washed off with copious amounts of water, then medical aid should be sought.

Strong Acids (hydrochloric, hydrobromic, hydrofluoric, sulphuric, nitric, perchloric, trifluoroacetic) are very corrosive, and sulphuric acid can react violently with water. Hydrofluoric acid should not be handled in the department currently. If there is any need to use hydrofluoric acid it must be discussed with the Departmental Safety officer. Nitric acid should never be allowed to mix with organic solvents, particularly acetone, ethanol and methanol, with which it reacts violently after a short period. Perchloric acid can cause wood and other organic materials to inflame; the bottles should be kept in glass or ceramic dishes, and the acid should be used only in designated fume cupboards.

Strong Bases (sodium hydroxide, potassium hydroxide, calcium oxide) are corrosive. They react exothermally with water, and particularly with acids. Sodium amide and sodium hydride are similarly reactive and corrosive, and further liberate large volumes of gas. In the case of sodium hydride, the gas is hydrogen which is lighter than air and has a very broad range of flammability in air. The alkali metals react with water and other protic reagents, often violently. The reactivity increases greatly in the sequence lithium < sodium < potassium. This causes a fire hazard and may eject the strongly caustic metals or hydrolysis products.

Strong solutions of ammonia ("880 ammonium hydroxide") are caustic and the vapour can be overwhelming. The bottles may be under pressure and should be opened cautiously in a fume cupboard.

Metal Halides: Some metal halides such as BBr3, AlCl3, SnCl4, TiCl4 and SiCl4 may be hydrolysed explosively if they come into contact with water.

Metal Hydrides: Some metal hydrides, in particular sodium hydride, lithium hydride, lithium borohydride and lithium aluminium hydride, react violently with water and other protic reagents, liberating large volumes of hydrogen. Particular care should be taken when destroying the excess of lithium aluminium hydride after a reaction. Also, it is important to make sure all items used to handle metal hydrides are suitable quench after use, e.g. spatula or weighing boat.

A number of explosions related to the use of lithium aluminium hydride have been reported. Extreme care should be exercised when heating any mixture containing LiAlH4. Except in special circumstances, such mixtures should never be heated above 70°C and, even then, an oil bath must be used to avoid "hot spots". Also, it is important to be careful with lithium borohydride which has reactive properties which are greater than sodium borohydride but are less than lithium aluminium hydride. Lithium borohydride is pyrophoric and can catch fire.

In general, calcium hydride is an adequate and much safer alternative to LiAlH4 for drying solvents.

Toxic Chemicals

Scales which are quoted for toxicity are the TLV (threshold limit value), which is the concentration of a chemical to which people may be repeatedly exposed without adverse effects, and the LD50 or LC50, which is the dose given orally, or breathed as a concentration in air, that is lethal to 50% of rats. Common toxic substances include alkaloids, aromatic amines, arsenic and its compounds, asbestos, beryllium, bromine, carbon monoxide, carbon tetrachloride, cyanides and hydrogen cyanide, diazomethane, dimethyl and diethyl sulphate, hydrogen halides, hydrogen sulphide, lead compounds, mercury and its compounds, metal carbonyls, osmium compounds, phosgene, pyridine, sulphur dioxide, and thallium compounds.

Highly toxic compounds (e.g. cyanides, thallium compounds) must be kept in a locked cabinet, and an inventory kept of their use.

Carcinogens, Mutagens, Teratogens. Research workers wishing to use known or suspected carcinogens must consult their supervisor or staff associate before starting work. Such substances must always be handled in fume cupboards or in closed containers. Vessels containing them must be clearly labelled cancer inducing. Persons using such compounds must wear gloves and other appropriate protective clothing and must ensure that all clothing is properly disposed of or cleaned if it becomes contaminated.

An MRC list of known carcinogens is attached (Appendix 1). Please bear in mind that it is not exhaustive.

8 CHEMICAL REGULATIONS

Controlled Chemicals

Chemical Weapons Convention

Under the Chemical Weapons Act, UCL is required to keep records on the use or production of all of the chemicals listed in the following schedules below. UCL Safety Services at the end of the calendar year requires from us a list of the restricted chemicals in the Chemistry Department, across all research groups and research laboratories for both the CIB and KLB. The audit requires details of restricted chemical, location and quantities of the chemical used and remaining stock.

As guidance UCL Safety Services provide us with a master list of restricted chemicals to work from. The information is assembled on behalf of the department by the DSO, who passes onto UCL Safety Services. UCL Safety Services assemble all the information across relevant UCL departments, and submits the total information to the UK enforcing authority. There is a departmental procedure covering this whole topic of restricted chemicals.

In some cases, the restricted chemical requires a license to be purchased before ordering and obtaining the restricted chemical. The UCL master list of restricted chemicals gives guidance chemical by chemical in the list, where a license is required this will be highlighted. It is very important that a license is in place before obtaining the restricted chemical in hand. Also, it is important to highlight that licenses do need to be renewed annually. For disposal of restricted chemicals an approved method of disposal has to be used, observed by a competent trained independent witness. The license will give guidance to what is the approved method of disposal.

Schedules of Chemicals

The following Schedules list toxic chemicals and their precursors.

Whenever reference is made to groups of dialkylated chemicals, followed by a list of alkyl groups in parentheses, all chemicals possible by all possible combinations of alkyl groups listed in the parentheses are considered as listed in the respective Schedule as long as they are not explicitly exempted. A chemical marked (*) on Schedule 2, part A, is subject to special thresholds for declaration and verification, as specified in Part VII of the Verification Annex.

Schedule 1

(CAS registry number) NOTE it is illegal to possess any Schedule 1 chemical without first obtaining a permit from the CWC National Authority.

A. Toxic chemicals

1) O-Alkyl (<C10, incl. cycloalkyl) alkyl (Me, Et, n-Pr or i-Pr)-phosphonofluoridates
e.g. Sarin: O-Isopropyl methylphosphonofluoridate (107-44-8)
Soman: 0-Pinacolyl methylphosphonofluoridate (96-64-0)

2) O-Alkyl (<C10, incl. cycloalkyl) N,N-dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidocyanidates

e.g. Tabun: O-Ethyl N,N-dimethyl

phosphoramidocyanidate (77-81-6)

3) O-Alkyl (H or <C10, incl. cycloalkyl) S-2-dialkyl
(Me, Et, n-Pr or i-Pr)-aminoethyl alkyl
(Me, Et, n-Pr or i-Pr) phosphonothiolates and corresponding alkylated or protonated salts
e.g. VX: O-Ethyl S-2-diisopropylaminoethyl
methyl phosphonothiolate (50782-69-9)

4) Sulphur mustards:
2-Chloroethylchloromethylsulfide (2625-76-5)
Mustard gas: Bis(2-chloroethyl) sulfide (505-60-2)
Bis(2-chloroethylthio) methane (63869-13-6)
Sesquimustard: 1,2-Bis(2-chloroethylthio) ethane (3563-36-8)

1,3-Bis(2-chloroethylthio)-n-propane (63905-10-2)
1,4-Bis(2-chloroethylthio)-n-butane (142868-93-7)
1,5-Bis(2-chloroethylthio)-n-pentane (142868-94-8)
Bis(2-chloroethylthiomethyl) ether (63918-90-1)
O-Mustard: Bis(2-chloroethylthioethyl) ether (63918-89-8)

5) Lewisites:
Lewisite 1: 2-Chlorovinyldichloroarsine (541-25-3)
Lewisite 2: Bis(2-chlorovinyl)chloroarsine (40334-69-8)
Lewisite 3: Tris(2-chlorovinyl) arsine (40334-70-1)

6) Nitrogen mustards:
HN1: Bis(2-chloroethyl) ethylamine (538-07-8)
HN2: Bis(2-chloroethyl) methylamine (51-75-2)
HN3: Tris(2-chloroethyl) amine (555-77-1)

7) Saxitoxin (35523-89-8)

8) Ricin (9009-86-3)

B. Precursors:

9) Alkyl (Me, Et, n-Pr or i-Pr) phosphonyldifluorides e.g. DF:
Methylphosphonyldifluoride (676-99-3)

10) O-Alkyl (H or <C10, incl. cycloalkyl) O-2-dialkyl (Me, Et, n-Pr or i-Pr)-aminoethyl alkyl (Me, Et, n-Pr or i-Pr) phosphonites and corresponding alkylated or protonated salts e.g. QL: O-Ethyl O-2-diisopropylaminoethyl methylphosphonite (57856-11-8)

11) Chlorosarin: O-Isopropyl methylphosphonochloridate (1445-76-7)

12) Chlorosoman: O-Pinacolyl methylphosphonochloridate (7040-57-5)

Schedule 2

(Use of these materials must be recorded).

A. Toxic chemicals:

1) Amiton: O,O-Diethyl S-[2-(diethylamino)ethyl] phosphorothiolate (78-53-5) and corresponding alkylated or protonated salts

2) PFIB: 1,1,3,3,3-Pentafluoro-2-(trifluoromethyl)-1-propene (382-21-8)

3) BZ: 3-Quinuclidinyl benzilate (*) (6581-06-2)

B. Precursors:

4) Chemicals, except for those listed in Schedule 1, containing a phosphorus atom to which is bonded one methyl, ethyl or propyl (normal or iso) group but not further carbon atoms, e.g. Methylphosphonyl dichloride (676-97-1)
Dimethyl methylphosphonate (756-79-6)
Diethylmethyl phosphonate
Exemption: Fonofos: O-Ethyl S-phenyl ethylphosphonothiolothionate (944-22-9)

5) N,N-Dialkyl (Me, Et, n-Pr or i-Pr) phosphoramidic dihalides

6) Dialkyl (Me, Et, n-Pr or i-Pr) N,N-dialkyl (Me, Et, n-Pr or i-Pr)-phosphoramidates

7) Arsenic trichloride (7784-34-1)

8) 2,2-Diphenyl-2-hydroxyacetic acid (76-93-7)

9) Quinuclidin-3-ol (1619-34-7)

10) N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethyl-2-chlorides and corresponding protonated salts

11) N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2-ols and corresponding protonated salts

    Exemptions: N,N-Dimethylaminoethanol (108-01-0) and corresponding protonated salts,

    N,N-Diethylaminoethanol (100-37-8) and corresponding protonated salts

12) N,N-Dialkyl (Me, Et, n-Pr or i-Pr) aminoethane-2 thiols and corresponding protonated salts

13) Thiodiglycol: Bis(2-hydroxyethyl)sulfide (111-48-8)

14) Pinacolyl alcohol: 3,3-Dimethylbutan-2-ol (464-07-3)

Schedule 3

(A record of the possession of these chemicals must be recorded)

A. Toxic Chemicals

1) Phosgene: Carbonyl dichloride (75-44-5)

2) Cyanogen chloride (506-77-4)

3) Hydrogen cyanide (74-90-8)

4) Chloropicrin: Trichloronitromethane (76-06-2)

B. Precursors:

5) Phosphorus oxychloride (10025-87-3)

6) Phosphorus trichloride (7719-12-2)

7) Phosphorus pentachloride (10026-13-8)

8) Trimethyl phosphite (121-45-9)

9) Triethyl phosphite (122-52-1)

10) Dimethyl phosphite (868-85-9)

11) Diethyl phosphite (762-04-9)

12) Sulphur monochloride (10025-67-9)

13) Sulphur dichloride (10545-99-0)

14) Thionyl chloride (7719-09-7)

15) Ethyldiethanolamine (139-87-7)

16) Methyldiethanolamine (105-59-9)

17) Triethanolamine (102-71-6)

In all cases, each bottle containing a relevant substance must be given a unique identifier and a record made of removals on a form that relates to that particular bottle. These records are to be kept in an easily accessible folder in each laboratory in which these materials are used.

Illicit Drug Precursors

EU Council Regulation (EC) No. 273/2004 (From August 2005), which relates to substances that could be used in the manufacture of illicit drugs (see list below), requires UCL to be licensed by the Home Office to permit the department to be supplied with these products:

- Ephedrine
- Ergometrine
- Ergotamine
- Lysergic acid
- 1-phenyl-2 propanone (BMK)
- Pseudoephedrine
- N-acetylanthranilic acid
- 3,4 Methylenedioxyphenylpropan-2-one (PMK)
- Isosafrole
- Piperonal
- Safrole
- Norephidrine
- Alpha-phenylacetoacetonitrile (APAAN)
- Acetic anhydride
- Potassium permanganate
- Anthranilic acid
- Phenylacetic acid
- Piperidine

The suppliers of these chemicals will require the completion of an 'End User' certificate prior to dispatch to the department. In some cases, the restricted drug precursor requires a license to be purchased before ordering and obtaining the restricted chemical. The UCL master list of restricted chemicals gives guidance chemical by chemical in the list, where a license is required this will be highlighted. It is very important that a license is in place before obtaining the restricted chemical in hand. Also, it is important to highlight that licenses do need to be renewed annually. For disposal of restricted chemicals an approved method of disposal has to be used, observed by a competent trained independent witness. The license will give guidance to what is the approved method of disposal.

There is a departmental procedure covering this whole topic of restricted chemicals, including illicit drug precursors.

Any inquiries regarding these regulations should be directed to the Departmental Safety Officer.

Antiterrorism Crime and Security Act (Schedule 5)

For UCL arrangements, please visit:

LINK: http://www.ucl.ac.uk/estates/safetynet/guidance/substances/toxins.pdf

The ATCS act imposes controls mainly on pathogens but also includes a number of biologically derived toxins. Controls include security requirements, control of access, the need to report possession and account for use. Possession of these materials is normally limited to microgram or milligram quantities.

