Health and Safety Statement of Intent

The School of Engineering and Physical Sciences recognises and accepts the responsibilities, as detailed within the University Health and Safety Policy, for ensuring, so far as is reasonably practicable, the health, safety and welfare of our staff while at work, and for the health and safety of any other person who may be affected by what we do.

To that end, the School will adopt and apply the requirements as detailed in the University Health and Safety Policy and the associated Procedures to all the activities carried out by the School.

Where there is a requirement for local subject-specific safe-working practices and procedures, these will be developed by the School of Engineering and Physical Sciences Safety Committee, in consultation with all relevant staff within the School, approved by the Head of School and made available to all staff and students through our website and new staff Welcome Pack.

The Head of School is ultimately responsible for leading and managing the School in accordance with the University Health and Safety Policy. In order to assist with the co-ordination of health and safety activities within the School, the Head of School shall appoint an appropriate member of staff to fulfil the role of School Health and Safety Officer, as well as any deputies to cover specialist areas as appropriate to the activities within the School.

Introduction

This document contains safety information and procedures for work carried out in the School of Engineering and Physical Sciences. Not all sections will apply to all buildings; however, since there is an increasing amount of inter-discipline and cross-building work carried out in EPS, all staff should familiarise themselves with this document.

Everyone in the School has a responsibility for the health and safety of themselves and others. As such, if any employee, student, supervisor or manager notices a health and safety problem which they are not able to put right, they must immediately inform the person responsible for safety in that area.

As responsible persons working or studying in EPS Buildings, everyone **MUST** read and abide by all safety and restricted access signage in the buildings.

Health and Safety Induction Training

The University has an obligation under health & safety legislation to provide staff with some basic training, which all staff must complete. This training is carried out on-line and you will receive an email from Health & Safety Services shortly after you start work in EPS with your login details

You can complete the training at your own pace within a specified timescale. This not only ensures our legal obligations in training delivery, but will also provide you with the opportunity to contribute to your own health and safety and personal development.

The interactive modules within the training programme consist of:

OHSA - Office Health and Safety Awareness. This module will give you a general introduction to health and safety in the workplace and forms the basis for staff induction.
AssessRite - Display Screen Equipment Training and Assessment. This module will provide you with the basic skills to correctly configure your workstation and minimise the risk of injury or ill health. The module also includes a workstation self-assessment tool which you must complete.
FireRite – This fire safety module provides you with a useful guide to fire safety and prevention, with specific instruction on the appropriate actions to take when faced with a possible fire hazard.
FeelRite – This module is a stress awareness tool which compliments stress management initiatives currently in progress via Human Resources Development.

First year PhD Students are also required to complete the above online safety induction training.

Further Specific Safety Training

Introductory Safety Information is given to all new undergraduates in their first year through either specific lectures or during laboratory classes, with more detailed advice given at the start of the student projects in the fourth and fifth years. The Building Superintendents give an introductory safety talk as part of the induction process. Safety training for postgraduate students is organised primarily by the Principal Investigator responsible for each laboratory.

In addition to these general safety training more specialised lectures/courses are given. There is a compulsory, annual laser safety lecture for MSc, PhD students and staff who use lasers and the School runs an annual Cylinder Handling training workshop. Other training courses are organised by the University Health and Safety Services and students are encouraged to attend these where appropriate. The training of technicians is organised by the Building Superintendent.

Health and Safety Committees

School Safety Committee

Chairman	Mr D Penman
School Safety Officer **Coulson/Nasmyth Building Safety Officer**	Professor R Ocone
Brewster Building Safety Officer	Dr L Paterson
Mountbatten Building Safety Officer	Dr P Record
Perkin Building Safety Officer	Dr D Ellis
Brewster/Perkin Building Superintendent	Mr I Jones
Coulson/Nasmyth Building Superintendent	Mr S McLean
Mountbatten Building Superintendent	Mr A Houstin
Head of Health and Safety Services	Mr L Allan

Brewster Building Safety Committee

Building Safety Officer and Chairman **Radiation Protection Supervisor**	Dr L Paterson
Building Superintendent	Mr I Jones
Union Safety Representative	Mr A Aitken
Electrical Safety Adviser	Mr G. MacKinnon
Laser Safety Officer	Dr J.Jarzynka
Life Sciences Representative	Dr I. Argyropoulos
Gas, cryogenics' and chemical advisor	Mr EJ Nelson
IPaQS Research Representative	Dr. A. Waddie
Office Staff Representative	Ms G. Nothard
PhD representative	Vacancy
PDRA representative	Dr D. Choudhury
Biophysics Research Representative	Ms K. Callaghan

Coulson/Nasmyth Building Safety Committee

Building Safety Officer and Chairman	Professor R Ocone
Building Superintendent	Mr S McLean
Mech Eng Technical Support	Mr R Kinsella
Electrical Technician Representative	Mr G MacKinnon
Radiation Protection Supervisor	Dr DA McNeil
Chemicals Specialist Adviser	Dr GB Thomson
Laser Protection Supervisor	Dr A Moore
Postgraduate Representative	Mr Chih-Wei Lin

Mountbatten Building Safety Committee

Building Safety Officer	Dr P Record
Building Superintendent	Mr A Houstin
Teaching Representative	Dr KE Brown
MACS Safety Officer	Mr D Cunningham
MACS Representative	Mr AC Hurt
Clean Room Representative	Mr M Leonard
Physics/Laser Safety Representative	Professor MJD Esser
Deputy Safety Officer	Dr A Belyaev

Perkin Building Safety Committee

Building Safety Officer	Dr D Ellis
Building Superintendent	Mr I Jones
Life Sciences Representative	Dr N.Kanase
Laser Supervisor	Dr ML Costen
Technical Services	Mr I Drummond
Deputy Head of Teaching	Dr V Arrighi
Molecular Chemistry	Dr. A.Robertson
Biological Chemistry	Dr. K.Callaghan
Teaching Laboratories	Mr. B. Hutton
Analytical Services & Minutes Secretary **Radiation Protection Supervisor**	Dr G Rosair
Materials Chemistry	Dr J.Tobin
Dynamics and Structure	Dr. A. Rosu-Finsen
Head of Research Institute	Prof K McKendrick

Accidents and First Aid

All accidents and dangerous occurrences, however apparently trivial, should be reported to Health & Safety Services using Shield, accessed through their SharePoint site - http://intranet.hw.ac.uk/ps/gls/safety (staff login required) or desktop icon Report a Hazard. The academic or technician in charge of the activity concerned is responsible for reporting any incidents, although they may also be reported by First Aiders after treating injuries.

In the event of an emergency situation you should contact the Security Control Room by either:

<table>
<tr><td> 
</td><td>Using the nearest RED emergency telephone handset located within your area. This will automatically give you direct contact to the Security Control Room,</td><td rowspan="2">The Security Patrol Officers are trained in dealing with emergency situations. You must stay calm at all times; depending on the situation you will be asked a number of relevant questions, which will enable Security Control to evaluate the situation and initiate the appropriate response.</td></tr>
<tr><td>  </td><td>or by dialling 2222 on any internal telephone handset.</td></tr>
<tr><td> 
</td><td colspan="2">Fire
If you find or suspect that there is a fire you should immediately raise the alarm by activating the nearest manual call point. Do not attempt to fight the fire, close doors in the immediate vicinity and follow the nearest escape route to the assembly point. Tell the Fire Marshall at the assembly point that you raised the alarm.</td></tr>
<tr><td>  </td><td colspan="2">Emergency First Aid
If a situation arises whereby someone is seriously injured or becomes ill you must treat this as an emergency. Use the nearest RED emergency telephone to contact the Security Control Room (or dial 2222 from any internal telephone handset).</td></tr>
</table>

Where the Situation is Not Serious

- A first aid service is also available from the Control Room in the James Watt Centre (**red telephone** or dial **2222** on any internal telephone). This is also available out with

normal working hours. Janitorial staff may be contacted on internal extension number **3500**.

- During normal working hours trained First Aiders are located in many buildings across the University; they are identified on safety notice boards.
- Additional support is available during working hours from the University Health Centre in the George Heriot Wing, internal **Ext No. 3010**.

University Health Service - Opening Hours

8.30 a.m. - 6.00 p.m. Monday to Friday: a nurse or doctor should be available at these times. There is no weekend service, but cover is provided by NHS 24 on phone number 08454 24 24 24. If necessary, a doctor can be called out of normal hours via the Control Room on internal extension number 2222.

First Aiders

There are a small number of trained first aiders in the School for minor emergencies as identified on safety notice boards. All EPS First Aiders are provided with a First Aid box, for which they are responsible, so that they have all the necessary equipment when called to an emergency.

Fire Safety

Fire Alarm

Each EPS building has an independent Fire Alarm System, which has sounders located in all corridors and some laboratories. The alarm is a two-tone siren system, which is tested weekly for approximately 10-15 seconds.

Please note fire alarm testing occurs on a weekly basis between 8.45 am to 9.15 am in the following buildings on these days;

Coulson and Nasmyth	**Monday**
Brewster and Perkin	**Tuesday**
Earl Mountbatten	**Friday**

Evacuation

In the event of the fire alarm sounding, (out with the ~15 second test), the building must be evacuated.

All persons in the building should leave quickly and calmly following the designated evacuation routes. The stairwells on these routes are fire protected escape routes – do NOT use lifts.

EPS staff are asked to direct visitors or other persons who may not be familiar with the evacuation routes for the building.

If possible, make sure that equipment is left in a safe condition. Close the windows and doors and turn off ventilating fans.

Do NOT stop to collect belongings or coats.

All persons should, unless instructed otherwise by Security Staff, Safety Officers or Fire Officers, congregate at the designated assembly points for their building. (Assembly points are listed on the Fire Action Notices in all buildings.) While walking to the assembly points, use the footpaths rather than the road as in the event of a fire, fire engines will be travelling down the road towards the building.

Do NOT enter or re-enter the building for any reason until the Fire Officers or Security Staff have given the all clear.

Staff & Student Responsibilities with Regard to Fire Safety

It is the duty of all occupants of the building to familiarise themselves with the escape routes from the rooms that they normally use. They must not act in a manner that causes fires, or hinder attempts to fight them or hinder attempts to evacuate the building. In particular, note the following points:

1. It is an offence to tamper with the fire alarms or firefighting equipment.
2. Do not block the escape routes from rooms or the stairwells.
3. Never store combustible materials (such as packaging or furniture) next to escape routes i.e. stairwells, etc.
4. Keep fire doors closed under normal circumstances. They may be chocked open temporarily for purposes such as moving furniture, but should be closed again immediately afterwards.