SUBSTANCES LISTED IN SCHEDULE:

- Abrin
- Botulinum toxins
- Clostridium perfringens epsilon toxin,
- Clostridium perfringens enterotoxin
- Conotoxin
- Modeccin toxin
- Ricin
- Saxitoxin
- Shiga toxin, Shiga like toxin
- Staphylococcal enterotoxins
- Tetrodotoxin

- Viscum Album Lectin 1 (Viscumin)
- Volkensin toxin

Note: Ricin and Saxitoxin are schedule 1 chemical weapon convention materials and cannot be possessed or use without an individual licence!

9 CLOTHING AND DRESS CODE IN LABORATORIES

Sensible footwear must be worn, no sandals or open toed shoes are allowed in laboratories.

Clothing should cover legs and ankles, no shorts, skirts or kilts may be worn in laboratories.

Sensible neckline should be worn (unless Howie style lab coats are worn fasten up to the neck.)

Loose clothing should be secured so they do not get caught in a flame or chemicals.

Consider using non-flammable materials, cotton or wool based fabrics should be worn where possible. Polyester, specifically polyester fleece material will readily absorb chemicals and will act a source of fuel if exposed to a flame.

The appropriateness of metallic jewellery must be considered when using lasers.

Loose hair should be tired back.

If you are dressed inappropriately for your safety you will be refused access to laboratories.

10 COMPUTERS & RELATED EQUIPMENT

Computers and related equipment are not normally electrically inspected by the department. Due to their design they should pose no risk to human health due to electrical hazards.

11 COSHH REGULATIONS

All experimental work must be carried out in accord with the COSHH (Control of Substances Hazardous to Health) Regulations, which require an assessment of the hazards and the drawing up of a Code of Practice. Details for doing this are given in the section “Assessment of Risks.”

12 CRYOGENICS

Liquid nitrogen 77 K, -196 °C and solid carbon dioxide 185 K, -78 °C can cause severe burns if they come in to contact with the skin. The major risk from liquid nitrogen and solid carbon dioxide is asphyxiation. Liquid nitrogen will expand **696 times** as it vaporizes from -196 °C to room temperature, even a small spill can result is filling an area with nitrogen gas. They should not be brought into an unventilated space and must not be transported in the passenger lifts in person. If transported by the goods lift, the liquid nitrogen Dewar must travel by itself, no-one should travel with the Dewar. Where there is a risk of oxygen depletion suitable gas monitors have been installed and maintained, e.g. lab 245, lab 201B, lab 129, NMR lab and Mass Spect lab.

Regular training sessions on the use of the liquid nitrogen dispensing system in the stores area are conducted by the Stores Manager.

Glass Dewar vessels may shatter violently, projecting sharp glass fragments. The Dewars must be thoroughly bound with protective tape, or better, be secured in a strong container.

Never store liquid nitrogen in stoppered vessels. Never leave vacuum line traps immersed in liquid nitrogen and exposed to the atmosphere; liquid oxygen will condense into the trap and may react violently with its other contents.

The filling of liquid nitrogen vessels or transfer of liquid nitrogen between vessels must never be carried out unless someone else is present.

People can be splashed on the skin by small quantities of liquid nitrogen without causing burns but severe burns can occur where the liquid nitrogen is absorbed into fabric.

Never transfer liquid nitrogen in areas that are not well ventilated.

Further details on the safe handling of cryogenic substances are available from the DSO.

13 CYANIDES

As little as 50 to 150 mg of cyanide salts can cause death. Poisoning can occur by inhalation of mists of cyanide solution and by inhalation of HCN produced by the reaction of metal cyanides with acid and with water.

Symptoms of non-lethal poisoning include weakness, headache, dizziness, rapid breathing, nausea and vomiting. These compounds are not regarded as having good warning properties! Training in the safe handling of cyanides is absolutely essential before these materials are used. You must consult your supervisor before using any cyanide compounds.

The HSE first aid procedures for suspected exposure to cyanides are reproduced below.

Cyanide in contact with skin

- Drench the affected area with clean running water for at least 10 minutes and until no chemical remains in contact with the skin. Use soap if the substance is oily.
- Remove contaminated clothing, provided it is not stuck to the skin, as soon as practicable after commencement of washing.
- If there is any injury or if skin absorption is suspected treat as follows.
- Keep casualty warm and at rest.
- If casualty has stopped breathing, start artificial respiration – not mouth to mouth.
- Dial 999 and arrange to transport casualty to hospital.

Cyanide in contact with eyes

- Flush the eye with clean running water for at least 10 minutes.
- Keep the casualty warm and at rest.
- Dial 999 and arrange to transport casualty to hospital.

Cyanide swallowed

- Do not give anything by mouth.
- Keep the casualty warm and at rest.
- If casualty has stopped breathing, start artificial respiration – not mouth to mouth.
- Dial 999 and arrange to transport casualty to hospital.

Cyanide inhaled

- Remove the casualty from exposure, provided there is no risk to yourself.
- Keep the casualty warm and at rest.
- If casualty has stopped breathing, start artificial respiration – not mouth to.
- Dial 999 and arrange to transport casualty to hospital.

CYANIDE CHECKLIST

Metal cyanide salts and the more toxic organic cyanide salts must not be stored on open shelves in the laboratory. They should be kept in a locked cupboard labelled POISON.

A Special Risk Assessment must be completed and approved by the DSO before any new use of these materials. Material can be ordered and issued by the Chemistry Stores only with the written permission of the DSO.

Procedures involving these materials must never be attempted by an untrained person.

Procedures involving these materials must never be attempted out of normal working hours.

Procedures involving these materials must never be attempted by someone working alone and, for larger scale operations, workers should operate in pairs.

All operations, including weighing material, must be carried out in a fume hood.

Appropriate personal protective equipment, i.e. impermeable gloves, lab coat and safety glasses, must be worn.

A first aid person trained in oxygen administration should be at hand to respond for a cyanide exposure incident, especially one involving hydrogen cyanide gas.

A container of 10% w/v aqueous ferrous sulphate solution must be kept at hand for the immediate immersion of all equipment which has contained or contacted this material (paper, spatulas etc.) and for disposing of small spills.

14 DISABLED PERSONS

The department will do its best to welcome people regardless of disability and will, within its power, make any necessary adjustments to allow this to happen. However, Health and Safety considerations will take priority. Disabilities that might affect upon the safety of individuals in the Chemistry Buildings are mobility, sight or hearing impairment.

Disabled Students

The UCL policy on admission of students with disabilities is located here: http://www.ucl.ac.uk/disability. All students with a physical disability will be required to undergo a mandatory risk assessment prior to being accepted by UCL. Students who develop a physical disability subsequent to their admission to the College need to undertake a similar risk assessment prior to continuing their programme of study. The risk assessment will be undertaken by the Disability Coordinator, in conjunction with the UCL Safety Officer.

In line with the Equality Act 2010, we make reasonable adjustments to support disabled students in higher education. Our aim is to promote and implement an inclusive learning and teaching environment, allowing students to study as independently as possible during their time at UCL.

Disabled Staff

Any member of staff with a disability that might affect their safety whilst in the department, whether temporary or permanent should inform the Senior FEM or DSO so a Personal Emergency Evacuation Plan (PEEP) can be carried out. Any information is kept strictly confidential.

Disabled Visitors

There is no requirement for PEEPs where people are visiting on the ground floor of the CIB as evacuation is on the same level. Where visitors wish to visit other parts of the CIB or KLB the Senior FEM and DSO should be informed so they can advise on the location of refuges and take measures to make sure in the event of an evacuation, emergency services are informed of the presence of someone in a particular refuge.

Evacuation of the building in case of emergency

Arrangements are in place for the evacuation of the CIB by staff and students who would have difficulty leaving the building by the stairs in case of emergency. Visual alarms (strobes) vibrating units can be arranged for anyone who might be unable to hear an audio alarm. Buddies can be arranged to assist with sight impaired people. A PEEP must be completed for each staff member

or student with a disability in the department, this will help to identify the best solution for individual cases. The DSO and Senior FEM should be consulted before any disabled person starts work in the CIB or KLB. Fire evacuation procedures for disabled persons are often reviewed in building fire risk assessment audits.

15 DISPLAY SCREEN EQUIPMENT (DSE)

To comply with the Display Screen Equipment Regulations (1992) and UCL Approved Code of Practice for Managing the Risks Associated with DSE Work, all staff and postgraduate students must carry out an annual DSE self-assessment online at:

LINK https://www.ucl.ac.uk/safety-services/policies/2021/may/display-screen-equipment-dse-assessment

Each member of the department will be assigned to a trained DSE assessor who will monitor the DSE self-assessments and carry out a DSE assessment if problems are raised in the self-assessment. However, all computational chemists must also be assessed by a trained DSE assessor for their first assessment, but not again if their work station does not change (see Appendix 3).

16 DISPOSAL OF WASTE

The Departmental Waste Control Supervisor (Mr David Ladd, CIB room 101S, tel. 24626, e-mail: d.j.ladd@ucl.ac.uk) will organize the removal of unwanted or surplus equipment and any clutter from the corridors. Such equipment and waste can be deposited in G3 (CIB) prior to removal.

Chemical Waste (not solvents)

Chemical collections by Tradebe occur fortnightly on Thursday. Tradebe are managed by Mitie, Mitie are employed by UCL to manage the waste collection processes.

Requesting a collection.

1. Fill in a copy of the New Chemicals & Solvents Form (excel spreadsheet, available on Moodle).

2. The top part of the form consists of drop-down menus where the requester can select bulk chemicals e.g. solvents. If the chemical is not listed, add it to the bottom section of the form.

3. If the requester has small containers of chemicals to dispose of, list them in the bottom part of the form. In the Volume/Weight column list the volume or weight quoted on the container (do not estimate).

4. If the requester requires replacement empty containers, for waste solvent for example, then this needs to be entered in the space provided on the spreadsheet.

5. Raise a chemical disposal request (only staff can raise requests) with UCL Estates using the following link:

LINK: https://www.ucl.ac.uk/estates/customer-helpdesk/raise-service-request

6. The UCL Estates helpdesk will send you a W number for your request. Please add this to the requesters New Chemicals & Solvents form. This number will be used to track the request.

7. Email the New Chemicals & Solvents form back to the UCL Estates helpdesk (complete with W number) efdservice@ucl.ac.uk

8. The request will be added to the next available collection (provided there is space).

9. Collections from the Christopher Ingold and Kathleen Lonsdale Buildings take place on every other Thursday. Collection of lab small chemicals will occur on the same day as the bulk collections.

10. The requester will be contacted with the date of the collection to be made. The requester (or a nominated person) must be available on the given date to direct the disposal chemist (Tradebe) to the waste location.

11. On the collection date, the disposal chemist (Tradebe) will contact the requester (or the person nominated on the form) to arrange a time to collect the waste.

12. At each collection the representative from the Chemistry Department will be required to sign a consignment note; a legal document that MUST BE KEPT FOR 3 YEARS.

13. The waste will be taken away and any empty container requested will be left behind.

Waste Solvent

Waste solvents must be disposed of in plastic drums and not thrown down the sink. Empty drums are supplied free by Chemistry Stores. Separate drums must be used for chlorinated and non-chlorinated solvents and care must be taken to see that waste is put into the correct drum. Acid waste must be neutralised first. Only liquid waste must be put into the drums. Aqueous waste must not be put into the waste solvent drums, but put in separate drums.

Note that drums containing waste solvents should be uncapped only when solvent is added to them and drums should be capped at all other times. The caps must not be damaged in any way.

To reduce the risk of Fire in our labs, free up space, and improve the general environment within laboratories in the Christopher Ingold Building, there is a weekly collection of chlorinated and non-chlorinated solvents.

Disposal of any solvent, chlorinated and aqueous waste can be achieved by contacting the chemical stores manager, Tony Field – who will confirm if there is capacity in stores to take the waste.

On Monday, Tuesday and Wednesday mornings, between 8.00 and 12.00 – waste solvents drums should be collected for storage prior to disposal from the department.

When drums are full or nearly full (note for denser than water solvents the drum should be disposed of when it weighs about the same as a full container of water, that is about 20kg, so that the container can be lifted safely) they should be brought to the departmental stores for storage prior to collection by the disposal company.

At the stores you will:

- Complete a form giving details of quantity, who you are, and your research group.
- You will take numbered tag(s) to attach on each drum(s),

- You will put the drum in room G.26 (the acid store).

The Departmental Safety Officer may require a drum not yet ¾ full to be emptied on safety grounds, e.g. if the drum is getting too heavy (for instance where halogenated solvents are collected) or where the drum may pose a risk if left to stand (the materials present are likely to react with atmospheric oxygen to form peroxides).

Empty bottles

These should be disposed of without delay. Before disposal, all bottles should be emptied of any residual content, rinsed and their caps discarded. It is particularly important that any drying agent is removed and particular care should be taken to destroy any sodium wire and remove all traces of residue.

All washed out, odourless, empty bottles should then be taken to the stores where the Stores Manager, Mr Tony Field, will inspect them prior to placing them in the recycling bins. Bottles should not be left in the Stores without Mr Field's knowledge.

Glassware (Pipettes, Chromatography Plates, Glass Syringes & Broken Glassware)

Items for disposal must be placed in UN approved yellow plastic waste containers, which can be obtained from the stores. When full, the containers should be sealed and put outside the laboratory for removal by the cleaning staff. If they are not removed by the cleaning staff, the Departmental Waste Control Supervisor (Mr David Ladd, tel. 24626) should be notified.

Note that cardboard containers are insufficiently robust for the disposal of broken glassware.

Solid Waste

Provided it is free of toxic substances, solid waste (e.g. alumina or silica residues) should be collected in plastic containers fitted with a lid (different types of waste should not be mixed). When full, the containers should be disposed of by taking to stores on Monday, Tuesday or Wednesday mornings between 8.00 and 12.00.).

Syringe Needles

Needles and cannulas for disposal must be placed in yellow, plastic, sharp safe bins, which can be obtained from the stores. When full, the lid must be firmly closed and the bin put outside the laboratory for removal by the cleaning staff.

Needle bins should be available at point of use, rather than at the front of labs or with other waste receptacles - so needles can be disposed of immediately and the need to gather a number of needles and carry them across labs is removed.

Laboratory Waste

UCL wishes to increase the amount of material that is recycled. There are two types of bags for waste, both of which can be obtained from stores.

Clear plastic bags are for uncontaminated hand towels, paper and cardboard.
Yellow bags are for contaminated waste, e.g. paper and gloves contaminated with chemicals. These bags will be incinerated.

When full, the bags must be sealed, which can be done by gathering the neck together and wrapping some sellotape round it. Sealed bags should be left outside the laboratory for collection by the cleaning staff.

Refrigerators and Freezers

Old or unrepairable refrigerators or freezers should be cleaned out and deodorised with charcoal and disposed of via the Departmental Waste Control Supervisor (Mr D. Ladd, tel. 24626).

17 ELECTRICAL APPARATUS

All equipment used within the department must be Electrically Inspected.

The Electricity at Work Regulations (1989) require that all portable electrical equipment (essentially anything with a mains plug) should pass some standard inspection of electrical safety; this must be made regularly, and the results recorded.

Inspection

Technical Support will inspect and test as necessary all electrical equipment on a two-year cycle and more often if needed.

On a 2 yearly schedule all electrical equipment is tested for electrical safety and labels are placed on items that are clearly in use. New equipment (less than two-years old) does not need an inspection or label. Any equipment that is repaired or modified will be electronically tested and labelled.

Users should visually inspect any equipment they intend to use before each use. Damaged or malfunctioning equipment must not be used until Technical Support or a competent service engineer has agreed it is safe to use.

All personal laptops must have a UK adaptor including a picture of the CE or UKCA mark.

New and modified equipment

New electrical equipment should be bought from a reputable supplier and must be CE or UKCA marked. Any electrical equipment with the capability to cause harm (mains voltage, high energy or that will be attached to people) that is manufactured or modified within the department must be approved by the department (Technical Support) before operation.

Equipment should have the correct rating of fuse (current and fuse speed). If a fuse ‘goes’ the reason for it ‘blowing should be rectified or if the reason is unknown the equipment should be checked by Technical Support before use. A higher current fuse must never be fitted to an item of equipment.

Extensions and multi-way connections

If there are insufficient numbers of sockets available extension leads may be used as a temporary solution.

Where extension leads are used:

- Extension boards must not have more than four individually switched sockets. They should not be 'daisy chained'.
- Cube multi-connector blocks must not be used.
- Extension boards should have individual switched sockets to allow individual items to be turned on or off.
- Extension boards should be attached to furniture or suspended off the ground if in continuous use.
- Leads must not trail across walkways in a fashion so as to cause a trip hazard.
- Extension reels have different safe maximum capacities when coiled or fully unreeled, if you need to use an extension reel, please see the DSO or Building Manager first.

Electrical Equipment in Hazardous Environments

Water; If electrical equipment is to be used in a wet environment or in an area likely to get splashed it should be of a type designed for use in that environment (i.e. Pumps used for circulating cooling water could be aquarium or pond equipment and be used in the according to manufacturer's instructions with regards to whether it is suitable for operation submerged or not.).

Flammable or Explosive Atmosphere: If electrical equipment is to be used in an area where there may be an explosive atmosphere, or where significant quantities of flammable materials are used or stored the equipment must be certified as safe to use in that environment.

Additional Electrical Safety Requirements

For current equipment and any newly purchased equipment each research group / facility **must follow the procedure below before the equipment will be permitted to be used**:

- UK law allows us to operate equipment without a CE/UKCA mark, but with a risk assessment, if we can prove that it is necessary to use that particular piece of equipment and other measures are in place to ensure electrical safety. If the equipment does not have a CE/UKCA mark all the other safety features must be in place. For all equipment an SOP (safety operating procedure) should be in place, i.e. a RiskNET should be logged by the research group / facility and clear guarantees that the equipment confirms to standards should be provided by the manufacturer.
- Adaptors must not be used and equipment must be bought from a reputable supplier, with the equipment having CE or UKCA marking. If it is a reputable supplier with CE/UKCA markings, then the equipment can be used once the RiskNET has been completed. Current/older and/or 2nd hand equipment must be checked by Tom Bridges and have a fused UK plug fitted. An up-to-date and valid RiskNET for the equipment must be provided to Tom prior to him checking any equipment.
- HSE guidance is that **instructions in English** must be provided with each piece of equipment bought. Please ensure all your kit has this in place.
- All new equipment should be checked carefully for damage before being used.

Any equipment not conforming to the above will not be permitted to be used in the department.

18 EMERGENCY PROCEDURES

The fire alarm sound

The fire alarm is a loud continuous ringing.

When the fire alarm bells sound:

- Close all windows and doors.
- Provided that there is no personal risk,
- Stop all machinery,
- Switch off electrical supplies to equipment,
- Turn off gas supplies and gas cylinders.
- Leave the room. The last person out should close the door.
- Do not use the lifts.
- Leave the premises by the nearest escape exit or staircase which is safe to use.
- On leaving the CIB assemble in Gordon Square, on the pavement outside the Institute of Archaeology or on the pavement in Endsleigh Gardens.
- On leaving the KLB assemble in Gower Place on the pavement or in the Physics Yard at the rear of the building.
- Fire Evacuation Marshals (FEM) have been appointed for each floor. They can be identified by the high-visibility waistcoats they will be wearing and all other personnel should follow their instructions during an emergency.

Staff and students must make sure they are familiar with all escape exits and assembly points.

Dealing with emergencies.

There are general principles involved with dealing with emergencies.

Check for danger for yourself or others - preventing injury or further injury is the priority.
Get help – make sure help is on the way and others know of the situation. Never try to deal with a safety emergency when you are on your own and nobody knows.
If you have the necessary knowledge, skills and equipment, you can attempt to deal with the emergency as long as you don't put yourself or others at significant risk and there is a realistic chance of succeeding.

On discovering a fire

If a fire occurs, the fire alarm must be activated by using one of the break glass call points. You should then leave the building by the nearest safe exit, and report to the Senior Fire Evacuation Marshall by the main entrance. You or the Senior FEM should dial 222 or 999 from an internal phone, or 999 from a mobile phone, and ensure that the Fire Brigade are aware there is a fire.

The only exception to this is if the fire is small, then once the alarm is raised, if you are confident you can deal with the fire and you have help you can attempt to deal with the fire if you are in no danger. Don't spend too long at it; if you are not successful within a few seconds, give up, and leave the building.

NOTE: The use of fire extinguishers is restricted to personnel who have completed the online Moodle Fire Extinguisher training and attended the College training course or equivalent. Fires can be made worse by the incorrect selection/use of fire extinguishers. Fire blankets may be used to smother a fire.

All use of fire extinguishers or fire blankets must be reported to the Technical Safety Officer, Mr Crosby Medley (CIB Room 201E).

All fire incidents must be reported to the DSO.

Explosion, major spillage or other imminent danger

Raise the alarm. Evacuate the room.
Call for assistance for any injured person – (or send under escort to the Health Centre or UCH A&E as appropriate – see under Accident). NOTE dealing with any injured people, and preventing further harm to them or others MUST be the number one priority!

If there are fires that are beyond the capability of personnel present, or if further danger threatens the surrounding area, Leave and inform the person managing the emergency.

In the case of major spillage contact the Technical Safety Officer or the Departmental Safety Officer.

Release of toxic substance

Evacuate the room and all others subject to any danger. Raise the alarm initially by telling everyone in the area and by notifying the DSO and departmental managers.

If the release is widespread, sound the fire bells to evacuate the building. Ensure that all personnel keep clear of the imminent danger zone whilst so doing.

Act as under “on discovery of fire” above.

The Hazards Laboratory

The Hazards Laboratory (CIB Room 451) is on the fourth floor of the building and fitted with special roof which is easy to shatter. The Departmental Safety Officer is responsible for the Hazards Laboratory and any requirements to use this lab need to be discussed with the DSO.

Aftermath

Whenever an incident has led to or may lead to damage to the fabric of the building or services, College Maintenance must be informed without delay (tel. 41224 for damage to the fabric of the building and 30000 for other issues). See accidents and incidents for how to report an incident. All incidents must be reported without delay to the DSO and will be investigated.

It is important that the cause of any incident be established to prevent recurrence. Therefore, once an area involved in an incident has been rendered safe, it is important that there is no further disturbance of the site that may in any way destroy evidence, until the incident investigation has been carried out.

After Unexpected Power or Service Outages

The following procedure following an unexpected power or service (such as water supply) outage or any event requiring closure of the Department must be implemented:

Ascertain the expected duration of power outage/other event:

- Technical Support Group to report outage by phone to Estates and Facilities Officers as appropriate and to update and advise DSO/Assistant DSO.
- If outage/event is of long duration:
- DSO/Assistant DSO, Joe Nolan (Technical Support Team), to meet with HoD/Deputy HoD and advise cessation of experimental work. Cessation of experimental work should only be agreed via consultation of HoD/Deputy HoD with DSO/Assistant DSO.
- All supervisors to be notified (by the above team) that researchers are to stop all work, turn off all appliances at the sockets, turn off all taps and leave laboratories. (Note: power outage stops water flow to the upper floors of the CIB).
- DSO/Assistant DSO, Joe Nolan tour all laboratories to check that appliances and taps are turned off and advise students to leave. Academics can remain in their offices provided there are safe exits, active fire alarms and the natural lighting is sufficient.
- Technical Support Group to keep all staff and students informed of significant developments where appropriate.
- No experimental work permitted until power is reliably restored.

Out-of-hours

If the seriousness of the situation warrants it, dial 222 and ask for the fire or ambulance service.

19 EMERGENCY CHEMICAL SPILLS

Material for chemical spills can be obtained from the Stores. Every laboratory should have at least one easily accessible ‘spills kit’. If a chemical spill cannot be dealt with safely (especially if it presents a respiratory hazard), evacuate the area. If the spill occurs outside normal working hours, then the affected area should be secured and the spill dealt with on the next working day. If at any time there is any reason to believe that life may be threatened, the Fire Brigade must be called immediately (tel. 222). If there is a mercury spill there are special mercury sponges available to use, they are currently stored in the Turner teaching laboratory, see Martyn Towner.

20 EMERGENCY SHOWERS AND EYEWASH STATIONS

For chemical splashes, dowsing with water from a nearby tap is the most suitable action. Note, laboratory sinks are supplied with Cat 5 fluid which expected to be contaminated. Hand wash sinks are provided with Cat 1 or Cat 2 water which is safe and is expected to be free from contamination. Research labs are equipped with flexible hoses connected to the mains water supply to provide an emergency eyewash station, and this can equally well be used in the case of chemical contamination.

There is an emergency shower located in the First Aid Room (CIB, G2).

The College Fire Officer advises that the use of Emergency Showers to extinguish a fire on a person is not generally considered appropriate. A conventional fire extinguisher (Powder, CO2 or water) or fire blanket is usually more effective.

21 EXPLOSIONS & IMPLOSIONS

Chemicals

If it should be necessary to conduct a reaction in which there is a significant risk of explosion, arrangements should be made to conduct it in the Hazards Laboratory (CIB Room 451), and a face shield, blast shield, and gloves should be used by the operator. The Departmental Safety Officer must be informed before any use of the laboratory.

Physical risk of vessel failure (pressurization or vacuum)

Any container with glass components (whether glass reaction vessels or viewing ports on steel vessels) where there is a possibility of pressurization whether deliberate or accidental should be treated as an explosion risk and precautions taken to prevent harm in such cases.

Glass vessels should always be inspected to ensure there are no cracks visible before use.

Glass bulbs and rotary evaporators under vacuum should be protected against the effect of implosion by plastic netting, or tape, or by use of a plastic screen.

22 EYE PROTECTION

Protective glasses or spectacles must be worn at all times when in laboratories or when conducting operations which involve the possibility of eye damage. Where liquid nitrogen is dispensed or where large volumes of corrosive or toxic by absorption chemicals are to be used a full-face visor should be worn. Safety glasses vouchers can be requested by staff and students, please contact the DSO or Dr Caroline Knapp about your safety glasses requirements.

23 FIRE

See Emergency Procedures.

All fire doors within the department must be kept shut. This will slow the spread of fire and prevent smoke or toxic fumes from being spread throughout the building.

All fire doors must be kept clear of signs across the glass. This allows firefighters to see into the rooms easier.

24 FIRST AID

See Accidents

First Aider Lists

A list of first aiders is available on the UCL Chemistry Intranet site and posted around the Chemistry Department buildings on walls. The posters give details of first aider name and gender, location and contact telephone number. There are two different first aid posters, one for the Christopher Ingold Building and one for the Kathleen Lonsdale Building.

Minor Injuries

Minor injuries should be treated in the department by a first aider or, if necessary, by the A&E Department of University College Hospital, the entrance to which is 235 Euston Road.

Serious Injuries

More seriously injured, but moveable, casualties should go straight to UCLH at all times.
For a serious casualty summon help immediately by telephone (Ext 222).
Any person involved in an accident which affects his/her eyes must be seen by the UCH A&E Department. This includes laser eye strikes or exposure to UV sources.

First Aid Boxes

First Aid boxes (containing dressings, plasters and other stores for treating minor injuries) are kept in laboratories and at other sites in the Department. Laboratory users should ensure the boxes in their areas contain adequate in-date supplies and should contact Mr Crosby Medley (CIB Room 201E tel: 24643) for refills. First aid boxes get checked regularly via a rota.