<u>If you discover a fire</u>

1. You can attempt to extinguish a very small fire that you have discovered only if you feel confident in doing so and know the correct fire extinguisher to use. **Never use water to extinguish an electrical fire**. Similarly, water may be incompatible with some chemical fires; CO_2 or dry powder extinguishers should be used.
2. If you cannot tackle the fire yourself, notify all people in the immediate area and then leave at once. If the fire is in a room you must shut the door after the last person has left.
3. Sound the fire alarm using the nearest break-glass point as soon as possible.
4. If you use a fire extinguisher or sound the fire alarm you must notify the Building Safety Officer at once.

Fire Assembly Points

The Fire Assembly Points for EPS buildings are in the North Car Parks adjacent to the buildings.

Building	Location of Fire Assembly Point
Brewster	Car Park N
Coulson/Nasmyth	Car Park M
Mountbatten	Car Park N
Perkin	Car Park N

Fire Drills

The Building Safety Officer will organise a fire drill at least twice a year in order to familiarise new staff/students with the alarm and the procedures for the evacuation of the building.

Duties of Fire Wardens

There are one or two Fire Wardens appointed for each corridor on every floor of the EPS buildings. The duties of the Fire Wardens are to assist in the orderly evacuation of the premises during a fire drill.

1. During a drill, on hearing the fire alarm Fire Wardens should, if it is safe to do so, proceed to their allocated area to check that it has been cleared and that the doors have been closed. They should not, however, re-enter the building to do this.

2. The Fire Wardens should check all rooms in their area including those that appear empty. It should be remembered that some experiments are carried out in total darkness and behind locked doors. In addition, the fire alarm may not be understood by foreign visitors or heard by someone with impaired hearing.

3. Where Fire Wardens do not have key access to locked rooms, then they should knock on the door and attempt to make any occupants aware of the need to leave the building.

4. All corridors within the building lead to stairwells which are fire protected escape routes and occupants should be encouraged to use their nearest exit route to avoid congestion.

5. On vacating the premises Fire Wardens should report to the Building Safety Officer to advise him that the area is clear.

6. In the event of a real alarm, then Fire Wardens should evacuate the building along with all other building occupants. When outside the building they may advise persons not to re-enter the building until officially deemed safe to do so.

Risk Assessment

All operations or working practices in EPS that carry an associated health and safety risk are subject to a risk assessment. The risk level is determined by looking at the potential to cause any kind of harm or damage (*hazard*) and the probability of that hazard occurring.

A brief explanation of legal requirements for risk assessment and general philosophy can be found in the document *Guide to Risk Assessment Requirements* on the Intranet[1].

According to HSE's *Five Steps to Risk Assessment*,

"A risk assessment is nothing more than a careful examination of what, in your work, could cause harm to people, so that you can weigh up whether you have taken enough precautions or should do more to prevent harm. The aim is to make sure that no one gets hurt or becomes ill."

There are two forms in general use for Risk Assessment in EPS:

- The EPS Risk Assessment Form should be used for general risk assessment including Laser and Fire Safety. It contains check boxes to assist assessors in identifying particular hazards that might be present, and an area in which control measures are explained and residual risk evaluated. For each identified hazard, control measures should be stated. N.B. – Page 4 of this form is designed for the use of chemists in the Perkin Building. A more detailed COSHH form is used in other EPS buildings as described below.

- The Scottish Universities COSHH form should be used to assess risks arising from use of chemicals and Biological hazards (see other information on Safety/COSHH later in this handbook). Remember that fire and explosion are not covered under the COSHH Regulations but should be covered on the general EPS Risk Assessment Form. N.B. – As noted above this form is for use in all EPS Buildings except by the chemists in the Perkin Building.

The *Five Steps to Risk Assessment* are:

1. Identify the hazards
   These should include anything with the potential to cause harm, whether or not it represents a significant risk; failure to identify hazards by dismissing them as insignificant early in the process is a common flaw in risk assessment. Hazards may be physical, chemical, biological, ergonomic or psycho-social (e.g. stress) in nature.
   Page 2 of the EPS Risk Assessment form contains tick boxes for the most common hazards, although this list is not exhaustive, if you identify any hazards not listed tick the "Others" box and note them in the next section.

[1] https://intranet.hw.ac.uk/schools/eps/safety/Pages/Risk-Assessment.aspx

2. Decide who might be harmed and how
   This usually includes the person carrying out the work activity, for obvious reasons, but co-workers, visitors, cleaners etc. should also be considered.

3. Evaluate the risks and decide on precautions
   On page 2 of the EPS Risk Assessment Form, risks may be classified qualitatively as low, medium or high, evaluated using a consequence-probability (risk) matrix.

4. Record your findings and implement them
   It is pointless identifying hazards and deciding on precautions if they are not recorded and acted upon. To that end the EPS Risk Assessment Form must be signed by those who carry out that activity, and copies given to them and the Building Safety Officer.

5. Review your assessment and update if necessary
   Risk assessments should be reviewed if conditions change and in any case at regular intervals. An annual review will suffice in most cases, just to make sure that the risk assessment is still fit for purpose. Page 3 of the EPS Risk Assessment Form contains a section for signing off that the assessment has been reviewed and is still suitable and sufficient.

Risk assessments may be supported by additional documentation, such as MSDS for chemicals. Advice can also be obtained from the Building Safety Officer or Building Superintendent.

Both of the forms described above can be obtained from EPS Intranet pages https://intranet.hw.ac.uk/schools/eps/safety/Pages/Risk-Assessment.aspx. Completed copies should be sent by the activity supervisor to the Building Safety Officer, who will check them and add them to a list of current active risk assessments on the SHIELD database. Please note that although it can be a useful educational exercise for students and supervised staff to write a first draft of a risk assessment, supervisors must give their formal approval by signing the document and should correct any deficiencies. Supervisors bear primary responsibility for the safety of those under their supervision and are expected to take this responsibility seriously and act accordingly; this should include discussion of risk and safety requirements with those supervised so that safe working procedures can be agreed and documented. In some cases, direct supervision in person may be necessary, although this is unlikely to be needed for the majority of research activities.

Written risk assessments should detail agreed operational procedures and any training needs. The forms will be signed by the person in charge of the activity and anyone else involved, particularly those under supervision. Risk assessment is especially important for undergraduate project students and general undergraduate laboratories. All undergraduate and postgraduate laboratory teaching activities which have an associated significant risk

must have a written risk assessment. Staff must ensure that the students and supervisory staff receive relevant information from risk assessments and are instructed on any safety requirements, e.g. necessity for specific safety equipment, and that safe working procedures are actually followed. A supervisor should always be present in taught undergraduate laboratory classes and taught course postgraduate laboratory classes.

If the Risk Assessment relates to a specific laboratory rig, experiment or workshop activity then, where practical, a copy of the risk assessment package should be displayed at a prominent place either on or nearby it. There should at least be a copy of the Risk Assessment displayed in the laboratory where the activity is being conducted.

Personal Protective Equipment

Personal Protective Equipment (PPE) is defined as all equipment which is intended to be worn or held by a person at work and which protects them against one or more risks to their health and safety.

The hazards and types of PPE (from HSE)

Eyes	**Hazards:** chemical or metal splash, dust, projectiles, gas and vapour, radiation.
	Options: safety spectacles, goggles, face shields, visors.
Head	**Hazards:** impact from falling or flying objects, risk of head bumping, hair entanglement.
	Options: a range of helmets and bump caps.
Breathing	**Hazards:** dust, vapour, gas, oxygen-deficient atmospheres.
	Options: disposable filtering face piece or respirator, half- or full-face respirators, air-fed helmets, breathing apparatus.
Protecting the body	**Hazards:** temperature extremes, adverse weather, chemical or metal splash, spray from pressure leaks or spray guns, impact or penetration, contaminated dust, excessive wear or entanglement of own clothing.
	Options: conventional or disposable overalls, boiler suits, specialist protective clothing, e.g. chain-mail aprons, high-visibility clothing.
Hands & arms	**Hazards:** abrasion, temperature extremes, cuts and punctures, impact, chemicals, electric shock, skin infection, disease or contamination.
	Options: gloves, gauntlets, mitts, wristcuffs, armlets.
Feet & legs	**Hazards:** wet, electrostatic build-up, slipping, cuts and punctures, falling objects, metal and chemical splash, abrasion.
	Options: safety boots and shoes with protective toe caps and penetration-resistant mid-sole, gaiters, leggings, spats.

Suitable protective clothing should be worn for all potentially hazardous operations, e.g. welding, handling hazardous substances, etc. The requirement for protective clothing should be detailed in the risk assessment for the activity concerned.

Where PPE has been provided or it is required in the risk assessment, it **must** be worn. Any student or member of staff without suitable protective equipment will be asked to leave the relevant laboratory or workshop area.

There are particular areas within the School where, due to the nature of the area and adjacent activities, a more defined PPE requirement is detailed below.

Personal Protective Equipment (PPE) requirement in the Nasmyth workshop and entire surrounding open area.

All students and staff are required to wear PPE for any activities taking place in the ground-floor area of Nasmyth that encompasses the machine workshop, the teaching, projects and research area and the Chemical Engineering Laboratory. Adequate PPE is considered to be:

- Either Boiler Suits or Laboratory Coats - depending on which is deemed by the Supervisor and Building Safety Officer to be the more appropriate in the area concerned
- Safety Glasses - in the Chem Eng Lab area, and in areas where there are rotating machines
- Safety Shoes

For Taught-Course students PPE will be made available for purchase at the beginning of Semester 1.

Whilst there may be relatively hazard-free activities taking place in the area, these generally do so alongside activities that demand PPE and hence are not exempt from the above policy.

For special events, such as the provision of well-identified, hazard-free areas for supervised groups of school pupils; relaxation of the policy may be authorised by the Building or EPS Safety Officer.

Visitors to the area, including students and staff seeking to discuss jobs with technicians, should either restrict themselves to the pathway indicated by yellow lines, or ensure that they are wearing the required PPE.

Anyone not adhering with the above policy will be asked, politely, to leave the area.

Notice for All Female Staff and Students in Science and Engineering Disciplines

EXPOSURE TO HEALTH HAZARD DURING PREGNANCY AND BREAST FEEDING

It is well known that there are possible health risks when pregnant women are exposed to certain teratogenic or carcinogenic substances.

Staff and students whose work involves contact with chemicals are requested to inform their supervisor and the Building Safety Officer or University Health Service as soon as they know they are pregnant so that steps can be taken to remove them from risk during the period of pregnancy.