First Aid Room

A First Aid room (CIB, G2) is available where casualties may rest or be treated by first-aiders. This room must be kept in good condition. The room is also used for parents to change their children, or for breastfeeding mothers. Its prime purpose is for First Aid.

First Aid Provision with UCL

The Occupational Health Service does not provide a "Walk In" service or a "Call Out" service for people who are injured or taken ill on the main campus.

If it is possible a casualty could faint or enter a state of shock they should not be walked to A&E, under such circumstances an ambulance must be summoned.

Ambulatory casualties should be sent or escorted to the Accident and Emergency Department at UCLH. It is very important to ensure that chemical splashes to the skin or the eye are very thoroughly irrigated in the Department before the casualty is sent to hospital.

25 FOOD & DRINK

Eating and drinking is forbidden in all chemistry laboratories, as is the storage of food and drink in refrigerators and deep freezers provided for chemical use.

26 FUME CUPBOARDS

The airflow for all fume cupboards is measured and logged annually. However, the airflow should be checked daily before use. To do this, the simplest method is to tape a small strip of tissue paper to the base of the sash and note if it is sucked gently towards the back of the fume cupboard. If there are any concerns about the performance of the fume cupboard, e-mail the authorised member of staff on the relevant floor of the building, who will contact the Estates and Facilities Maintenance Division and request that the problem be investigated on safety grounds. See Maintenance of the Building for a list of the names of authorised staff.

Do not use a fume cupboard with the sash above the recommended height. In this case an alarm should sound as the airflow is insufficient.

Keep fume cupboards clean, tidy and uncluttered. Do not block the airflow by storing large containers at the back and do not write messages on the glass.

A guide to fume cupboard use can be found on the Safety Service website

LINK https://www.ucl.ac.uk/safety-services/policies/2021/dec/local-exhaust-ventilation-lev

27 GAS CYLINDERS

Gas cylinders, particularly the larger sizes, are very top-heavy and can cause serious crush injuries on falling.

The contents at high pressure constitute a large amount of stored energy, sudden release of which can be highly dangerous: fracture at the neck can convert a cylinder into a missile.

The contents may be toxic, flammable or fire-promoting. Sudden or slow escape may lead to fire, explosion or deadly concentration of toxic gas.

Hazards associated with gas cylinders may not only affect the regular users of laboratories and workshops, but also put at risk members of the emergency services if called upon to tackle fires in those places containing gas cylinders.

From 1st July 1994, full compliance with the Pressure Systems and Transportable Gas Containers Regulations 1989 is a statutory requirement in the UK.

The following rules, a composite of Government statutory requirements, HSE recommendations and common-sense precautions, are mandatory for all users of gas cylinders in the department.

General

- All cylinder valve spindles have right-hand threads.
- Non-combustible gas cylinder heads have right-hand threads.
- Combustible gas cylinder heads have left-hand threads.
- Only individuals properly instructed by a person of experience are allowed to use gas cylinders. In case of difficulty the Technical Safety Officer, Mr C. Medley, CIB Room 201E should be consulted.
- In use or in storage, cylinders must at all times be secured adequately against falling. Large cylinders must be clamped to the bench at all times. Smaller cylinders should be kept in the stands provided. Lecture bottles while in use must be clamped to a suitable stand, unless hand-held; when not in use they must be stored in a rack, away from any source of heat (and not kept hidden in a drawer). Lecture bottles containing toxic, offensive, or corrosive materials are best stored in a fume cupboard.
- The number of cylinders held in a laboratory or workshop must at all times be kept to a minimum, but in any event shall be restricted to those in current use and connected to equipment.
- Within laboratories or workshops, cylinders must be kept away from sources of heat and corrosion and should be located if at all possible against an outside wall.
- All cylinders must be turned off at the cylinder valve when not in use and must be returned to BOC or other supplier for financial as well as safety reasons.
- The valve on a discharged gas cylinder must be closed.
- Excessive force must not be applied to valve spindles or regulator securing nuts; accordingly, the use of non-standard valve keys and regulator spanners is not permitted. Cylinder valves should always be opened slowly.
- Cylinders of permanent (i.e. non-liquified) gases must be operated with the correct type of regulator fitted. The cylinder valve must not be used to regulate the gas flow.
- Cylinders of liquified gases may, depending on the supplier's instructions, be used with or without a regulator.
- Cylinders of liquified gases must always be stored in an upright position.
- Cylinder valves or regulator fittings must never be lubricated or greased.
- As cylinder regulators contain elastomers and seals which deteriorate in and out of service, it is recommended that these regulators are changed after 5 years from manufacture. Regulators are now stamped with an expiry date.
- For corrosive and toxic gases, e.g. hydrogen chloride, ammonia, hydrogen sulphide, chlorine, the regulators deteriorate and corrode quicker. They need to be replaced after 1-2 years. Monitoring the regulator for corrosive damage is important.
- Even when carried on trolleys, cylinders must have valves closed and regulators removed during transport.
- Cylinders must not be used as rollers; work supports or jacks.
- If cylinder-supplied gas under pressure is introduced into an apparatus containing glass or other frangible components, adequate protection against explosive fragmentation must be provided.
- Where gas is delivered from a cylinder by dip-tube into liquid, the regulator and cylinder must always be protected against possible suck-back by a trap of adequate capacity.
- Equipment newly connected to a gas cylinder should always be tested for leaks. Leaks at the regulator connections and other joints may be detected simply and safely by applying a dilute aqueous solution of washing-up liquid.
- If rubber tubing is used it must be inspected for cracks or perishing and be securely attached.

Flammable Gases

Before flammable gas can be used a risk assessment of the experiment and the environment where the cylinder is to be used must be completed and a UCL Flammable Gases permit must be completed and signed by one of the appointed persons (flammable gases).

LINK: https://www.ucl.ac.uk/safety-services/policies/2020/jul/gases-compressed

The “Appointed Persons (flammable gases)” are:

- Christopher Ingold Building Robert Wilson

- Kathleen Lonsdale Building Jamie Baker

Acetylene and Liquefied Petroleum Gas (LPG)

Note: Acetylene is considered an explosive under explosives regulations and a license must be obtained to possess or use acetylene cylinders.

- Cylinders of acetylene must be operated in conformity to the '21 POINT CODE' documented in the HSE publication 'Use of Acetylene'.
- Under no circumstances is it permitted to operate an acetylene cylinder without a fitted flash-back arrestor (within its expiry date).
- Cylinders of acetylene and LPG must not be used or stored otherwise than in the upright position.
- Acetylene must not be used with piping or joint fittings that contain copper (or silver).
- Position of all acetylene cylinders must be reported to the DSO (requirement of the Fire Brigade).

Carbon Monoxide

Carbon Monoxide gas should be used only by properly instructed individuals and in the vicinity of a carbon monoxide monitor.

Cylinder Checklist

- Check that the cylinder you use contains the gas you want (check the label).
- Site BOC workers will transport all cylinders on notification by e-mail (ucl@boc.com). If necessary, transport the cylinder on an approved trolley (if the trolley is damaged take it to the Workshop) by pushing and not by pulling.
- Make sure the cylinder is firmly secured in an approved location.
- Cylinders must not be used from the trolley in a laboratory.
- Cylinders must never be left freestanding.
- Check the pressure regulator. Is it designed for the gas you are using? Check the pressure rating. Is it capable of coping with the pressure in the cylinder?
- Never use oil, grease or sealing tape (e.g. PTFE), especially on an oxygen cylinder: the result can be catastrophic.
- Turn the regulator to zero without using excessive force before opening the valve at the cylinder head and when finished close the valve at the cylinder head first.
- Never transport the cylinder with its regulator in place.

28 GLOVES

Introduction

Gloves can be used in laboratories for a number of reasons including:

1. Protect the work- (product protection)
2. To protect the user from contact with hazardous substances.
3. To protect the user from sharp or abrasive objects.
4. To keep hands clean.
5. Control and containment of contamination.
6. Protection from hazardous radiation.

It is imperative that where gloves are worn for safety reasons (as personal protective equipment) that the glove is selected as the result of a suitable risk assessment process.

Safety Legislation and Gloves

Gloves are articles of protective equipment under the Personal Protective Equipment regulations 1992 revised 2005 (the PPE regs).

The PPE regs require that risk assessments are conducted to ensure that sufficient protection is provided and that any hazard created by wearing the gloves does not outweigh the benefit.

The Control of Substances Hazardous to Health regulations (CoSHH) requires that all other risk control methods of risk reduction must be applied before PPE is used. So, PPE is only ever used to protect against residual risk.

General requirements of Personal Protection gloves

The PPE regs require:

- Gloves should fit the individual correctly, be comfortable and allow sufficient dexterity that the intended task can be efficiently and safely conducted.
- Laboratory gloves should usually cover the hand and wrist to overlap with lab coat or overalls.
- Where glove are reusable, proper storage facilities should be provided so that the gloves can be stored without risk of damage or of contamination, either the glove contaminating its surroundings or the glove becoming contaminated by its environment.
- There may be requirements that gloves do not reduce dextrousness and do not remove too much touch sensitivity.

UCL policy is that latex gloves can only be used after a risk assessment and determining that latex is the most appropriate polymer for the task in hand. People intending to use latex gloves must be screened by UCL Occupational Health for allergy prior to use.

Considerations with wearing gloves

- Wearing gloves can create a false sense of security,
- Wearing gloves can reduce sensitivity and manual dexterity
- Wearing gloves can result in allergies to the materials in the glove or the materials used in manufacture
- Wearing gloves can result in skin infections.

- Gloves may be flammable or melt and cause burns to be more serious.
- Gloves end up as laboratory waste

But it is important to remember despite the down side to wearing gloves they do offer important protection against laboratory-based hazards, whether is chemicals or hot/cold objects.

Selection of gloves

Gloves can protect against physical hazards, sharp surfaces, hot or cold surfaces and electric shock, or they can protect against substances toxic, corrosive or pathogenic organisms or a combination of all the hazards.

Selection of gloves for use with hazardous chemicals

The decision should be made to use chemical resistant gloves on the basis of the hazards present.

If the during a risk assessment for a procedure, it is identified (e.g. from a Safety Data Sheet) that the substance(s) used, (or are produced in a process) are highly toxic by skin absorption or are highly corrosive to skin and during the procedure there is possibility of skin contact. The CoSHH hierarchy of control for chemicals hazards must be applied:

- Consider substituting safer chemicals.
- Reduce the amount of chemicals.
- Contain the chemicals – use closed systems, carry out reactions in ‘spill trays’.
- Use the chemicals in a safer form – use as solution rather than neat.
- Use remote manipulation techniques – contain in glovebox, use Schlenk apparatus, use automatic dispensers of pipettes.
- Use good laboratory technique and hand wash to protect against contamination
- After the controls from the CoSHH hierarchy have been applied if there is still a possibility of skin contact and harm from the substance then gloves should be worn that provide the necessary protect at the points in a procedure where skin contact could occur.

Sources of information to assist with glove selection

Laboratory Chemical protection gloves must conform to EN374 (http://www.guide.eu/en/info/EN/en374.html).

1. Manufacturer’s Safety Data Sheets recommend glove types for specific substances.
2. Tables giving breakthrough and permeability data for specific gloves

Glove supplier	Link	Comment
Ansell Chemical resistance Guide, Permeation & Degradation	https://www.ansellhealthcare.com/pdf/guide_hazardous_materials.pdf	PDF table.
Kimberly-Clark	https://www.kimtech.com/nitrilechemicalresistanceguide/K2365_09_01_SN%20Chem%20Guide_v10.pdf	Online table - suggests Gloves for chemical name or CAS

General Laboratory Chemical Glove use

Users should check gloves for holes prior to use and use proper technique for the safe removal of the gloves.

- All commonly used laboratory gloves have a failure rate, the higher the grade of glove (the AQL rating) the lower the percentage chance that the new gloves will have holes. Gloves should be checked before use. (a simple test is to trap some air in the glove, seal the mouth of the glove by gathering it and squeezing, if the glove does not hold the trapped air there is a hole in it.)
- When using a hazardous material, the manufactures specifications must be checked to ensure the glove will provide protection against the material used. Some materials will quickly penetrate certain materials or degrade them to the point of failure.
- Laboratory grade (not medical device grade) should be used to prevent exposure.
- Even materials that provide 'good' protection against penetrating or corrosive materials only do this for a time. Gloves should be changed immediately after handling high hazard materials.
- Gloves must be removed and hands washed before leaving the laboratory.

Glove use in Teaching Laboratories

It is the responsibility of the person designing the practical course 'experiments' for the teaching laboratories to ensure that risk assessments for the activity is suitable and sufficient and that control measures such as any requirement to wear specific gloves, are communicated to participants and demonstrators. It is possible for the laboratory class participants to undertake aspects of the risk assessment process as learning exercises, but the risk assessment must be authorized by a competent person.

Alternatively, the person responsible for the laboratory class can decide that a specific type of glove must be worn by everyone for specific times.

Mechanical protection gloves

Traditionally steel chainmail, tanned hide or leather gloves are traditionally used when carrying out tasks where there are risks of slashing or puncture. However newer materials such as Kevlar or Dyneema provide greater protection in a lighter more easily used alternative.

These gloves should comply with EN388 (See http://www.guide.eu/en/info/EN/en388.html).. Gloves classified as EN388 compliant are given a four digit code which indicates the abrasion resistance, blade cut resistance, tear resistance and puncture resistance. The numbers are 1 to 5 with 5 offering greatest protection (e.g. Honeywell DSM brand gloves have the code 4543).