In addition to these chemical and/or biological hazards, there are other risks such as heavy lifting or similar strenuous activities.

It is essential that action is taken without delay, as the risks are greatest during the early months of pregnancy. All information will be treated as confidential; for more detailed medical advice, you are encouraged to contact the Building Safety Officer or University Health Service. Further advice for students can also be found through Student Support and Accommodation Services.

Continuously Running Equipment

Labelling of Equipment

It is essential that experiments involving the use of overnight and continuous running of equipment should be labelled with a form provided for the purpose. Electronic forms are available on the Sharepoint intranet and include instructions on completion. See https://intranet.hw.ac.uk/schools/eps/safety/Pages/default.aspx

Shutdown of Equipment

In the event of an emergency, the majority of equipment in EPS Buildings can be safely disconnected from its power supply, for example, by turning off at the mains. If any piece of equipment requires a more complex shut down procedure, then it is the responsibility of the operators to ensure that clear detailed instructions are placed in an obvious position to enable untrained operators to shut the item down.

Water Supply

The following procedure should be adopted with continuous running equipment involving a continuous water supply.

1. Suitable reinforced nylon or PVC tubing should be used. However, for light-weight glass condensers (typical in chemistry laboratories) silicone tubing may be used, provided that the water flow rate is not so fast that pressure in the inlet tube generates an aneurism. Rubber condenser tubing should generally not be used in apparatus that is left unattended.
2. The condition of all tubing should be inspected before use, and perished or hardened tubing discarded. Check especially that there are no longitudinal splits in the ends of the tubing as these can propagate in certain types of tubing.
3. The tubing should be clamped to the water supply and to the apparatus. It is recommended that two connecting clamps be used at each end of the tube. Self-locking cable ties are ideal for securing hosing to light-weight condensers; ensure that the ties are tight but do not cut into the fabric of the hosing.
4. The water supply should be set running at the correct rate, allowing for any increase in pressure.
5. The exhaust hose must be securely fixed or weighted to the drain.
6. The equipment must be labelled by a "please leave on" notice and the flood hazard specifically mentioned.

In addition, all water supplies should be plumbed in and permanently attached to solid supports. It is not allowed to have components of a water supply system, such as water filters, lying around under apparatus and not permanently attached.

Overnight Laboratory Chemistry Processes

Experiments which just require magnetic stirring at room temperatures or reactions under gentle reflux which have reached equilibrium and are fitted with suitable flow controllers and a thermostatically controlled heating device, may be left running overnight. Isomantles are NOT to be used overnight. Silicone oil in baths must have a centistoke (cSt) grading commensurate with the maximum temperature of operation such that the bath temperature will not approach the flash point of the oil used. Mineral oil is NOT to be used for heating baths. The fume hood used for heated reactions must be uncluttered, free of combustible material (*e.g.* paper towels), free of flammable solvent wash bottles or other flammable solvent (*e.g.* filled chromatography tubes). The use of the following is MANDATORY with overnight reflux reactions:

1. A contact thermometer set to avoid the oil bath temperature rising to a dangerous level.

2. A water flow meter that cuts the electrical supply to the hotplate in the event of condenser flow failure. The flow sensor should be set up in-line in the condenser exhaust tube.

Out of Hours and Lone Working

Normal working hours in EPS buildings are defined as 8.00 a.m. to 6.30 p.m. from Monday to Friday.

Staff or authorised students working in any EPS building outside of normal working hours, or over weekends, are required to sign in and out, in the Safety Register located in the relevant building.

Building	Location of Safety Register
Brewster	North Entrance (middle of Gait 2)
Coulson	Ground Floor main entrance/exit lobby
Mountbatten	North Entrance (middle of car park N)
Nasmyth	South West Entrance (Gait 3)
Perkin	South entrance (top of Gait 2)

Any staff member or student entering the buildings on days that are not regular working days, or after 6.30pm, must sign in and out.

Those entering before 8am must sign in. Those in the building at 6.30 pm, intending to stay beyond that time must sign the register.

Undergraduates and Postgraduates on Taught Courses (PGT Students) are NOT permitted to be in any of the EPS buildings between the hours of 10 pm and 8 am and additionally are not permitted in the Perkin or Brewster Buildings between 7pm and 10pm unless there is dispensation for access in run up to exams

Undergraduates and PGT Students intending to remain in the Mountbatten, Nasmyth or Coulson Buildings beyond 7pm must sign the register by that time, and sign out when they leave.

Undergraduates and PGT Students are NOT permitted to be in any of the EPS buildings on days that are not regular working days.

Staff wishing to work during University “Buildings Closed” days must contact their local Building Safety Officer in advance, and obtain permission to work, which will only be granted in exceptional circumstances. After permission is granted, staff are required both to sign in/out and advise University Security (Ext: **3500**) when they enter and leave the buildings.

Lone Working

As a general rule lone working in laboratory environments is not permitted for students or staff.

It is recognised, however, that certain laboratories contain equipment of sufficiently low-level risk that lone working is not hazardous. Written permission from the local Safety Officer is required in such circumstances – this might be as part of the displayed risk assessment for the laboratory.

Advanced level students (fourth/fifth year UG project students and PGT students) may work without direct supervision if justified by the risk assessment for the activity, but they should not work alone in isolated environments and under no circumstances are they permitted to work alone outside the hours of 9am to 5pm.

Waste Disposal

Within EPS there are several established recycling and disposal procedures for Electrical Waste, IT Waste, Batteries, Paper and Cardboard Waste, Sharp Waste, Biologically Hazardous Waste, Clinical Waste and Chemical Waste including Solvents and Oils.

Electrical and IT Waste

Items of electrical and IT waste from all EPS Buildings are collected together and sorted before uplift, contact the Building Superintendents to arrange collection of any items from laboratories.

Batteries

Within each building there are small blue barrels for disposing of batteries. Locations are listed below.

Building	Location of Battery Barrel
Brewster	Print Room DB1.24
Mountbatten	Electronics Store EM1.79
Nasmyth	Stores NSG.21
Perkin	Stores WPG.23

Paper & Cardboard

There are paper recycling bins in each office and in areas where networked printers are located. Cardboard should be flattened and placed into the yellow cage trolley located at various points around Campus.

Sharps

Dedicated Sharps bins are available from Stores, when filled, return to Stores for disposal.

Chemical Waste

All Chemical Waste is disposed of through specified procedures. A completed copy of the Waste Disclosure Notification Form[2] should be emailed to Stuart Grant (S.Grant@hw.ac.uk) for accounting purposes, who will then reply with details of collection or delivery to the waste storage area. For waste from Nasmyth/Coulson, the e-mail to Stuart Grant should be cc'd to C. Smith (C.Smith@hw.ac.uk) who will arrange for local storage prior to uplift. Below is a list of important safety points to remember with regard to Chemical Waste (See also Chemical Safety Section).

- Never put ANY chemical waste (including used desiccants such as magnesium sulfate) in the general waste bins.
- Never dispose of any glass, syringe needle, sharp metal or other sharp object in the general waste bins.

[2] https://intranet.hw.ac.uk/schools/eps/safety/Document Library/COSHH Form.doc

- Never leave paper towels contaminated with oxidising agents and disposed in the general waste bins.
- Never leave paper towels / filter papers *etc.* contaminated with reactive metals (e.g. sodium) and disposed in the general waste bins. Always destroy the reactive metal first.
- Under no circumstances discard disposable syringes in the general waste bins or waste container in the Perkin Building backyard. Syringes and needles (rinsed free of toxic or noxious contaminants) must be disposed of in a waste sharps container (available from Stores).
- Ensure that any chemical waste that has potential incompatibility issues or special hazards is separately disposed of in an appropriate container. This must be clearly labelled. Liaise with Stores for separate disposal of such containers and do not stockpile them in a lab. Example: waste hydrogen catalysts after purging with nitrogen would be put into glass waste jars under water.
- Never contaminate waste solvent containers with oxidising materials.
- Never add volatile noxious or toxic materials (*e.g.* TMSCN) to waste solvent containers.
- Never contaminate combustible organic solid waste with oxidants.
- Never put reactive chemicals into waste solvent containers.
- Never contaminate the waste flammable solvents with chlorinated solvents.
- Waste solvent containers in the lab must have pressure release caps or, in the case of a Winchester, leave the cap on the bottle UPSIDE DOWN. Do not tightly seal such Winchesters because of the risk of pressure build up and rupture/explosion. However, never leave a loosely screwed cap on in case someone picks it up by the cap. Within the Perkin Building, waste solvent should be collected as follows: flammable solvent waste (in red 8 L Justrite® safety containers); chlorinated solvent waste (in 4 L red Justrite® safety containers); aqueous waste (in 2.5 L plastic Winchester bottles). Use of glass Winchesters for collecting waste is strongly discouraged.
- Never overfill waste storage containers — always leave expansion room in the container.
- Glass for disposal must be rinsed free of any noxious, biological or toxic contaminants before discarding in the waste glass bins, using correct methods according to waste type i.e. biological waste should be disinfected or autoclaved.

Disposal of Waste Solvents

Waste solvents are classified into three categories:

A. Chlorinated solvents;
B. Flammable non-halogenated solvents;
C. Special solvents and liquid residues;

You should ensure that these categories are adhered to and that the waste complies with the relevant classification. Contractors handling waste solvent will insist that classification is accurate because different categories require different disposal routes.

The following points apply when disposing of solvents.

1. After use, small quantities (~2ml) of clean water-soluble solvents may be disposed of via the drain.

2. **Solvents immiscible with water** must not be disposed of down sinks to the drains; they should be accumulated in designated waste solvent containers for later disposal by other routes.

3. Solvents should be kept in clearly labelled bottles or containers to show category of waste and flammable hazard if present in the lab. In order to dispose of a full bottle, first notify the stores, who will remove the container and then dispose of it.

Clinical waste

Waste that requires incineration e.g. human primary cell lines, tissue, plasma/blood etc. should be tied in a yellow waste bag, labelled with the lab number generating the waste and placed in the yellow, clinical waste wheelie skip in the Perkin yard (Key to skip is available from Perkin store).

Biological and GM waste

Waste that requires to be autoclaved e.g. Agar plates, contaminated paper towels, gloves, plastics, tissue culture flasks and plates etc. should be autoclaved before being placed into a black bag and placed in LandFill skip in Perkin Yard.

Chemical Safety

COSHH

The use of chemicals within EPS Buildings is covered by the COSHH regulations. These regulations affect the use, disposal, storage and monitoring of all hazardous substances used within the School. In particular, the following points which apply to **all** chemicals must be noted:

1. Any order or request for a chemical substance must be placed via the Stores. This procedure allows all requests for chemicals to be logged.

2. Users of chemicals that are no longer needed should dispose of them via the Chemical Waste Disposal Procedure.

3. In order to see that the above points are being adhered to, there may be an annual audit of chemicals. This will usually take place during the annual safety inspection, where appropriate.

4. The following points apply only to chemicals deemed to be hazardous, that is, chemicals which are:

   a) very toxic
   b) toxic
   c) harmful
   d) corrosive
   e) irritants
   f) produce dust
   g) are carcinogenic, mutagenic, teratogenic or
   h) have a WEL (workplace exposure limit).

   These terms are defined on the HSE website[3].

5. The user of these chemicals should ensure that they have available manufacturers' safety sheets that cover any hazards associated with the chemicals and their use. It should be noted that many common chemicals have a WEL, among them most common solvents, carbon monoxide and carbon dioxide. **Users of CO and CO_2 lasers are therefore covered by these regulations.**

6. The person responsible for the work being carried out, or in the case of a student, the academic supervisor should ensure that a written COSHH assessment is carried out for each process involving these chemicals. **It is an offence to use chemicals classified as hazardous without first carrying out a COSHH assessment.**

[3] www.hse.gov/chip/phrases.htm

7. This assessment involves describing details of the process, such as:

   a) quantities of chemicals involved
   b) ways in which they may cause harm (e.g., skin contact, ingestion)
   c) protective clothing used
   d) working practices adopted
   e) disposal methods

8. When completed, the form must be signed by the person responsible for the work, or in the case of a student, the supervisor. Copies of the assessment will be given to all persons working on the process, including final year project students, and any others who need to know details of the project. This latter category includes technicians and visitors, who may come into contact with the process for extended periods of time.

9. Any change to the assessment as described on the COSHH form, or to the personnel working on the process, must be notified to the Building Safety Officer. This includes the appointment of final year project students to work on the process or near to where the process is being carried out.

10. In addition to the above, all processes will be re-assessed on an annual basis.

11. Many processes being carried out involve changing from one compound to another similar one after a short period of time. An example of this is the use of different types of dye in lasers. Here, the method is to treat all substances as if they were as harmful as the most harmful compound in the group. For example, in the case of laser dyes, all dyes are treated as carcinogens.

12. Any person thinking of changing a process involving chemicals or instituting a new process should contact the Building Safety Officer.

Users of such chemicals should be familiar with modern safe laboratory practices that are a prerequisite to a process being granted COSHH approval. To this end, the School has adopted a set of standards relating to work with chemical substances. These standards are detailed in the HSE Approved Code of Practice and Guidance to COSHH document available on the internet[4].

[4] http://www.hse.gov.uk/pubns/priced/l5.pdf

Use of Highly Flammable Liquids

Highly flammable liquids, predominantly organic solvents, are commonly used in laboratories across the School. Their presence increases fire risk because in many cases such liquids have flash points below ambient temperature, so that a flammable mixture of fuel vapour and air can develop above the liquid; this mixture may be ignited readily by ignition sources such as Bunsen burners, hot surfaces or electrical sparks, potentially leading to a much larger fire.

There are various technical definitions of what makes a substance highly flammable, but for practical purposes highly flammable liquids may be considered to have flash points below 32°C at atmospheric pressure. Liquids with flash points in the range 32-55°C are generally classified as flammable, while liquids with higher flash points, such as heavy oils, are classified as combustible. Flammable and combustible liquids present a much lower fire risk than highly flammables, because they will not form flammable vapour mixtures in air at ambient temperature and are thus relatively difficult to ignite, although they can still burn and could be involved in escalation of an existing fire if overheated.

It is a requirement of the School to limit the amount of highly flammable material that could be involved in the initiation of a fire or the escalation of a fire that starts elsewhere. Any potential for fire should be addressed in risk assessments and suitable precautions, for example control of ignition sources, taken.

Quantities of highly flammable liquids stored in workrooms and smaller laboratories should not exceed 50 l. Larger total quantities may be appropriate in larger laboratories, but the amount in any single storage area should not exceed 50 l and if multiple storage areas are present they should be separated as far as practically possible. The total inventory present should not be greater than that needed for routine use without excessive inconvenience.

Larger containers of highly flammable liquids, for example 200 l steel drums, should not be stored in laboratories but kept at a remote location away from personnel, preferably in an external store designed for this purpose. Quantities for bench top use can be dispensed from these larger containers into smaller bottles or cans as required, taking suitable precautions against spillage and accidental ignition.

Highly flammable liquids stored in workrooms and laboratories should be kept in dedicated labelled steel cabinets with internal drip trays capable of holding at least 110% of the volume of the largest container present. These cabinets should have suitable fire resistance and should be kept closed except when actually adding or removing containers. Oxidising agents, including acids, should never be kept in the same cabinets as highly flammable liquids. The amount of highly flammable liquid present on a bench top at any time should be as low as possible (HSE guidance states that “only the minimum quantity needed for frequently occurring activities or that required for use during half a day or one shift should

be present in the workroom/working area"). Highly flammable liquids taken out of storage to use on the bench top should be returned to the storage cabinet at the end of the working day and not left on the bench overnight. Fume cupboards should not be used as storage areas for highly flammable liquids.

Chemical Laboratory Environment

The following is a list of simple yet important safety points to remember when working with chemicals.

- Keep work surfaces clean and free from chemical contamination.
- Work surfaces MUST be kept free of loose syringe needles and glass shards (*e.g.* TLC spotters).
- Minimise trip hazards (trailing equipment wires, obstacles on floors).
- Never pick up a solvent bottle by the cap.
- ALWAYS use a Winchester carrier when transporting solvent Winchesters.
- Never contaminate solvent Winchesters (*e.g.* by use of a dirty pipette).
- Immediately mop up any water spills (*e.g.* from condenser hosing).
- Avoid contaminating taps, surfaces and door handles with dirty gloves — remove disposable gloves by pulling off inside out whilst still inside the fume hood.
- Never wear lab gloves in the corridors.
- Any reaction flasks of >1 L capacity must be supported by the base and not clamped solely from the neck.
- Consider use of a surrounding spill tray when using glass flasks with heavy magnetic stir bars.
- Never use broken or chipped glassware. Always check reaction flasks for star cracks and flaws before use and discard or have them repaired if damaged.
- Never handle silica gel powder in the open lab.
- Ensure that all chemical bottles are clearly labelled. Repair any damaged labels.
- Never double label a bottle with a new label stuck over an old label.

- Ensure that all chemical samples are fully labelled (your **name**, **date**, and **contents**) with a robust label that cannot accidentally be lost from the sample tube. Do not store samples on a long term basis in round bottom flasks in fridges and freezers.

- Store incompatible reagents and materials separately.

- Be familiar with the location of emergency exits, fire extinguishers, emergency corridor phones, first aid boxes, eye wash stations, laboratory sinks and chemical spill kits.

- Solvent Winchesters must be stored in bespoke solvent storage cabinets when not immediately in use.

- Never place solvent Winchesters (including smaller bench top bottles) in direct sunlight. Bear in mind the direction of evening sunshine.

- Never place solvent Winchesters on working floor space or raised bench islands.

- Dispense and use any flammable solvents in fume hoods without any ignition source (*e.g.* adjacent hotplate).

- To minimise the risk of accelerating the spread of a fire or exacerbating an accident, working areas on lab benches and in fume hoods must be free from unnecessary clutter and combustible materials (*e.g.* paper towels, NMR spectra etc.).

- Similarly minimise any unnecessary combustible clutter in under bench areas.

- Ensure that under bench oil pumps are distant from any combustible material and that there is no risk of solvent spill or contact with flammable solvent vapours. Such pumps must be easily visible / accessible for monitoring and be located in a bespoke cabinet or region with freely circulating air.

- Never obstruct emergency exits.

- Never wedge open fire doors.

- Flammable solvent content must NEVER exceed 50 L in any single laboratory unless stored within specialist vented storage cabinets.

- Flammable solvent wash bottles (*e.g.* acetone) must never be used in the vicinity of an ignition source (e.g. bench-top ovens)

- Take action to put any electrical equipment with damaged mains leads out of use and have it repaired. Laboratory users must report any equipment that does not have a valid PA Test sticker to the Building Superintendent.

Handling of Major Chemical Spillages

Prevention

Although these guidance notes are primarily directed at dealing with major chemical spillages, it is appropriate to start with a reminder on some of the precautionary measures which, if implemented, reduce the possibility of a spillage occurring.

- Proper carriers should be used when carrying Winchesters through stair and corridor areas.
- Where possible, Winchesters of corrosive chemicals such as strong acids should be purchased in the new plastic coated safety bottles.
- If available, a lift (e.g. Perkin Building service hoist) should be used rather than carrying heavy Winchesters of chemicals up or down stairs. Liquid Gases must NOT be transported in a lift with personnel.
- Extreme caution should be taken when carrying any quantities of dangerous bottled chemicals on trays; this practice should be avoided unless alternative methods are not practical.
- Keep manufacturers' and suppliers' protective packaging around chemicals until they can be safely stored.

Definition of 'Major Spillage'

A major spillage of a chemical can only be termed as major relative to the risk presented by the particular chemical involved, i.e. a Winchester of concentrated sulphuric acid dropped on the floor would be a major spillage as opposed to a few ml of the same material which could be mopped up quickly and safely. On the other hand, a few milligrams of beryllium spilled on the floor would be a major spillage due to the carcinogenic effect of minute quantities and the fact that air currents could distribute this over a wide area in a short time.

The area of spillage is also a contributing factor to the definition of the word *major*, i.e. a few hundred ml of flammable solvent spilled in a laboratory with absorbent material at hand and no sources of ignition present is an entirely different matter from the same quantity spilled in a corridor where the fumes could be quickly ignited by finding ingress to another laboratory where Bunsen burners are being used.

Response to a Major Spillage Incident

This is dependent on the substance involved and the location where the spillage occurred. If the spillage occurs in a laboratory or room and can be confined to that room, it can be treated as a local incident. If the spillage occurs in corridor or stairwell it obviously has much

wider implications and may warrant the evacuation of the entire building. This should be achieved by operating the building fire alarm after first notifying the University switchboard (Control Room at Riccarton - Ext **3500**) of the incident.

Priorities for Action

- Immediately evacuate the area concerned.
- Identify the substance involved and establish its hazardous properties and means of neutralising it.
- Treat anyone injured or contaminated by the substance, summoning medical aid if required.
- No attempt should be made to rescue anyone overcome by the chemical and still within the danger area. In such circumstances summon the Fire Service immediately.
- In all major spillages creating a non-respirable atmosphere or other health hazard the Fire Service should be called on to assist in dealing with the incident.
- The member of staff responsible for the activity must report the accident through Safeguard.