UV protection (laboratory)

Different grades of laboratory gloves absorb UV to different extents; the amount of transmission of UV is dependent on a number of factors:

- the specific material used (note different coloured nitrile gloves absorb UV to a significantly different level),
- the thickness of the material,
- the extent to which the glove is stretched and
- the frequency or wavelength of the UV.

Note UV can change the properties of the polymers used in gloves.

It can be difficult getting information from glove suppliers on the level of protection their gloves provide, it may be necessary to use a light meter to make measurements of available gloves to select the one that offers the best protection.

Gloves used to Protect from heat

- Gloves designed for use with hot objects must comply with EN 407. (http://www.guide.eu/en/info/EN/en407.html)
- Oven gloves are designed for a maximum temperature of 250 degree C in a domestic environment so should not be used in laboratories.

Gloves used to protect from cold

- Gloves used to handle cold materials should be designed for the task, and comply with EN511 (See http://www.guide.eu/en/info/EN/en511.html). Oven gloves although insulated, are not designed to protect a cryogenic liquids.
- It is recommended that gloves used to handle liquid nitrogen have a closed cuff rather than be of the wide gauntlet type. This means that if there are splashes they will not run inside the glove.
- Gloves should be inspected and replace if showing signs of wear.
- Wet gloves will conduct heat, so will not protect against contact with cold objects or materials.
- Gloves are designed to protect against splashes not for immersion. Do not plunge gloved hands below the surface of hot liquids or cryogenic liquids.

29 HAZARDS LABORATORY

CIB Room 451, the Hazards Laboratory, is a departmental facility and is intended for use in carrying out experiments which the experimenter or his/her supervisor consider to be too hazardous to be performed at his/her usual workplace. A typical example would be an experiment where some risk of explosion is present, but it might equally apply to a physical chemist needing fume cupboard facilities which his/her workplace does not have.

Note that no experiment may be performed where the hazard (if it occurred) would not be contained within the Hazards lab. The aim is the Hazards Laboratory will always have good housekeeping, and any person wanting to use it, must return the Hazards Laboratory back to the clean state they find each time.

The key to the laboratory and the register are kept by the Departmental Safety Officer. If unavailable, Mr Joe Nolan can provide access, provided the laboratory has been previously booked with the DSO.

Procedures for its use are as follows:

- The Hazards Laboratory must be ‘booked’ after consultation with the DSO.
- The equipment must be set up immediately before the experiment and dismantled immediately afterwards, and the laboratory properly tidied up.
- Details of both the experiment performed (including all reactants used), name of the user and the time of use must be entered in the Hazards Laboratory register as well as on the white board on the outside of the laboratory door.
- If an experiment is to be performed overnight and left unattended the usual overnight permission must be obtained and placed outside the Hazards lab door, with an additional copy on the apparatus if needed to avoid confusion.
- Long-term high-pressure hydrogenation experiments must be checked carefully at regular intervals.
- A warning bell-push to summon assistance is installed in the hazards lab and causes a siren to sound.

30 HOUSE VACUUM SYSTEM

Unpleasant smells are sometimes evident in certain areas of the department. These have been traced to odorous chemicals being pumped through the house vacuum system. All research workers are reminded that an appropriate trap, normally one cooled in solid CO2, must be used to prevent volatile substances from entering the House Vacuum System.

31 HOUSEKEEPING

Many accidents can be avoided by good housekeeping. Bench and fume cupboard spaces are valuable resources and should not be unavailable because they are storing clutter that is waiting to be cleaned or disposed of.

Guidelines for housekeeping:

- Work with a clean and uncluttered bench, fume cupboard and laboratory.
- Keep coats and bags in the write-up area, and not in the laboratory.
- Do not allow paper (e.g. spectra) to accumulate so that it becomes a fire hazard.
- Clean up any spillages immediately, return chemicals to the appropriate shelves or cupboards, and dispose of empty containers.
- Empty Winchesters should be washed out and returned to Stores immediately.
- Working areas should be left clean and tidy at the end of the day.
- Label, with the contents and your name, any samples and flasks that will be left unattended.
- Never leave any sample, particularly an unlabelled one, that has to be disposed of by someone else at a later date.
- To have the laboratory cleaned and bins emptied, it is necessary to display on the door to the laboratory a signed yellow ‘‘Safe to Clean’’ card which can be obtained from Mr Joe Nolan (room 101B). On displaying these cards, the signatory takes the responsibility for the laboratory being safe for the cleaners to operate there. Offices, write-up areas and computational areas do not need yellow cards.

32 HYDROGEN FLUORIDE (HYDROFLUORIC ACID)

Hydrofluoric acid has a number of properties which make handling particularly difficult. HF attacks glass, concrete, most metals and organic compounds. HF damage to the body causes long term pain and burns which are slow to heal. Burns around the finger tips are reputed to be particularly painful and may require the surgical removal of finger nails. Fluoride ions are both acutely and chronically toxic so that even 1% solutions of HF (or metal fluorides) must be handled with care. The ability of HF to carry fluoride ions through intact skin increases greatly with increasing concentration. Above 10% concentration, the dangers of handling HF increase sharply and any contact with the skin for more than a few seconds can result in latent burns which may take hours before they start to cause pain. Manufacturers commonly supply HF as a 48% (28M) aqueous solution and sometimes as a 73% (44M) solution. Handling HF at these concentrations is far more dangerous than handling any other common concentrated acids.

Hydrofluoric acid contact with skin in not only dangerous due to the caustic or burning action of the acid, but will liberate calcium from bone to the blood causing cardiac failure.

Skin contact must be treated with HF antidote (calcium gluconate gel) as soon as possible, taking care that the person applying the gel does not get burnt from contact with the contaminated skin of the casualty.
HF antidote must always be available at point of use of HF.

NOTE: Currently Hydrofluoric acid use in research experiments is not permitted in the Department. If it is anyone wants to use hydrofluoric acid they must see the DSO first, there is an experienced team in the UCL Earth Science Department, who have a dedicated laboratory set-up for the safe handling and use of hydrofluoric acid in research work. This must be discussed in detail, please see Robert Wilson (DSO).

33 LABELLING CHEMICALS

It is vital that all containers of chemicals are clearly labelled; that loose and defaced labels are replaced; and that where necessary the labelling conforms with The Classification, Labelling and Packaging of Chemicals (Amendments to Secondary Legislation) Regulations 2015.

Within the Department the following information should be given on a label for safety reasons: the chemical name of the contents, the name of the person who made it or bottled it, the name of his/her supervisor/affiliate, and the date it was bottled. Any known hazards should also be noted. The Stores have a supply of the conventional hazard signs and the appropriate one should be affixed, particularly if the bottle is likely to be kept for any time. The signs are illustrated in the section on Chemical Hazards. All bottles stored should preferably have their tops resealed, and their labels covered with transparent adhesive tape (both to fasten them more securely and to prevent the ink from bleaching). The Stores have self-adhesive labels, adhesive tape, and a selection of hazard warnings.

It is particularly important that any samples placed in refrigerators should be fully labelled and no samples should be stored in a refrigerator indefinitely.

Re-labelling of bottles for the storage of different chemicals is potentially hazardous. If bottles are re-used for different substances, the old label must be completely removed and replaced, or the old label must be completely and securely covered by a new label. Suitable labels are available from the Stores.

34 LASERS

Use of Laser Equipment

Special precautions have to be taken to avoid exposure to high-energy laser sources because of the concentration of the output energy into a beam of very small cross section. Those responsible for the local rules for the use of lasers are as follows.

Responsibility for Laser Safety rests with the Head of Department.

The College Laser Safety Officer: Fiona O'Farrell, tel. 58607.

The Departmental Laser Safety Officer: Dr Michael Parkes, CIB Room 205, tel. 24639.

Room Person in charge Contact Details:

CIB LG30 Dr G Volpe CIB Room 431, tel. 25812

CIB LG31 Dr T Clarke CIB Room 431, tel. 25812

CIB LG32 Prof H Fielding CIB Room 3xx, tel. 2xxx

CIB G16 Prof D Caruana CIB Room G16G, tel. 24527

Use of Classes 3B and 4 laser Equipment

All users of lasers in classes 3B and 4 must perform the mandatory college training and be registered, using the Laser User Registration Form (see Appendix 4), prior to the commencement of any laser work. The purpose of this procedure is to ensure that all users have received full information and instruction on the hazards involved and the procedures necessary to control them. When all parts of the form have been completed and it has been signed and dated it must be returned to the Departmental Laser Supervisor (Dr Michael Parkes, CIB Room 205, tel. 24639).

All class 3B and 4 lasers must be registered using the laser registration form. Further, before any use of the laser occurs a full risk assessment and scheme of work must be developed and approved by the Department Laser Safety Officer (Dr Michael Parkes, CIB Room 205, tel. 24639). This procedure is necessary to ensure that the laser will be used in a safe manner.

Any purchases of lasers in classes 3B and 4 must be first cleared with the Departmental Laser Safety Officer (Dr Michael Parkes, CIB Room 205, tel. 24639).

When working with lasers general rules are:

· Make sure the lasers are operated in a safe manner. Goggles should be used and all laser beams terminated safely. Where possible laser beams should be fully enclosed.

· Only authorized and trained users are allowed into the laser laboratories.

· Make sure other users of a laboratory are aware of any active lasers.

· If a contractor (such as a laser engineer) visits the laboratory to perform work on a laser system all users should be aware of their presence. The nature of the work a contractor may perform can lead to unguarded beams and reflections and the defeat of interlocks. Therefore, extra care is required.

· For more information, please contact the Laser Safety Officer (Dr Michael Parkes, CIB Room 205, tel. 24639).

35 LEAD COMPOUNDS

All work with lead or its compounds must, by law, comply with the Control of Lead at Work Regulations 2002 which imposes specific additional requirements to those already imposed by the Control of Substance Hazardous to Health Regulations - these include a requirement to place under medical surveillance anyone whose expose is significant. Therefore, anyone who wishes to work in this field must first seek advice from the Departmental Safety Officer. This includes the use and handling of organo-lead compounds.

36 LIFTS

The passenger lifts must not be used for the carriage of solid CO_2, liquid nitrogen or liquid helium. Liquid nitrogen or liquid helium can be transported in the goods lift in the CIB without passengers

by using the key on the basement level to lock the lift to prevent anyone boarding during transportation. Working in pairs to move cryogenics is a good practice. The dumbwaiters can be used for transportation of cryogenics.

People must not travel in the goods lift with Dewars or containers storing liquid nitrogen. They should put Dewars in the lift, close the doors and call the lift from the desired floor. There is a warning notice to this for each lift door on every floor for the CIB.

In the Kathleen Lonsdale Building there is a 'Call and Send' system which should be used to transport liquid nitrogen, the system is key operated and allows the operator to call the lift to the basement floor and then send it to the desired floor without anyone else being able to interrupt or operate the lifts. See Professor Jamie Baker for further information.

Passenger lifts should not be used to transport hazardous chemicals; hazardous chemicals should be transported in the goods lift or hoists (dumb waiters).

If the fire alarm sounds, use the stairs, not the lifts.

37 MAGNETIC FIELDS

The strong fields associated with the superconducting magnets of modern NMR spectrometers can be hazardous. In particular, stray magnetic fields from these spectrometers can affect heart pacemakers. HMSO publications give permissible levels for stray magnetic fields.

Care should be taken to prevent ferromagnetic objects being brought across the safe demarcation lines into strong magnetic fields

Anyone wishing to use NMR facilities in the Chemistry Department must receive appropriate induction for the NMR supervisor.

38 MAINTENANCE OF THE BUILDINGS

Members of staff authorized by the Head of Department to complete Service Request Forms are listed below.

Christopher Ingold Building

Basement
Dr Kersti Karu kersti.karu@ucl.ac.uk
Dr Michael Parkes michael.parkes@ucl.ac.uk

Ground Floor
Mr Tony Field t.accini@ucl.ac.uk
Dr Louise Price l.s.price@ucl.ac.uk

First Floor
Mr Tony Bernard j.a.bernard@ucl.ac.uk
Dr Helena Wong helena.wong@ucl.ac.uk

Second Floor
Mr Crosby Medley c.medley@ucl.ac.uk

Mr Alan Philcox a.philcox@ucl.ac.uk

Third Floor
Dr Chris Blackman c.blackman@ucl.ac.uk

Fourth Floor and Upper Fourth Floor
Mr Dave Ladd d.j.ladd@ucl.ac.uk
Dr Robert Wilson robert.wilson@ucl.ac.uk

Kathleen Lonsdale Building:

Second Floor
Dr Helen Allan h.allan@ucl.ac.uk

Third Floor
Dr Scott Woodley scott.woodley@ucl.ac.uk

Report any faults connected with the fabric of the building (lights, doors, taps, fume cupboards etc.) by e-mailing the relevant authorised person on the floor where the fault is located. The emergency maintenance phone no. to be used by the staff listed above is ext.30000 or ext.33333 after hours.

39 MANUAL HANDLING

Lifting or moving by untrained personnel can cause serious injury. Never handle any heavy object (e.g. a gas cylinder, a vacuum pump or even a box full of photocopier paper) unless you are competent to do so.

The College runs courses on manual handling and you should attend one of these if you are required to carry out this type of work. If you are in doubt, always consult your supervisor before moving heavy objects.

40 MERCURY METAL

Mercury is a virulent poison that is readily absorbed through the respiratory tract or through unbroken skin. It acts as a cumulative poison since the element is eliminated from the body only very slowly. The present accepted threshold limit for mercury in air is 0.05 mg m-3. (NB. air saturated with mercury vapour at 20 °C exceeds the toxic limit by 100 times.) High concentrations of vapour may cause a metallic taste, nausea, abdominal pain, vomiting, diarrhoea and headache. Chronic effects from continual exposure to small concentrations can cause severe nervous disturbance, insomnia, loss of memory, irritability and depression.