Restriction of Access

It is imperative that those handling a major spillage are not hindered by passers-by or onlookers who may put themselves at risk. It is essential, therefore, that proper warning signs and barricades are available for use by the clean-up team after they have initially contained the spillage. Makeshift barriers are of little use as their non-official appearance encourages people to ignore them and pass through rather than take a longer route. Contact the Building Superintendent for access to barricades and emergency tape to cordon off areas.

The final clearance of the spillage area could, in some cases, take a considerable time and the area should be thoroughly checked before the barriers are removed.

Stocks of Spillage Neutraliser and Absorbents

It is obviously desirable to hold stocks of spillage neutralisers and absorbents for use in an emergency and kits are available commercially from the main chemical suppliers. In addition to such materials the following items should be readily available for emergencies: large polythene bags, shovel, disposable over-boots, shoes and gloves.

Ideally, such items of equipment should be stored together in a readily accessible, appropriately marked bin or cupboard.

Spill Kit Locations

Building	Location of Spill Kit
Brewster	1st Floor Photocopy Room
	DB G.31
Coulson/Nasmyth	Stores NSG.21
	JN 1.39
	JN 1.38/37
Mountbatten	None
Perkin	Stores WPG.23
	1st Floor TL WP1.11
	2nd Floor TL WP2.25
	WP3.24
	WP3.21
	WP3.26
	WP3.30
	WP3.17

General Points

- Promptness of response to a chemical spillage is essential.
- The contents of spillage kits should be checked regularly and replenished as necessary.
- Local Authority regulations may govern the disposal of hazardous spillage residues. Check before disposing of such waste in the normal refuse bins.
- In addition to protective clothing, items of personal clothing contaminated in a spillage incident should be removed and laundered or disposed of as necessary.
- All persons involved in a spillage incident affected by hazardous fumes or chemicals should report to the University Health Centre or their own doctor for a medical check as soon as possible.
- Details of all major chemical spillage incidents should be reported as soon as possible through Safeguard.

Mercury Spillages

The use of mercury thermometers within the School should be kept to a minimum - Thermometers containing alcohol can almost always replace those containing mercury, except in some special cases (high temperature applications).

Mercury is a toxic substance by inhalation of the vapour given off, even at room temperature, and also by absorption through the skin (WEL is 0.025 mg of Hg/m^3 TWA over 8hrs).

The most common and likely source of mercury spillage is from the accidental breakage of bulb thermometers and manometers. Care should be taken when working with apparatus which uses mercury and breakages reported to a supervisor or responsible person *immediately*. Avoid using mercury manometers if an alternative is possible at a reasonable cost *but*, if you must use these, provide a "catch pot" in case of blow-out.

Spilled mercury readily breaks into droplets, increasing the surface area exposed and the emission of toxic vapour (which increases with heat). If a spillage occurs it *must* be cleaned up as thoroughly and as quickly as possible. The droplets may cover a wide area and a thorough check of the extent of contamination should be made; a hand torch can show up droplets effectively. Avoid standing on the droplets if possible, as the soles of some shoes can act as a sponge and absorb them. Initial cleaning up may be done by sucking up the large droplets with a plastic hypodermic syringe and placing the mercury in a suitably sealable container, e.g. a screw top glass or plastic jar, for re-use or recycling. Dispose of the syringe with the waste as detailed in the Waste Disposal Section. Alternatively, the mercury may be 'mopped' up with a mercury droplet collector pad and container, available from Stores.

Mercury spilt into floor cracks and/or very small mercury droplets can be made non-volatile by covering the contaminated area with a layer of 'Flowers of Sulphur' and leaving it for 24 hours. The waste should then be swept up and placed in a sealed bag or container marked 'mercury waste'. This should be returned to stores for subsequent proper disposal. The treated floor area can be washed down after sweeping.

Use of Laboratory Fume Cupboards

The primary purpose of a laboratory fume cupboard is to protect the breathing zone of the laboratory worker and others from the possible harmful effects of gases, vapours, dusts or aerosols evolved during work processes. A fume cupboard with a lowered sash may also, in many cases, provide a measure of protection against spillages or violent reactions. However, a fume hood window must not be considered an adequate safety measure for processes with an assessed risk of explosion (e.g. chemical reactions in sealed tubes); in such case bona fide explosion screens must be used within the fume hood.

However, recognition of the limitations of fume cupboards as well as their advantages is crucial to the safe and efficient use of such equipment. Whilst it is not possible to cover every aspect of fume cupboard use, care should be taken to comply with the points listed below:

- Fume cupboards should not be used for storage. Where there are joint/multiple use fume cupboards, all chemicals should be labelled clearly with including the name of the person using it. Chemicals should be stored elsewhere when not actually in use,

including overnight. Chemicals that appear to have been abandoned in fume cupboards may be removed without warning.

- Check that the fume cupboard is operating satisfactorily *before* starting work. The air flow entering each fume cupboard is tested annually, but if there is any doubt about satisfactory operation contact the Building Superintendent. Normal minimum air velocity under the sash should be 0.5 m/s for standard cupboards and 0.3 m/s for laminar flow cabinets.

- Note that some teaching lab fume hoods are on automatic central timer switches and turn off overnight (typically at 19:00). Therefore, check with the technician in charge of the lab before leaving any overnight processes in such labs.

- Ideally a separate cupboard should be used for each experiment. If this is not possible, care should be taken to ensure that experiments are compatible.

- Ensure that all necessary items are in the fume cupboard before commencing the experiment or process. This will avoid the need to leave the operation with the consequent disturbance of air flow and the risks associated with unattended experiments.

- If quantities of flammable liquids are involved spark and flame proof equipment must be used. Even if flammables are not involved, naked flames should be avoided unless they are essential to the process as they can upset the air-flow.

- Equipment should be set up at least 150 mm from the front edge of the fume cupboard. If it is placed too close to the front edge it will increase eddies in the air flow with the consequent risk of fumes escaping into the laboratory.

- Do not obstruct the slot at the bottom of the damper at the rear of the cupboard as this will prevent its function and hence affect the air flow.

- Trays and relatively bulky pieces of equipment should be placed on blocks so that air can pass beneath them thus minimising disturbance to the air flow. Remember that bulky pieces of equipment, such as ovens etc., will have a drastic effect on the air flow. In such cases face velocity checks and possibly smoke tests should be undertaken to ensure effective containment.

- The sash opening should not be set above the indicated maximum height for satisfactory operation, in most instances 300 mm.

- Do not sit at a fume cupboard if potentially hazardous work is in progress. Being seated could restrict your mobility in an emergency.

- Avoid all rapid movements especially of the arms within the cupboard. Do not allow other people to rush around behind you. Doors in the vicinity should not be opened or closed rapidly. All of these actions will have serious affects on the fume cupboard performance.
- Do not place large objects, such as gas cylinders etc., in front of a fume cupboard.
- Never leave potentially hazardous chemicals or processes unattended.
- Work tidily and always clean up at the end of the experiment or process. Leave the cupboard ready for others to use, i.e. clean and free of contamination, rubbish and/or equipment.

Use of Biological Safety Cabinets

There are 3 main classes of Biological safety cabinets (BSCs) – the thing they all have in common is that they protect the worker/environment from the cultures.

Class I BSCs protect the worker and environment *but not the samples*. Class I BSCs draw "dirty" room air into the cabinet and do not filter the air prior to circulation throughout the cabinet. Air is filtered through a HEPA filter prior to exhaust to prevent release of pathogens into the environment. (i.e. this is the opposite flow to the one shown in the diagram above)

Class II BSCs are the most common cabinets found in the lab and are the type of cabinet used for mammalian cell culture. Class II cabinets protect the worker, the environment and the samples. Air is HEPA-filtered as it is drawn into the cabinet and is also filtered upon exhaust. Because filtered air is circulated throughout the cabinet, aseptic procedures can be performed preventing contamination of samples. Class II BSCs are subclassified based upon airflow patterns, velocity, ventilation rates and exhaust methods.

Class III BSCs are gas tight cabinets that provide the highest level of protection to worker, environment and samples and are only used in maximum containment laboratories. They are custom built according to lab needs.

The selection and use of cabinets is dictated by the Risk Assessment of the materials being used and the techniques carried out.

Further information is available from the HSE website

http://www.hse.gov.uk/biosafety/

Clean benches only protect cultures or work items from the worker, so should only be used if the cultures or work items are harmless to you and the environment.

The clean bench works by pumping air through a HEPA filter into the top of the cabinet, and then out of the front of the cabinet where the user sits. The air that comes through the HEPA filter is sterile, and the flow of sterile air over the workspace and out of the front of the cabinet prevents non-sterile air from the environment from entering the cabinet and contaminating the cultures or work items.

Compressed Gas Safety

All users of compressed gases must read Compressed and Cryogenic Gas Safety[5] and be aware that the high-pressure gas system may come under the jurisdiction of the Pressure Systems & Transportable Gas Containers (PC & TGC) Regulations (1989). These regulations cover all pressurised gas systems except those which operate below 7psi. or where the amount of gas stored in the largest vessel is less than 250 bar litres. They also cover pressurised liquids, including liquid nitrogen and liquid helium.

New high-pressure systems, which fall within the scope of the regulations, must comply with all the regulations. Staff who wish to install equipment which they believe will come within the scope of these regulations should seek the advice of the Building Safety Officer before they proceed with installation.

Cylinders of Compressed Gases

Use of high pressure fluids

In addition to the PS & TGC regulations, there is a code of conduct regarding the safe use of all pressurised gases. All staff should be aware of the following points:

- Cylinders of compressed gases must not be stored inside any building except in a properly designated area.
- Cylinders must be securely chained or strapped, either to the wall or to a bench (and in some cases a trolley), at all times. On no account should they be left free standing.
- Cylinders must be transported by trained personnel only, using a proper cylinder trolley and must never be left in any corridor area. Cylinders must be ordered through stores and only those with the correct PPE and training will be allowed to access the cylinder store. Training is arranged roughly every 2 years, a list of currently trained personnel can be found on the O:drive P:\Support\Safety\eps safety responsibilities\Training
- Proper spanners, keys, regulators (and blowback devices with flammable gases) must always be used. Any connecting hoses must be of an approved design. Never attempt to open a cylinder without ensuring that the appropriate regulator has been fitted correctly, or remove the regulator head without first closing the cylinder neck valve.

It is an offence to tamper with or to attempt any adjustment to the internal mechanism of a regulator. If in doubt: ask.

5. https://intranet.hw.ac.uk/schools/eps/safety/Pages/Gas-Safety.aspx

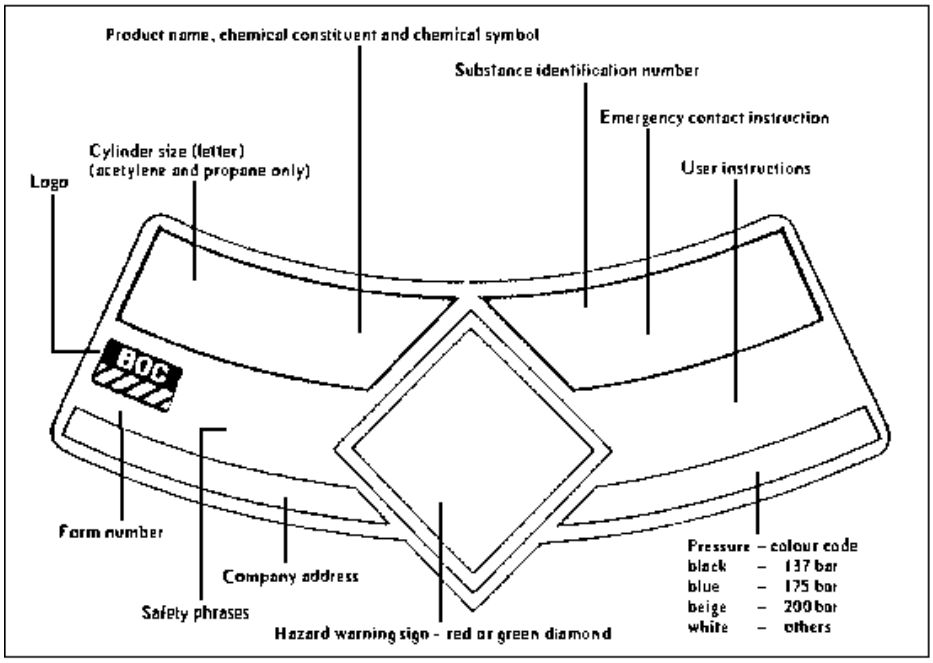
Immediate local advice is available from Building Superintendents or the Building Safety Officers. Further guidance and information is available from the BOC Gas Safety Website[6].

Responsibilities in the provision of high pressure fluids

If any gas cylinder is used, the staff member involved (research supervisor for research students) must determine the safety precautions needed with a particular gas and ensure that these safety precautions are carried out, e.g. appropriate labelling of the room and emergency procedures established. The staff member must be aware of their responsibility with regard to both the PS & TGC regulations, mentioned here, and also with regard to chemical safety under the COSHH regulations as detailed in the Chemical Safety section.

The locations of all gas cylinders within the buildings are kept on a database held by the Building Superintendents. Floor plans showing the locations of these cylinders have been produced and are held in Fireboxes in each building for use by the Fire Brigade in emergency situations. Any changes to the provision of gas supplies to laboratories must be notified to the Building Superintendent at once.

BOC cylinders now appear with a label designed to give more safety information. The format is shown below and the various sections identified.



Before use

1. Check that the reducing valve is adjusted for zero outlet pressure i.e. turned anti-clockwise until no resistance is felt.

[6] www.boconline.co.uk/health/gas_safety/index.asp

2. Open main cylinder valve slowly about 1/8th turn. Pressure gauge indicates valve open.

3. Turn reducing valve screw clockwise until pressure gauge indicates the required outlet/pressure.

After use

1. Close main valve on cylinder avoiding excessive force (highly dangerous).

2. Turn reducing valve screw anti-clockwise until no resistance is felt.

Remember that gas cylinders can be highly dangerous. They are filled to a pressure of 2500 lb in^{-2} (>1 ton per square inch) or >170bar. A sheared cylinder valve can have fatal results.

The Building Superintendent should be advised of any fault or malfunction of any of this equipment.

Services in Laboratories and Workshops

In most of the EPS Buildings, compressed gases are piped into laboratory areas from external gas cylinder stores.

Entry into the external cylinder stores is controlled by the Building Superintendent and certain members of technical staff. Please consult Building Superintendent for access.

All the gases come into the buildings at 6 bar line pressure except some in laboratory JC NG10, which has additional lines at 60 bar pressure.

The gases are piped to service stations in specific laboratories to outlet manifolds where pressure reducing regulators **must** be fitted before a gas can be used. Only regulators labelled for a specific gas can be used for that gas.

All gases can be dangerous or lethal if allowed to build up in a confined space. It is therefore important that all connections to the system are fully checked as being leak-tight before any operations are carried out. This should be checked by a competent person.

Under no circumstances are connections to be made to services or valves **opened** or **closed** without reference to a competent person familiar with the area.

The Mountbatten laboratories G.74 and the G.77 cluster have nitrogen, oxygen, helium and argon piped in from the compressed gas cage outside G.77.

Below is a list of all the services available in the Nasmyth and Coulson Buildings with their maximum on-line pressure and local rules about their use; not every laboratory has every service.

Pressurised Water: **140 psi** (Coulson), **64 psi** (Nasmyth)

Compressed Air: **100 psi**

Steam: **20 psi + a few at 100 psi** - **check before use**, all with condensate return (Coulson)
150 psi (Nasmyth)

Natural Gas: Mains pressure

Cooling Water: **40 psi or possibly higher** (flow & return) – **check before use**

Low Pressure Air: **4 psi** and **8 psi** - **check before use**

Compressed Gases: **6 bar** and **60 bar** - **check before use**

The following gases are available: nitrogen, oxygen, carbon dioxide, hydrogen, helium, argon.

With the exception of the compressed gases which are labelled with the name of the individual gas, the services are all colour coded with standard coding strips. Please familiarise yourself with these codes. All outlet valves are labelled stating the service and in some cases its pressure; if it is not labelled then do not use it.

Where all the gases are permanently on-line in Nasmyth and Coulson, isolation valves are fitted for safety reasons. These are located where each gas enters each building as well as in the cylinder store where a service or either of the buildings can be isolated.

It will be appreciated that, with the gases being permanently on-line, some rules will have to apply to ensure safety and also continuity of experimental work. Therefore, before working with the compressed gases:

a. Know what the rules are relating to the use of the compressed gases. Information relating to the gases and their use is in each laboratory concerned or can be obtained from the Building Superintendent.
b. Know where the main isolation valve into the building is for the gas being used, in case of a serious emergency.
c. Enter details of the gases being used in the book outside the Nasmyth Stores. This requires users to identify the gases concerned and the laboratory where they are used, and to note the time when gases are connected and the time when they are turned off. This enables some monitoring of gas use and would be useful in allowing the Fire Service to be advised of any live gas lines in the event of fire.

<u>Steam Under Pressure</u>

Autoclaves and steam pressure vessels must be operated as per the instructions displayed by them and must not be left unattended for any length of time.

All autoclaves and bench steam pressure vessels are to be examined at yearly intervals by Royal Sun Alliance Insurance.

Gas Detector Alarms

Within the Nasmyth and Coulson buildings, in areas where a risk has been identified there are gas detectors in areas where a risk has been identified to monitor any possible escapes of flammable gases into the atmosphere. The alarm system has two levels of operation:

a. If a concentration of 10% of the 'Lower Explosive Limit' is detected then a local alarm will sound in the area of the control panel, i.e. a high pitched monotone. There are instructions near each panel for finding the suspect area.

b. If a concentration of 20% of the 'Lower Explosive Limit' is detected the same local alarm will sound and the main building fire alarm. In this case the building must be evacuated.

Detectors are operating in:	Coulson NG1 and NG6.
	Coulson NG 15-18
	The Solvent Store situated in the yard.
	Coulson NG11-14
Locations of control panels are:	Corridor outside Aquaculture Laboratory, NG6;
	Corridor outside NG 10
	Solvent Store electrical box;
	Corridor outside NG 11

Operation under Positive Pressure

Pressure vessels and any other equipment to be used at elevated pressure must be designed, constructed and operated to meet present standards and should comply with any statutory requirements. Design, construction and modification of such equipment should only be undertaken after full consultation with your supervisor, the Building Superintendent and the Building Safety Officer.

Pressure systems must meet the requirements of the Pressure Equipment Regulations 1999 and the Pressure Systems Safety Regulations 2000. These Regulations do not apply to non-vacuum systems which operate below pressures of 0.5 bar gauge.

Particular care should be taken when equipment constructed of glass or plastic could be subject to internal pressure or vacuum.

All pressure systems should be equipped with proper instrumentation and relief systems. The provision of adequate containment and venting facilities should also be considered. It may be necessary to provide a dump tank for the discharge of the contents of the system under emergency conditions.

Insurance requirements dictate that there is a system of labelling and registration for pressure vessels and relief devices. Inspection and testing should be carried out at appropriate intervals and detailed records kept, i.e. all pressure vessels that come under the regulations must be registered. Notify your local Building Superintendent if you are planning to purchase this type of equipment in order for it to be registered.

The maximum temperatures and pressures for which a system is designed must never be exceeded.

Operation under Reduced Pressure

Equipment which is used under vacuum conditions should be screened from the operator.

If laboratory glass components are involved these should be of good quality and free from cracks or flaws; a visual inspection must be made (e.g. for star cracks in round bottom flasks). Bench scale filtrations using Buchner flasks above 1l should be protected against implosion by enclosing the flask in a fine metal cage.

For larger vessels where undesirable vacuum conditions can occur, protection can be effected using vacuum breakers which vent to atmosphere when the internal pressure drops below atmospheric.

Polycarbonate vacuum desiccators are preferable to glass ones; however, when used, glass vacuum desiccators must always be used with a desiccator guard cage. All rotary evaporator condenser units and receiver flasks must have plastic implosion protection coatings (*e.g.* Büchi PlastiGlass™) or be covered with appropriate plastic safety stockings.

Cryogenic Safety

Before using cryogenic fluids such as liquid nitrogen or liquid helium users must familiarise themselves with the BOC booklet Care with Cryogenics[7] and Compressed and Cryogenic Gas Safety[8].

Proper safety equipment must be available if required and transferring of fluid to a cryostat must not be carried out without another person present. This does not apply to small continuous flow cryostats once the initial connections have been made.

Staff and research students who are not familiar with cryogenic techniques must not attempt to transfer or use cryogenic liquids before they have received adequate supervised instruction.

Advice and instruction is available from the technician in charge of cryogenics: Mr E Nelson.