Mercury should normally be handled in a fume chamber and gloves should be worn. Apparatus containing mercury should be placed in a tray, so that any spillage is contained. Spilled mercury rapidly develops a film of grease and dirt which reduces the vapour pressure, but this film is readily broken by vibration. Any spillage of mercury should be cleaned up immediately. A small aspirator fitted with a capillary tube and connected to a water pump or the house vacuum can be used for sucking up droplets. Mercury spilt into floor cracks can be made non-volatile by putting zinc dust down the cracks to form the amalgam. Smooth surfaces may be decontaminated by scattering and sweeping up a mixture of equal weights of zinc dust and dry sand or sawdust, which should

then be disposed of as toxic waste. The Department also has mercury sponges available as well, these are currently stored in the Turner Lab (Lab 201) see Martyn Towner.

Mercury compounds are also highly toxic, especially organo-mercury compounds.

Mercury Checklist

- Mercury must only be transported in small quantities in plastic containers (glass bottles are unsuitable because breakages will result in spillage over a large area).
- Always handle mercury in a well-ventilated area and in a suitable plastic tray (mercury may react with a metal tray or may be absorbed into a porous material e.g. wood). Do not breathe the vapour.
- Avoid skin contact; wear disposable gloves. Wash hands thoroughly after using mercury, especially before eating, drinking or smoking, to avoid ingestion.
- Use secondary containment on all apparatus containing mercury (e.g. manometers and McLeod gauges). Take care with mercury in glass thermometers.
- The exhaust from vacuum pumps on systems containing mercury must always be vented either to the outside or into a fume cupboard (this is good practice for all vacuum pumps in any situation).
- Clear up all spills immediately.

41 NOISE

Working in a noisy environment can be stressful and a health hazard. If noise is perceived to be a problem, the following strategy should be adopted prior to calling in specialist advice.
Identify all significant sources of noise within each affected area.

The simplest methods of noise control involve restricting the number of machines in use at any given time. Also limiting the amount of time in a given working day that staff and students work in the noisy environment.

Staff and students using machinery in these areas must be encouraged to take frequent breaks away from the noise. They must also be provided with quiet havens where they can do written work.

A noise assessment audit has been performed across working areas in the CIB and KLB in 2021. Noise readings had been taken and Exposure Points determined. No areas were found with noise levels beyond the UK legal limits.

Ensure that all mechanical sources of noise are part of a planned preventative maintenance programme. Efficient routine maintenance should eliminate drumming and rattling from loose machine parts and high frequency background noise. Some noise may be reduced by improved lubrication.

If a machine stands on or is fixed to a hard surface, noise may be transferred through the mounting blocks to the surrounding surface. A possible solution is to insert vibration isolators between mounting points and the operating surface.

The emphasis in this strategy is on cheaper options; however, if these make no perceptible difference to noise levels, it may be necessary to consider the following:

- An enclosure for either the whole or part of the machine, i.e. the source of the noise, to insulate it from the surroundings. This method must take account of the ventilation and exhaust requirements of the machine.

- Absorption materials, which reduce sound reflection, may be placed on walls, ceiling or floor. It may be necessary to consider placing screens of absorptive material between machines or between machine and operator.

42 NOTEBOOKS

To comply with the CoSHH regulations, a permanent record of all experiments must be written up at the time the work is carried out and must be preceded by an assessment of the hazards of the experiment. A model of this is provided in Assessment of Risks.

43 OIL BATHS

Oil baths must not be used unless there is no alternative method of heating. Use of graphite baths or aluminium heating blocks should be used in preference.

If there is no alternative to oil baths. (that is, your experimental design and risk assessment have concluded that an oil bath must be used) it must be used inside a fume cupboard.

44 OUT-OF-HOURS ASSISTANCE

The UCL Control Room is manned on a 24-hour basis for non-emergencies call ext.33333 (from an external phone 020 7679 3333) or for emergencies call 222 (from an external phone 020 7679 2222 – this number is on the reverse side of UCL ID cards)

45 OUT-OF-HOURS WORKING

See Access to and Use of Building.

46 OVERNIGHT EXPERIMENTS

See Unattended Experiments

47 OXYGEN DEPLETION MONIORS AND GAS DETECTORS

When gas cylinders containing asphyxiant or toxic substances are stored or used in a confined space with limited ventilation, or liquid nitrogen is stored or used in a confined space with limited

ventilation, a gas detector or an oxygen depletion monitor should be installed and the appropriate UCL approved signage should be attached to the outer door. The member of staff responsible for the work which involves the use of gas monitors and detectors is responsible for their maintenance and must ensure that researchers are instructed on the action to be taken should the alarm sound.

Low oxygen detector/alarm systems are installed in key places where there is high potential for low oxygen working environments (hypoxic) this includes the NMR room and Mass Spect lab (LG11) where there is high usage of liquid nitrogen. Approaching a venting liquid nitrogen Dewar without the use of breathing apparatus is highly dangerous, the area around the venting Dewar

will be almost pure nitrogen atmosphere. Liquid nitrogen will expand **696 times** as it vaporizes from -196 °C to room temperature, even a small spill can result is filling an area with nitrogen gas, thus depleting the oxygen in the room.

48 OZONOLYSIS

Ozonolysis experiments can be performed using the safe system in the hazards lab. This apparatus has an indicator to make sure all excess ozone is destroyed. Before any researcher uses the system for the first time, training must be given by Dr Helen Allan (KLB Lab 220). The logbook must also be signed each time this equipment is used. If an experiment is to be completed overnight, the usual overnight permission must be obtained, and the card displayed on the fume cupboard sash.

The flow rate of ozone must not be increase above that recommended by the manufacturer of the equipment with additional precautions and full risk assessment on RisKNET approved by supervisor with the DSO on the distribution list.

49 PERCHLORATES

The Departmental Safety Officer or the Deputy Safety Officer must authorise the issue of perchlorates in writing before they may be ordered.

All experiments with perchlorates must be treated as potentially hazardous. There have been reported explosions of perchlorate complexes, including those of chromium, iron, osmium and ruthenium, and the rapid disintegration of many other perchlorate complexes has occurred.

Only experienced research workers, or research workers under direct supervision, should perform experiments involving the preparation and handling of perchlorates. To ensure that maximum care is taken when handling perchlorates, the following rules and safety tests have been devised.

Risk Controls for the use of perchlorates:

The following controls must be applied in the order they appear in the list.

- The perchlorate ion should be used only if there is no other suitable anion.
- Before a perchlorate is prepared on a large scale (>100 mg), the sample must pass certain safety tests. In the presence of the Departmental Safety Officer, the product (<100 mg), having been prepared behind a safety screen, must be subjected in <1 mg quantities to the hammer and anvil test, heating on a metal spatula, and mixing in an organic solvent (e.g. DMSO). If all of these tests have been satisfactory, that is, there have been no explosions, the experiment may be scaled up to say 1 g. An appropriate extra risk assessment must be carried out before beginning the experiment.
- Whenever possible, use perchlorates in aqueous solution; when this is not possible test the perchlorate in the organic solvent on a small scale (<100 mg) before employing the solvent for the reaction.
- Blast screens must be used whenever perchlorates are used or prepared.
- When handling perchlorates, plastic spatulas should be used.
- Perchlorates must never be scraped from sintered glass filters.
- Perchlorates must never be heated or ground in the dry state.

50 PEROXIDES

All reactions involving organic peroxides or concentrated (i.e. >30% w/v) aqueous hydrogen peroxide must be conducted in a fume chamber and behind a safety screen. An appropriate extra risk assessment must always be carried out before beginning the experiment.

51 PERSONAL SAFETY

Eye protection must be worn at all times in laboratories, and anywhere else involving work that poses a danger to the eyes. Safety spectacles are available from the Stores and must be worn on the ears, not over the top of head scarves. A selection of eye shields and goggles for use when spectacles are deemed to be insufficient protection are also available from the Stores. Tinted goggles may be needed by those using certain light sources. Advice as to the need for these should be obtained from supervisors.

Food or drink may not be stored, prepared or consumed in any chemistry laboratory, and may not be stored in any refrigerator or deep freeze intended for storing chemicals.

Smoking is forbidden in all parts of UCL buildings.

Gloves of various types are available from the Stores and should be used to protect hands where appropriate. Note that many common organic solvents will pass through rubber gloves and will

be held against the skin, increasing rather than reducing exposure. Hence gloves should be carefully chosen with regard to the operation being undertaken, and not wearing gloves may be the best solution. Seek advice from your supervisor if you are unsure.

Safety screens are available and should be used as appropriate.

Lab coats must be worn at all times in the laboratories and cleaned, or changed, regularly. Sensible footwear must be worn in the laboratories; no open-toed shoes, sandals or high heels are permitted. Long hair must be tied back when experiments are being undertaken.

Wherever possible, synthetic chemical preparations should be undertaken in a fume cupboard. Any reaction involving toxic or offensive chemicals must be carried out in a fume cupboard.

When manipulating dangerous chemicals, you should ensure that the following conditions are met.

- A second person is within call and knows what you are doing.
- The facilities you have available are suitable for handling the materials in question.
- Suitable fire extinguishers and first aid equipment, and people trained in their use, are on hand.
- Suitable warning is given to passers-by or other occupants of the laboratory.
- Flames should never be left burning in unattended laboratories.

The use of mobile telephones or personal entertainment systems is forbidden in all chemistry laboratories. (Note – it is acceptable to use smartphones as - cameras, calculators or to access information from the internet.)

If there is another type of personal safety issue, which requires help, especially outside of normal working hours, dial 222 and ask for the UCL emergency response team. They also be reached by ringing 020 7679 2222. It is worth having this number stored on your mobile phone.

52 POISONS

Any research worker who needs to use a compound that is known to be very toxic (e.g. inorganic cyanide, arsenic, osmium or thallium compounds, or alkaloids such as strychnine), must consult the Departmental Safety Officer, who will issue an order for its purchase provided that the use of the chemical is covered by an adequate Risk Assessment. The chemical must then be kept in a locked cupboard marked POISON. There is a list of S1 poisons in Appendix 2

53 PREGNANT WORKERS

Expectant mothers and breastfeeding mothers do need a specific risk assessment written, see DSO if you are pregnant. Guidance for women who are pregnant (or considering having a child) and their supervisors is available here:

LINK:
https://www.ucl.ac.uk/safety-services/policies/2021/aug/pregnancy-new-and-expectant-mothers

54 RADIOACTIVE ISOTOPES

For work with radioisotopes, as with other sources of radiation, it is necessary (a) to avoid undue exposure to external and internal sources of radiation, and (b) to avoid contaminating laboratories, particularly with active materials of long life.

No work with radioactive isotopes should be undertaken without consultation with Dr Stefan Howorka (CIB Room 333 Tel. 24702), who is the Departmental Radiochemical Protection Supervisor (DRPS) and who liaises with the College Radiation Safety Officer. In the CIB, he will authorise the ordering of radioisotopes, and will direct where and how they may be used (and stored).

In the KLB, Professor Erik Arstad (KLB Tel 53784) is responsible for all work with radioactive materials.

UCL personnel involved in radiation safety are:

Head of Radiation Safety	Ms Fiona O'Farrell (Safety Services, UCL) Tel. 58607
Radiation Protection Officer & Safety Advisor	Ms Noreen Farooqui (Safety Services, UCL) Tel 59053
Radiation Protection Officer (RPO)/ Laser Protection Officer	Ms Gwen Mott (Safety Services, UCL) Tel 56482

Radiation Protection Team (RPT) email: radreporting@ucl.ac.uk

The local rules for the use of radioactive materials

General

Each piece of work involving radioactive isotopes requires a project registration and a radiation risk assessment, which would determine how work with ionising radiation can be carried out safely. The UCL Operating Procedure (OP17: Project Approval Process (Ionising Radiations) covers the UCL project approval process for work with radioactive substances (including sealed sources) and with x-ray generating equipment, and outlines the requirements before such work can commence. Anyone planning to use radioactive substances should read this procedure along with contacting the DRPS.

Radiation project approval process procedure (OP17) Link:

https://www.ucl.ac.uk/safety-services/policies/2022/apr/radiation-project-approval-process

All workers must read, understand and strictly adhere to the Departmental local rules.

Work with Thorium and Uranium (depleted or natural)

Thorium and uranium are actinides which emit alpha and soft beta particles. These materials are subject to additional regulations - The Nuclear Safeguards (EU Exit) Regulations 2019.

All such compounds must be approved before bringing them on site and they require monthly reporting. Safe practices for handling such materials will be determined by a specific risk assessment. See the DRPS (Dr Stefan Howorka) about carrying out work with uranium compounds in a “wet lab”

55 RADIOS

A radio may only be operated in a research laboratory provided that the volume is kept low, that it does not constitute a distraction and that no research worker objects to its operation. The use

of personal entertainment systems which involve wearing headphones is not permitted in any research laboratory.

56 REFRIGERATORS AND DEEP FREEZERS

Refrigerators and deep freezers in the laboratories are provided for the storage of chemicals and must not be used for the storage of foodstuff or drink. Items stored must be in sealed containers labelled as to content and owner's name.

Refrigerators and freezers used in laboratories should be designed for laboratory use and have appropriate features such as being spark proofed (occasionally referred to as spark-free).

Technical Support section can adapt certain ‘domestic’ appliances for laboratory use – but must be consulted before purchases are made.