Hazards of Cryogens

Cold burns – Skin contact with cryogenic liquids can cause severe cryogenic burns, with results similar to those of frostbite or heat burns. Contact with non-insulated materials containing or exposed to cryogens can produce similar results, Skin may also stick to the material and flesh may be torn on removal of the material.

Oxygen deficiency – On evaporation ("boil off"), the volume of cryogenic liquid expands ~700-800 times its volume in gaseous form. If this occurs in an area that is not well ventilated, oxygen in the air will be displaced, resulting in a reduction of oxygen content in the air to a level that may not be sufficient to support life, leading to anoxia or asphyxiation.

Combustion due to oxygen enrichment – liquid nitrogen and liquid helium can condense air from the atmosphere, leading to the production of liquid with a higher oxygen content than that of air. This higher oxygen content increases the combustibility of many materials, creating potentially explosive conditions.

Effects on materials exposed to cryogen – The expansion ratio of cryogens mean that should expansion occur in a confined area then the violent change in pressure could result in an explosion. Venting systems should allow gas to escape from confined areas, however due to the low temperatures involved ice can form on vents blocking the gas release. Some materials become brittle when exposed to cryogenic temperature, so can crack or shatter during use.

[7] https://intranet.hw.ac.uk/schools/eps/safety/Pages/Gas-Safety.aspx

[8] https://intranet.hw.ac.uk/schools/eps/safety/Pages/Gas-Safety.aspx

Magnet quenching - this hazard relates particularly with liquid helium, where it is used to cool magnetic materials for analysis, if the superconducting magnet has a defect or malfunctions it can produce rapid heat to a particular spot on the magnet which heats the surrounding area. When this occurs there is a loud bang as the energy in the magnetic field is converted to heat, and rapid and possibly explosive boil-off of the liquid helium.

Dispensing

Dispensing liquid nitrogen from the BOC Tank in the Perkin Yard area must only be carried out by trained personnel.

The Dewars to be dispensed into:

- Must be visually inspected for damage;
- Must have suitable transport equipment (trolley);
- Must have a sufficient label (name, lab, contact no);
- Should be brought to liquid nitrogen cage in the Perkin yard for filling;
- Must not be left outside overnight.

Only request dispensing of the amount of cryogen immediately required, to prevent the unnecessary storage of cryogen and sign for the amount dispensed in the Perkin Stores.

Storage

Do not store excess cryogen, only order/acquire the amount immediately required.

Store in a well-ventilated area with suitable labels on the lab door and access restricted to authorised users only.

Use an appropriate container with suitable labels indicating the contents and maximum volume.

Transport

Manual Handling rules apply when transporting Dewars.

Dewars (<25l) should be secured to a suitable trolley for transport, larger pressurised Dewars are wheel mounted for ease of transport.

Where possible, transport Dewars on level, even surfaces, away from crowded areas.

When transporting Dewar in lift, ensure that no-one travels in the lift with the Dewar. A lift is a confined space and should leakage of the cryogen occur, anoxia or asphyxiation is a potential danger.

Transporting in vehicle - Transportation of cryogenic substances is covered by the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 ("CDG 2009"). These Regulations cover specific volume/mass of dangerous goods that may be

transported, duties of responsibility, correct packaging and labelling of goods, vehicle usage and driver training.

Note: These Regulations come into force if the cryogenic substances are transported on public roads, for however brief a period.

University Vehicles

- Written risk assessment for the activity, including the route to be taken, the vehicle used and the drivers experience/competence;
- Appropriate label on container describing the contents;
- Vehicle suitable for the purpose (driver separated from load by bulkhead);
- Driver made fully aware of the nature of load, associated hazards and emergency procedures;
- Appropriate PPE provided to driver;
- A CO_2 fire extinguisher provided to the driver, in order to extinguish any fires before heating of the cryogen within the Dewar;
- An information sheet carried within the vehicle to inform the Emergency Services of foreseeable hazards and emergency procedures.

Third Party Vehicles

The transport company should be supplied with the following information:

- Product designation, i.e. NITROGEN, REFRIGERATED LIQUID
- Product classification code, i.e. Class 2.2.
- Product UN number i.e. UN 1977
- The volume of each Dewar and the number of Dewars
- The consignor's name and address
- The address of the consignee
- A statement signed or authenticated by, or on behalf of, the consignor confirming that in accordance with the relevant provisions of the Carriage of Dangerous Goods and Use of Transportable Pressure Equipment Regulations 2009 ("CDG 2009")
    - the dangerous goods as present may be carried
    - the Dewars are properly labelled

Use

Use only in well ventilated areas. Transferring of cryogen must not be carried out without another person present. This does not apply to small continuous flow cryostats once the initial connections have been made.

- Ensure the vessel is dry and pour cryogenic liquids slowly into the receiving vessel to minimise splashing, spillage and thermal shock to the vessel.
- Use tongs when placing objects into or removing them from cryogenic liquids.
- Avoid use of wide-necked, shallow vessels to prevent excessive evaporation and the possibility of oxygen enrichment.
- Use a suitable pole for checking the level of the cryogenic liquid in a Dewar.
- Never overfill Dewars.

Use in Research and Teaching Labs: Suitable information, training, instruction and supervision will be given to all cryogen users, as discussed above.

Use in Visitor Workshops: Suitable protection for benches must be used, screens protecting groups should be used, all persons present will be given a briefing on safe use of cryogens and provided with PPE as necessary, there will be at least 2 preferably 3 trained EPS staff present (for the purposes of this policy EPS Staff include PhD students paid for their work in these workshops).

Lone/out of hours use: No transfer or direct handling of cryogens can be carried out indoors without at least 2 people present.

While experiments making use of cryogens may be carried out out-of-hours, there should be no direct handling of cryogens or transfer of cryogens from Dewars out-of-hours.

PPE

Appropriate PPE must be used when handling cryogens.

Gloves – Must conform to BS EN 511 (Cold Protection). The gloves should either have been specifically designed for cryogenic handling with ribbed cuffs to prevent splashing into the glove or be loose fitting gauntlets that can easily be removed. The material should be rough to give good grip while handling and not increase the chance of spillage.

Safety glasses – to protect eyes from splashes, ideally closed goggles should be used.

Shoes – should be top-sealed. Never wear wellington boots (due to the chance of spillage inside the boots) or open sandals (which offer no protection in the event of spillage).

General – Sleeves and trousers should be worn outside gloves and boots. All metallic jewellery should be removed to prevent liquid becoming trapped under them.

Disposal

Dispose via natural boil off in well-ventilated area.

Care needs to be taken when disposing of cryogenic liquids.

DO NOT pour cryogenic liquids down the sink - they will crack waste pipes causing potentially dangerous leaks.

DO NOT store cryogenic substances or allow them to vaporise in enclosed areas, including: fridges, cold rooms, sealed rooms and basements.

DO ensure that the area in which the cryogenic liquid is left to vaporise is well ventilated.

Emergency Procedures

Burns

- Remove any restrictive clothing - but not any that is frozen to the tissue
- Flush area with tepid water (not above 40 ºC) to return tissue to normal body temperature
- DO NOT apply any direct heat or rub affected area
- Cover with a loose sterile dressing and keep patient warm
- Obtain medical assistance from a First Aider or Security Control

Minor spillage (< 1 litre)

- Allow liquid to evaporate, ensuring adequate ventilation
- Following return to room temperature, inspect area where spillage has occurred
- If there is any damage to the floors, benches or walls, report it to the Building Superintendent
- If any equipment has been damaged following the spillage, inform the relevant person

Always report any spillage via Safeguard.

Major spillage (> 1 litre)

- Shut off all sources of ignition;
- Evacuate area of all personnel;
- Inform Building Safety Officer;
- DO NOT return to the area until it has been declared safe by an appropriately qualified person.

Anoxia

DO NOT attempt to rescue anyone from a confined space if they were working with cryogenic materials and have lost consciousness - call the Fire Brigade and Ambulance Service.

- If someone becomes dizzy or loses consciousness while you are there move them and yourself to a well-ventilated area immediately;
- If breathing stops apply artificial respiration;

- Seek help from a First Aider;
- Keep casualty warm and at rest;
- If deemed necessary call for an ambulance

Explosions

- If a tube or Dewar explodes injuring someone, seek immediate medical attention;
- If magnet quenching occurs (indicated by loud banging noise discussed earlier), evacuate the area immediately, and if necessary the building, and contact the Building Safety Officer and Building Superintendent. Do not attempt to re-enter the area.

Laser Safety

The EPS Laser Safety web pages (available to internal HWU users only) contains links to copies of all documentation, sign templates, safety presentation handouts, and links to safety/eyewear suppliers. These are available at:

https://intranet.hw.ac.uk/schools/eps/safety/Pages/Laser-Safety.aspx

General Safety

Nearly all the lasers[9] within the EPS buildings fall into the 'dangerous' high power classes 3B and 4, with the exception of those in the teaching laboratories. All lasers used within the buildings are potentially hazardous.

Laser beams can cause permanent damage to the retina of the eye in less than the reaction time for closing the eyelid. Elsewhere on the body the high power of both focused and unfocused beams can cause burns.

There are also other types of hazard associated with certain types of laser, e.g. carcinogenic and toxic effects of dyes and solvents used in dye lasers, risk of skin cancer from ultraviolet radiation from excimer lasers and electrical hazards associated with the high voltage of the power supplies.

It should also be remembered that the risks are particularly great when the laser is operating in the non-visible region of the spectrum. Some visible lasers sometimes produce simultaneous invisible output at significant levels.

Contact the Building Laser Safety Officer for advice on laser classification, eyewear and other safety related information regarding lasers.

Working with Lasers

When working with lasers, appropriate precautions must be taken as outlined below.

1. The academic supervisor responsible for a project involving a laser must provide the Laser Safety Officer with the following details:

    a) The specification of the laser.

    b) The experiment or experiments to which the laser is being applied.

[9] Note that the range of potentially hazardous sources includes semiconductor diode lasers, superluminescent sources, high brightness LED sources, and supercontinuum sources. The term 'laser' is commonly used to cover all of these types of source even though some of them are not technically lasers.

c) The names of everyone involved in the project to an extent requiring their regular presence in the laboratory.

d) Any changes in (a), (b) and (c). Details of lasers and personnel are contained in the documents giving the *List of Registered Laser Users* and the *Laser Register* [10], which is updated regularly.

2. Everyone in regular contact with lasers must read the '*Association of University Radiation Protection Officers GUIDANCE ON THE SAFE USE OF LASERS IN EDUCATION AND RESEARCH*' [11]. (This replaces the Safety in the University Note for Guidance Part 2:1 Lasers. The latter remains available for reference[11]).