57 SAFETY COMMITTEE

The committee membership represents all sections of the department i.e. research, teaching, technical and administration. The committee has the following responsibilities:

- To review all indicators of health and safety performance within the department.
- To receive safety reports specific to certain areas within the department including, but not limited to:
- Buildings safety (CIB and KLB)
- Electrical safety
- Research laboratory safety
- Teaching laboratory safety
- To monitor and review the adequacy and implementation of departmental arrangements for training and health and safety communication and publicity.
- To review safety practices within the department and implement new procedures as necessary.
- To monitor progress against objectives, targets, plans and remedial actions, and determine actions necessary to address areas of non-compliance where there is significant risk.
- The committee shall meet once a term plus once in the summer break.

58 SAFETY INSPECTIONS

The Technical Safety Officer carries out safety inspections of the laboratories at least three times each year. The Head of Department, Departmental Safety Officer or the Technical Safety Officer may inspect the laboratories at any time.

Problems requiring immediate attention will be notified directly to the Supervisor/Section Leader responsible. Rather less urgent problems (that still require attention) identified during the Technical Safety Officer's inspection will be summarised on a report form and sent to the Supervisor/Section Leader, who is then responsible for ensuring the deficiencies are rectified within 10 working days.

59 SAFETY TRAINING COURSES

The College has a Safety Training Unit which provides short courses on many aspects of safe working practices, e.g. "Manual Handling and Lifting Risk Assessment Workshop" and "Safe Handling of Unsealed Radioactive Sources". These courses are free to members of the Department and all research workers are encouraged to attend where relevant.

Details of all safety training available as well as application forms can be found at http://www.ucl.ac.uk/estates/safetynet/training/. The departmental code needed when booking courses for staff and students is obtained via Liz Read (Departmental Manager).

60 SEIZED (STUCK) GLASS APPARATUS

A common cause of minor, and sometimes very serious, cuts is when force is used to free seized-up glass joints, taps and desiccators. Always be extremely careful when applying any force to glassware using your bare hand. Do not attempt to free seized taps, joints, stoppers or desiccator

lids without consulting your Supervisor or the Glassblower. Wear appropriate protective clothing when attempting to free stuck class apparatus such as safety specs and cut resisting gloves.

61 SMELLY CHEMICALS

Chemicals which have an obnoxious odour, e.g. organo-sulphur compounds, should be handled only in an efficient fume chamber. Residues must not be put into solvent waste drums or down the sink.

Before any work with, or experiments which would produce, thiols or hydrogen sulphide can be carried out, the experimenter must complete the online log at http://tinyurl.com/pbmwu6m

When working with volatile thiols, sulphides, selenides and related compounds, it is essential to keep any discharge into the atmosphere via the fume chamber exhaust to an absolute minimum. In some circumstances the odour of thiols can be detected outside the Department at building level and below, and this has resulted in the Fire Brigade being called to deal with a suspected leak of domestic gas and the evacuation of UCH. Whenever possible, volatile sulphur compounds should be removed from a vapour stream using a cold trap, or a trap filled with aqueous alkaline potassium permanganate or with household bleach solution, in order to prevent discharge into the atmosphere via the fume chamber. These solutions must be changed regularly. Unwanted thiols, sulphides and selenides should be destroyed and rendered odourless by treatment with aqueous alkaline potassium permanganate or with household bleach solution.

62 SMOKING

Smoking is illegal in all UCL buildings. This includes smoking on external fire escapes or near the entrance of a building.

UCL is obliged to take disciplinary action against anyone found smoking in buildings within its control.

63 SOLVENT STILLS

Stills, used in the laboratory to provide dry flammable organic solvents, are potentially very hazardous. The safety of the Building, and, more importantly, personal safety can be put at risk.

Remember that hot flammable organic solvent, containing alkali metal or reactive metal hydride, is often separated from water only by thin glass. If, because of breakage, water in the condenser comes into contact with the drying agent in the organic solvent, a major fire and possible explosion will result.

Thus, there is a Departmental Anhydrous Solvent System set up in CIB Room 467C under the overall supervision of Professor Andrea Sella (CIB room 228). This system produces dry, high quality oxygen free solvents (toluene, tetrahydrofuran, dichloromethane, hexane and acetonitrile) in a safe manner. Any person wishing to use these solvents should contact Professor Sella and then be shown how to remove the pure, dry solvent from the system. Anhydrous solvent must be collected using a Strauss flask or equivalent apparatus only, not a round bottom flask.

Other solvents that may be required can be dried following the instructions below:

- An extra risk assessment must be completed for the assembly and operation of the still.

- The still should be set up in a fume chamber and clamped securely. No other experiments must be carried out in the fume chamber while the still is in operation.
- The fume chamber must be kept tidy. It must not be used for the storage of other flammable solvents, thus minimising the effects of any fire.
- The solvent still should be operated with the fume chamber sash fully down.
- If the still contains drying agent it must be cleaned out after use, by an experienced person, and the drying agent disposed of safely. Inexperienced research workers should always seek advice and help before using or cleaning out a solvent still.
- Stills containing alkali metals or metal hydrides as drying agents must be labelled appropriately.
- Hoses providing the water supply to the condenser should be wired/clipped on securely. A safety interlock valve must be provided to switch off the electricity supply to the still if the water supply fails.
- The still must be dismantled immediately after use. No stills are permitted to be permanently erected.

64 STORAGE OF CHEMICALS IN LABORATORIES

Storage of chemicals in laboratories is essential if work is to proceed efficiently. However, if poor working habits allow the number of chemicals to rise above a safe limit, or to clutter working areas, the chances of accidents occurring are much increased. The aims of all persons working in laboratories should be as set out below.

- To ensure that only those chemicals needed for the project in hand are kept on the laboratory benches, that there is sufficient safe storage to accommodate them, and that it is so arranged as to minimise hazards caused by accidental spillage or breakage.
- To return all chemicals to their rack, or other storage, immediately after use.
- To ensure that all containers are correctly labelled to show their contents.
- To ensure that all empty containers, surplus chemicals, and waste solvents are disposed of promptly.
- In general, to ensure that the laboratory in which they work is kept clean and tidy.

The notes below give a more detailed guidance on aspects of the above.

General

Only the minimum of chemicals required should be kept in the laboratory. Unless required for immediate use, not more than one bottle of each chemical should be kept. Chemicals and solvents can be stored in the under-bench cupboards or in suitably designated areas. Be careful to store chemicals which might react with each other apart, in case of accidental breakage. Bottles containing concentrated acids should always be kept in drip trays.

Flammable Solvents

The law requires that these are kept in metal containers of approved design, and these are installed in all laboratories. There are two types: (a) metal chests to take 2.5 litre Winchester quart bottles (the usual pattern) and (b) metal cupboards. The synthetic laboratories are equipped with ventilated cupboards under the fume cupboard working surfaces which are fitted with trays to retain spillage; these can be used for solvent storage. Flammable solvents may be kept in laboratories only in these cupboards, from which it follows that you must not have more bottles than there are storage spaces. Bottles must always be in the containers or cupboards except while actually being used. For highly flammable solvent like diethyl ether, pentane, and light

petroleum b.p. 40-60°C are particularly hazardous, and their vapours can be ignited by a hotplate or heating mantle. Care for storage of these low boiling solvents during very hot weather in the UK, bottles should be kept out of direct sunlight in appropriate solvent cabinets with the caps of the bottle loosened to allow pressure relief from any possible solvent vapour build-up, if the day-time laboratory temperatures are greater than 30°C.

Poisons

Certain poisons, including cyanides and arsenic-containing compounds, must be kept in a locked cupboard. Common examples of such poisons are given in Appendix 2. If you use any of these, you should tell the Departmental Safety Officer, who will arrange for a suitable cupboard to be provided. A list of the contents should be kept inside the cupboard and the additions and withdrawals noted therein.

Smelly Chemicals

Smelly/offensive toxic chemicals must be stored in a fume cupboard, but the number kept must not be so great as to make it difficult or dangerous to carry out chemical manipulations therein.

Heat-sensitive Materials

Heat-sensitive materials should be kept in a deep freeze or refrigerator as appropriate. If flammable or explosive materials are involved, a flash proofed model should be used (it should be so marked on the door). It is dangerous to store such materials in a non-flash proofed refrigerator.

Labelling

All chemicals kept in laboratories should be labelled clearly as to their content. This is most important. Please also see Labelling of Chemicals.

65 SUMMER STUDENTS

Summer students working in the research laboratories, are required to read the Department Safety Code of Practice and complete the online safety form prior to starting work.

These students are allowed access to the department only between 0800 and 1800 Monday to Friday and are to be under strict supervision at all times.

66 SUPERVISION

It is the duty of the Head of Department (HoD) to appoint competent supervisors in order to ensure that no departmental work is undertaken without a level of supervision appropriate to the work.

The requirement for supervision extends to all work (academic, technical and professional services) carried out in the department by staff, students and visitors.

Supervisors exercise authority on behalf of the HoD to ensure that work under their supervision is carried out in accordance with the Departmental Safety Code of Practice and the procedures to control the risks identified in the relevant risk assessments.

The competence of those appointed as supervisors is derived from their possession of sufficient skills, knowledge and experience of the work which they are required to supervise and the personal skills necessary to promote active cooperation within the group.

Supervisors must ensure that the working practices of those under supervision do not fall below the standard required by the department by regularly monitoring their work and providing such information, instruction and training required to perform tasks safely and to promote the competence of those under supervision. This may be achieved largely by on-the-job coaching and counselling, in addition to attending relevant formal training courses.

The level of supervision must be commensurate with and take into account the circumstances of the work and the competence of those under supervision. In deciding this, the following factors must be considered:

- age and experience
- people occasionally working out of normal hours
- risk (based on risk assessment)
- those engaged on tasks where failure has critical implications for health and safety
- introduction of new materials, equipment or methodologies

67 TECHNICAL SERVICES & OTHER THIRD PARTIES

It is the responsibility of research workers to ensure that they do not ask any member of the technical services, or anyone else (e.g. service engineers) to undertake any task which might lead to an accident. Past examples include asking the glassblower to seal a tube containing a perchlorate, or to work on a vacuum line containing phosphine. Vacuum lines should be flushed first with air or nitrogen. Proper warning should be given of the hazardous properties of any chemicals which are to be handled.

68 ULTRAVIOLET SOURCES

Ultraviolet light causes conjunctivitis and more serious damage to the eyes and skin. Special UV-excluding goggles must be worn by anyone exposed to a source but, most importantly, the source must be adequately shielded. The skin as well as the eyes must be protected from UV light. Ventilation must be provided for high-intensity sources to remove the ozone which is formed.

69 UNATTENDED EXPERIMENTS

All unattended experiments must be accompanied by an red experiment card, obtainable from reception. 'Unattended' means if you leave the experiment for any period of time, even a few minutes.

If an experiment is to run overnight or at other times when the laboratories are closed you must comply with the following arrangements:

The red card must be filled in and authorised by the experimenter's supervisor, or his/her nominated deputy (this can be a PDRA) or in their absence by another member of the permanent academic staff. The card must include details of hazards, a brief description of the experiment, what immediate emergency action might be taken in case of problems and telephone numbers where the experimenter and his/her supervisor can be contacted.

The card should be completed by the experimenter, signed by the authoriser, and be affixed to the experiment. Experiments will normally be authorised for one night only when run for the first time; if the experiment is likely to extend for a longer period, permission should be renewed on a daily basis until completed. Subsequent repeats may be authorised for the likely duration of the experiment at the discretion of the Departmental Safety Officer.

The experiment must be housed in a fume cupboard, unless it is part of a permanent installation, and all services must be safely connected. In particular, the following points must be complied with:

All electrical wiring must be sound, with no bare wires, and plugs fused at the correct rating.

All experiments requiring heating under water reflux must use a system of circulated water, in a fume cupboard. A cut-off switch must be used to turn the electricity off if water is not flowing through the condenser. All hoses must be sound and wired securely to the apparatus. Water straight from a tap must not be used overnight.

Gas heating is not permitted; any heating must be electrical. If a heating bath is used it must be graphite bath or silicone oil bath (not liquid paraffin), in order to reduce the danger of fire. A heating metal block may be used.

All supports must be firm and securely fitted.

Any gas cylinders used must be securely clamped to the bench or to a stand. Proper arrangements must be made to see that the gas flow remains constant and that waste gas is properly trapped or exhausted safely.

Any vacuum required must be supplied from a rotary vacuum pump. The use of water pumps is not permitted, nor should the Departmental vacuum supply be used.

As far as possible, experiments should be arranged so that failure of any service results in a safe shutdown.

Particularly hazardous experiments must be set up in the Hazards Laboratory.

Only non-pyrophoric compounds may be used.

Equipment should not be left on if not in use.

70 UNDERGRADUTE RESEARCH PROJECTS

Undergraduate students doing research projects are allowed to work in the research laboratories between the hours of 0800 and 1800, Monday to Friday. They must complete the online safety form and Supervisors are responsible for ensuring that they are properly trained in the techniques they are using. They must work in accord with the Code of Practice set out in this document, and in particular they must never work alone. See Supervision.

Visiting Project Work

Visiting project work can be carried out in the department after authorisation has been obtained from a staff member or the Head of Department, the hazards assessed and a Code of Practice defined to minimise risks. Before research starts, the visitor must complete the online safety form, which must then be authorised by the supervisor. Work must not begin until this process is completed.

The assessment must be revised annually and also if the nature of the project should change or if any unforeseen new hazards should be encountered.

71 VISITORS

Day visitors to the CIB must sign the book held by security at reception. Personal visitors are welcome in general areas such as the Nyholm Room in the CIB, but visitors in laboratories should be restricted to scientific colleagues. Visitors to laboratories must wear safety glasses. Children are not allowed in the laboratories, workshops, other hazardous areas nor write up areas and must be supervised at all times. You are responsible for the conduct and safety of your visitors.