3. Laser users using laser classified above class 2 must have a detailed eye examination - contact the Building Laser Safety Officer to arrange this.

4. Additionally, the academic supervisor must ensure that the laboratory or part of a laboratory in which the laser is situated is clearly indicated by a warning sign. The laser itself should carry a label giving its class. Template warning signs are available at http://internal.eps.hw.ac.uk/safety/laser.htm

5. Academic supervisors should ensure that adequate training is given to all students working on lasers and that final year undergraduates are properly supervised at all times. All new laser users must attend the annual Laser Safety Lecture.

6. Eye protection must be provided, at the entrance to each laboratory, appropriate to the lasers therein. Persons working regularly in the laboratory are provided with eye protection on an individual basis.

7. Warning signs, which are provided outside the laser laboratories, must be activated if the laser is in use and the door must be kept closed.

8. The David Brewster ground floor laser laboratories are within a designated risk area, and entry to the corridor is restricted to persons within the building who are actively engaged in laser projects or have a definite need. Undergraduates and visitors must be supervised in this area.

9. All windows within the laser laboratories must be adequately blacked out.

10. Any routing of a laser beam from one laboratory to another must have the prior approval of the Laser Safety Officer.

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[10] Copies of this document are kept by the Laser Safety Officer and are available for download from http://internal.eps.hw.ac.uk/safety/laser.htm

[11] Copies of this document are kept by the Laser Safety Officer and the Building Safety Officer and are available for download from http://internal.eps.hw.ac.uk/safety/laser.htm

11. Good housekeeping is important to laser safety. Know where everything is and have equipment out of cupboards only if it is necessary. Portable lasers should be kept in a locked cupboard when not in use.

12. Warn all visitors to the laboratory of the hazards, particularly of looking into the beam or bumping into components in the beam's path.

13. Good laser practice requires one to:

    a) always wear eye protection;

    b) whenever practicable keep the intensity of the beam to a very low level;

    c) never look directly along a laser beam or a specular reflection of the beam;

    d) never introduce an optical component into the path of the beam without first ensuring that the power is turned down to a safe level (1 mW in the visible), or, preferably, is blocked at source with a shutter. Always warn co-workers when you are about to move a component in the beam.

    e) always provide a stop for both the direct beam and any reflected beams. Beam stops should be used where the beam exits from the experiments. They are readily available from stores and reflecting neutral density filters should never be used as beam stops.

    f) avoid the use of highly-reflective accessories, where possible use matte black paint. We have a special matte paint from 3M. Be aware that a wrist watch and jewellery can reflect the beam.

    g) ask for advice if you are not sure.

14. Before switching on a laser:

    a) Check as far as possible that the beam will not be a hazard. Place a beam stop in front of the beam.

    b) Warn co-workers that you are about to switch on the laser.

15. ‘Normal’ hazards must not be ignored: a laser beam may blind you, the laser's supply may well kill you.

Laser Interlock System

Note: This section describes the system currently in use in the majority of research laboratories. Slightly different systems are in use in some laboratories, for example where there are many lasers in one room. Signage on individual laboratories MUST make the meaning of any illuminated indicators/keypads clear.

All lasers are now electronically interlocked to the main entrance in a particular laboratory. There are two stages of activation:

1 The Laser Hazard Sign switches on as soon as the laser supply is energised.

2 Every laser has an electronic shutter in front of it and its switch is coupled to the main door. If someone accidentally opens the door, the shutter closes and dumps the beam. **This also disrupts all ongoing experiments in the laboratory.**

Signage on the laboratory door should explain the meaning of the indicators on your particular system. Anyone wishing to enter a laboratory MUST follow the directions provided.

If the Laser Hazard Sign is lit, intercoms, where provided, should be used to communicate with personnel inside the laboratory; otherwise, knock on the door and await instruction.

Inside the laboratory there is a shutter control system which operates the shutter in front of the laser. It has three buttons:

Shutter Open: Opens the shutter

Shutter Closed: Closes the shutter

Enter/Exit: Enables researchers to by-pass the interlock and get in and out of the laboratory.

Electrical Safety

Electrical Testing

All electrical equipment is covered by the Electricity at Work Regulations 1989. In accordance with these regulations, all electrical equipment is inspected visually and tested for electrical integrity using a Portable Appliance Tester. A database of equipment is held by the Building Superintendents and includes details of test/inspection dates, location of equipment and name of the approved person conducting the test/inspection. Portable electrical equipment should only be used where it has a valid dated and initialled label indicating that an electrical safety inspection has been carried out.

Electrical safety testing of equipment that is not compatible with a portable appliance tester is carried out by outside contractors.

New Equipment

Any new equipment purchased for use on EPS business must be tested prior to use. When you have received new equipment from Stores, please contact your local Building Superintendent as soon as possible to arrange for testing to be done.

Repairs to Electrical Equipment

Under the above Regulations, no person shall be engaged on any work activity involving the construction, modification, repair or maintenance of electrical equipment and associated electrical connections unless they are deemed to be competent to undertake such work or are under suitable and competent supervision.

In assessing competence due account should be taken of the following:

(a) Adequate knowledge of electricity;

(b) Adequate experience of electrical work;

(c) Adequate understanding of the system to be worked on and practical experience of that class of system;

(d) Understanding of the hazards which arise during the work and the precautions that need to be taken;

(e) Ability to recognise at all times whether it is safe for work to continue.

In practical terms it is unlikely that such technical knowledge and experience will be available other than through a qualified electronics technician, electrician or electrical engineer. If in doubt, contact the electronic technicians who will assess your competence.

UNDERGRADUATE STUDENTS ARE NOT PERMITTED TO WORK WITH POTENTIALLY DANGEROUS VOLTAGES, ELECTRICAL WIRING, OR RING MAIN (13 AMP) CIRCUITS.

Staff may wish to carry out simple repairs on lab equipment, for example, replacing a like-for-like fuses, however any more extensive repairs should be carried out by the Electronics Workshop (EM1.78). Worn mains leads can be exchanged for moulded plug leads in the Electronics Workshop.

Where modifications or repairs have been carried out on mains voltage equipment it must be immediately PA tested for electrical safety and a dated and initialled label attached; contact the Building Superintendent to arrange this.

Alterations or repairs should never be made to three-phase equipment. Always contact the Building Superintendent, who will arrange for the repairs to be carried out.

The electrical supplies to laboratories are a part of the building's infrastructure and as such are the responsibility of Estates Services. They should not be modified by any other person. Requests for changes to supplies should be made to Estates via the Building Superintendent.

All electrical faults must be reported immediately
to the Electrical Technicians on extension 3332.

Guidance on 240V Distribution in Offices and Laboratories.

If overdue for retesting, equipment should not be used.

Any type of room heater, other than those supplied by the University, must NOT be used within the Buildings.

Connection of personal electrical items in labs and offices is discouraged. Where it is essential, e.g. personal laptops etc., all mains powered items must be PAT tested before use. No more than one adapter should be used in a mains socket, and all adapters and other multi-way distribution boards should be designed to BS 1363 and be PAT tested for safety. The overall load used with adapters should not exceed the recommended 13 amps per socket.

It is the duty of all staff and students to report potentially dangerous electrical equipment, e.g. broken plugs, split wires, out-of-date test labels, etc.

<u>Supplying power to equipment from wall sockets.</u>

In many of the older laboratories, the mains supply is via wall mounted sockets, while the equipment supplied is either rack mounted or on a free standing table or optical bench. Despite this, there is no excuse for trailing electrical leads across the floor, or worse, just above the floor. It is always possible to route electrical supplies overhead (on cable trays) or along the floor under bridges. When upgrading a laboratory, members of staff should seek

advice from the Building Superintendent and Electrical Workshop staff as to ways of improving the number and position of mains outlets, such as by using overhead supplies.

Adaptors (multiway socket blocks) **These devices are banned.**

They generally provide poor contact quality that may result in both overheating of the adaptor under high loading and poor earth bonding of connected equipment. In addition, the weight of connected plugs and flexes tends to pull the adaptor from its socket.

Distribution boards (4-way extensions)

These are allowed, but note the following points:

a) They must be wired with 13 amp cable.

b) If the boards are not fixed to a wall or piece of apparatus then they must be plugged into a fixed 13 amp socket, which can be either:

   i) a switched 13 amp socket supplied via conduit or trunking or

   ii) another fixed distribution board constructed from a number of 13 amp face plates, which is in turn plugged into a switched 13 amp socket not more than 2 metres away.

c) A fixed distribution board may be plugged into another fixed distribution board but the board into which it is plugged must be connected to a switched 13 amp socket.

d) Rules (b) and (c) above are intended to prevent boards being "daisy chained" together. The possible hazard introduced by daisy chaining distribution boards is one of poor earth bonding, where a high resistance earth path may fail to protect the user against a fault.

e) As a rule of thumb, no more than 6 outlets on distribution boards should be used which connect back to the same switched 13 amp socket.

f) There are occasions when the use of connected distribution boards can be justified by the nature of the apparatus being used, such as when all items on a mobile platform can be connected to one mains socket, and therefore isolated from the mains with one switch. **Distribution boards should never be used to cover for the lack of provision of sockets in a laboratory.**

Electrical Isolators

All laboratories and Workshops are fitted with electrical isolators, generally of the lever type. All personnel should be informed and aware of the location and purpose of the electrical isolator for the area they are in or equipment they are using.

Electrical Trips

Earth leakage circuit breakers are fitted throughout the buildings and will cut off the electricity supply if an excessive earth leakage current, such as might arise from faulty insulation, is detected. Should the electricity supply to the area you are working in be cut off, touch nothing and report it *immediately* to the Building Superintendent.

Electric Shock

Do not touch the victim until you are *CERTAIN* that the electricity supply has been switched off. Remove the victim to safety. If he or she has stopped breathing, *SPEED is VITAL - artificial respiration and cardiac massage MUST be STARTED within THREE MINUTES... SUMMON QUALIFIED HELP!* It is dangerous to go to the help of someone suffering from an electric shock unless you know the correct procedure.

Electrical Stop Buttons

There are a number of electrical *Emergency Stop Buttons* in laboratories and workshops.

Emergency stop buttons are COLOURED RED. These should be pressed in an **emergency only** to isolate all 240 volt or 415 volt 3 phase electricity in the area where they are fitted.

The Activity Supervisor should inform those working in the laboratory of the locations of the Emergency Stop Buttons during the initial laboratory session.

Guide to Personal Safety in Electrical Laboratories