Disabled visitors are restricted to the ground floor in the CIB due to the availability of fire exit routes. The Senior FEM (Mr Joe Nolan, tel. 24627) or the Departmental Safety Officer must be informed when disabled visitors are in the CIB.

Visitors who will be carrying out research in the building must complete the online safety form and have it approved by a supervisor in the chemistry department. Contact the DSO for advice.

72 VISITORS: CONTRACTORS AND MAINTENANCE WORKERS VISITING UCL CHEMISTRY

- Contractors must give notice as specified by Estates division before start of work unless they are dealing with an emergency.
- Contractors will sign in at reception unless they have taken Control of an area and posted appropriate notices.
- All contractors must notify the Technical Services Manager (Joe Nolan) or someone acting on behalf of the Department on arrival and get agreement before entering any laboratories.
- The necessary forms must be completed and signed before entering any laboratory.
- Any contractor entering a laboratory under Departmental control will wear safety glasses and either lab coats or their own company protective overalls.
- Contractors MUST NOT touch or in any way interfere with any chemicals or laboratory equipment without the agreement of an appropriate member of the Chemistry Department
- Do not turn off any services to Chemistry (including: Air handling, heating, cooling, power or water.) without giving notice to and obtaining the agreement of the Technical Services Manager on behalf of the Department.

73 X-RAY DIFFRACTION

Use of X-ray Diffraction Apparatus

Special precautions have to be taken to avoid exposure to the X-radiation, whether from an X-ray tube or from the monochromator. Dose rates are so high that permanent skin injuries may be caused even by brief irradiation. Almost all radiation injuries caused by X-ray diffraction work have been to the fingers of the operators.

When the equipment is used for research purposes, the non-routine nature of the work greatly enhances the possibility of radiation injuries. It is therefore essential that workers should be aware of the hazards and how to guard against them.

The UCL Operating Procedure (OP17: Project Approval Process (Ionising Radiations) covers the UCL project approval process for work with radioactive substances (including sealed sources) and with x-ray generating equipment, and outlines the requirements before such work can commence. Anyone planning to use radioactive substances should read this procedure along with contacting the DRPS.

Radiation project approval process procedure (OP17) Link:

https://www.ucl.ac.uk/safety-services/policies/2022/apr/radiation-project-approval-process

The responsible authority in the CIB for X-ray equipment is Mr Martin Vickers. General rules for the use of any piece of equipment are as follows:

No-one may use the equipment until instructed in safe methods of operation. Every user must be prepared to attend any mandatory safety course(s).

The equipment may not be used with safety interlocks overridden except by authorised individuals working under an appropriate code of practice.

Keys for any room will be issued only if authorised by the relevant group leader who will need to be satisfied that the above conditions have been complied with.

APPENDIX 1: Common carcinogenic substances

Omission from this list does not imply that a compound is not carcinogenic:

Common Carcinogenic Substances

2-Acetylaminofluorene	N-Nitrosodimethylamine
4-Aminobiphenyl	β-Propiolactone
Benzidene	bis-(Chloromethyl) ether
3,3'-Dichlorobenzidene	Chloromethyl methyl ether
4'-Dimethylaminoazobenzene	4,4'-Methylene-bis(2-chloroaniline)
α-Naphthylamine	Ethyleneimine (aziridine)
β-Naphthylamine	Vinyl chloride
4-Nitrobiphenyl	Benzene

The following have also been identified as strong carcinogens*:*

Benz(a)pyrene	N-(2-Hydroxyethyl)ethyleneimine
2,4-Diaminotoluene	Methylhydrazine (and salts)
Dimethylcarbamoyl chloride	2-Nitronaphthalene
1,1'-Dimethylhydrazine (and its salts)	Nitrosoamines
Dimethyl sulphate	1,3-Propane sultone
Hexamethylphosphoramide	Propyleneimine (2-methylaziridine)
Hydrazine (and salts)	

The following compounds have been identified as experimental carcinogens:

Acrylonitrile	Lead chromate
3-Amino-1,2,4-triazole	Methylenedianiline
Carbon tetrachloride	Styrene
Chloroform	Tetramethylthiourea
1,4-Dichloro-2-butene	Thiourea
Dioxane	o-Toluidine
Epichlorohydrin	Trichloroethylene
Ethylene dibromide	Vinylcyclohexene dioxide
Ethylenethiourea	Zinc chromate

APPENDIX 2: Poisons

There is often reference made to S1 poisons. These were materials listed in the Poisons act (1972) which has since been replaced by the Control of Poisons and Explosive Precursors Regulations 2015. Both pieces of legislation applied to retailers supplying chemicals to members of the public, although this is not applicable to the university research or teaching environment the lists provide a useful list of examples of poisons requiring formal access controls.

EPP list of poisons

- Aluminium phosphide
- Arsenic; its compounds
- Barium, salts of,
- Bromomethane
- Chloropicrin
- Fluoroacetic acid; its salts; fluoracetamide
- Hydrogen cyanide; metal cyanides, other than ferrocyanides and ferricyanides
- Lead acetates; compound of lead with acids from fixed oils
- Magnesium phosphide
- Mercury, compounds of, the following: -nitrates of mercury; mercuric cyanide oxides; mercuric thiocyanate; ammonium mercuric chlorides; potassium mercuric iodides; organic compounds of mercury which contain a methyl group directly linked to the mercury atom
- Oxalic acid
- Phenols (phenol; phenolic isomers of the following cresols, xylenols, monoethylphenols) except in substances containing less than 60% weight in weight of phenols
- Phosphorus yellow
- Strychnine; its salts in quaternary compounds
- Thallium, salts of

S1 poisons

The list is not complete but includes compounds which are known by the general public to be poisons. When issued, these compounds must be kept in a locked cupboard and details of usage must be noted in the poisons inventory which should be kept in the cupboard.

Alkaloids and derivatives, e.g.

- Aconitine
- Atropine
- Brucine
- Hyoscine
- Strychnine
- All compounds of arsenic.
- Metal carbonyls (e.g. nickel carbonyl) *
- All inorganic cyanides (e.g. potassium, sodium and silver cyanides).
- Digitoxin and digitonin.
- Paraquat.
- Phosgene*
- Osmium compounds.
- Thallium compounds.

* Should be kept in a secure fume cupboard in a lockable laboratory.

Research workers are expected to take suitable precautions with all known highly toxic compounds in their possession, whether or not they are listed above.

APPENDIX 3: Working with Display Screen Equipment

ADVICE AND INFORMATION FOR USERS

More and more people are using display screens and inevitably some people will be at risk of developing related health problems, notably those affecting the hands and arms, caused by prolonged use of the keyboard and mouse coupled with unsatisfactory workstation layout and/or poor keyboard or mouse technique. Please use the following checklist yourself, and if you have any problems that you think are connected with your display screen work please discuss them in the first instance with the Departmental Safety Officer.

Adjust the backrest of your chair to support your lower back, and sit well back in the chair.

Adjust the seat height until your forearms are horizontal and wrists straight while using the keyboard.

Do not rest your wrists on the edge of the keyboard or desk or bend your hands up at the wrist while typing. Keep a soft touch on the keys and do not overstretch your fingers. If you are not a competent typist you should consider taking a course, as poor keyboard technique can cause symptoms.

When you have the seat height right, if your feet do not rest comfortably on the floor use a footrest.

The screen should be approximately at arm's length. Adjust the height of the screen to suit yourself. If you need to look at the keyboard the screen should be lowered to avoid repeated neck movement. Adjust the angle of the screen to suit your sitting height.

Do not lean over to read documents. Use a document holder, and place it beside the screen at the same distance, height and angle as the screen.

Position the mouse within easy reach so that you can use it with the wrist straight and without stretching. Intensive use of a mouse, trackball or other pointing device can cause symptoms as it concentrates effort on a small group of muscles of one hand/arm. Substitute keystrokes where you can, and if you need to use it a lot, try learning to use it with the other hand so that you halve the load on your preferred hand/arm. You will be surprised at how quickly you become ambidextrous. If you find gripping your mouse awkward, try a differently shaped or larger one or try a trackball.

Position the workstation so that you are not looking at windows or lights. Avoid reflections from windows or lights on the screen. Sit sideways to windows, and use a blind to cut out unwanted light. An earthed mesh filter may be found helpful in reducing reflections and static.

Adjust the brightness to suit the lighting conditions in the room.

If there is drifting, flicker or any other deterioration of the image on the screen this should be put right (see Mr L. C. Willoughby or Mr D. Ladd - IT Support Group).

Keep the screen clean.

Sitting in the same position for long periods is undesirable, so break the work up with other activities which do not involve similar movements of the arm and wrists, and which preferably involve some walking about. You should aim to spend 5 to 10 minutes out of every hour doing

something else. Do not work continuously at your display screen for periods longer than an hour without a break.

If your eyesight is good or is satisfactorily corrected by spectacles or contact lenses, you should have no difficulty using a display screen. If you wear bifocals you may find that you need a separate pair of spectacles to work at the display screen comfortably. (Most wearers of reading glasses find that their reading prescription is suitable for display screen work.) If you are quite sure that your workstation is satisfactory and yet you get headaches or "eyestrain", or if you cannot achieve a layout that is comfortable, you should consider visual problems. It would then be appropriate for you to have your eyesight tested.

If you are an employee of the UCL, and using a display screen forms a substantial part of your work, you may be entitled to an eye test provided by the College. The College has made arrangements to provide appropriate eye tests for designated users, and you should ask the Departmental Safety Officer for further information.

To avoid excessive heat building up, if it is practicable to do so the machine should be switched off when not in use. A dry atmosphere assists build-up of static electricity; anti-static mats, humidifiers or leafy pot plants may help

If you find your software difficult to use you should discuss this with your Supervisor, Section Leader or Staff Associate.

If you have not had any training on the safe use of a work station, further information should be obtained from the Departmental Safety Officer.

If you experience symptoms which you think are related to your display screen work you should report this to your Supervisor, Section Leader or Line Manager. Do not delay this, as new symptoms can usually be relieved quickly but established problems can be very difficult to resolve.

Do not store items around your workstation which would lead to restriction of leg room or equipment becoming poorly arranged.

Basic Recommendations to Avoid Muscular Skeletal Disorders

The chair should be at the right height, so that the feet reach the floor.
The chair should support the lower back.
The screen should not be further away than arm's length.
There should be no glare when the screen is blank.
The screen should not flicker.
The wrists should be straight when typing, so that the hands are not arched up or down.
There should be adequate leg room.

APPENDIX 4: Laser User Registration Form

Notes:

The use of lasers in research poses a number of serious safety hazards. The purpose of the registration procedure is to ensure that you have received full information and instruction on these hazards and the procedures necessary to control them. This is to ensure your safety. This form should be completed with help and guidance from your Supervisor who will usually also be designated the person "responsible" for the laser(s) you will be using.

All users of lasers in classes 3B and 4 must be registered using this form prior to the commencement of the laser work. When all parts have been completed, sign and date the form and return it to the Departmental Laser Supervisor.

REGISTRATION DETAILS (Please use block capitals)	
NAME AND TITLE	
DEPARTMENT	
STATUS (UG, PG, RA, ETC.)	
ACADEMIC SUPERVISOR	
TYPE & CLASS OF LASER(S)	
LOCATION OF LASER(S)	

CHECKLIST (tick boxes as appropriate)

	I have accessed UCL's Guidance on Safe Use of Lasers (http://www.ucl.ac.uk/estates/safetynet/guidance/lasers/guidance.pdf).
	I have read and have a working knowledge of the above guidance.
	I have attended the UCL course "Safe use of Laser Devices".
	My supervisor has discussed specific safety issues and instructions related to my laser work with me, to my own and to his/her full satisfaction.
	I have read and understood the risk assessments and written procedures that are relevant to my use of the laser(s).
	I understand access restrictions in Designated Laser Areas.
	I know the location and capabilities of laser safety equipment (goggles, beam dumps, gloves etc) in my laboratory.

LASER USER:

NAME _____SIGNATURE _____

DATE _____

ACADEMIC SUPERVISOR:

NAME _____SIGNATURE _____

DATE _____

APPENDIX 5: Risk Assessment for Special Experiments

Experiment Title	Date	Reference
Experiment details (reaction and steps)		
Scale of Reaction (expected volumes, mass or m.mol.)		
Hazards: (Remember physical and ergonomic hazards as well as chemical)		
Safety precautions: (order of consideration: alternative, minimise, engineer, SOP & PPE)		
Emergency procedures:		

Disposal of Waste (destruction of smellies or pyrophorics, waste streams)		
People to whom the risk assessment applies.		
Signed by (person creating the assessment)		
Authorised (Supervisor or designated person):		
Is the lab safe to clean whilst this activity is happening?	Yes	No
Does this need approval of the DSO or HoD?	Yes	No
Unattended Experiment/Overnight form issued	Yes	No
Notes:		

Appendix 6 ACCESS to Department of Chemistry Laboratory areas

Name: Joe Nolan (Department of Chemistry Building Manager) **Date:**
Valid for dates:

ROOM NUMBER/AREAS	
COMPANY	
TASK	
REQUIREMENTS OF ACCESS	• You will make the **lab supervisor or manager** aware of your presence, as well as any other lab occupants (perhaps to further clarify points below). • You know the **PPE** requirements of these areas. • You will make yourself aware via each lab supervisor or manager of the **main hazards & local conditions**, which often include chemicals, solvents, glassware and instrumentation in close proximity. • You are aware that there may often be **other persons working in the laboratory** and hence the possibility of accidental collisions? • You understand that there can be **no service outages** without prior agreement.
NAMES OF 'ON SITE' OPERATIVES (include mobile contact details)	

Signature/s: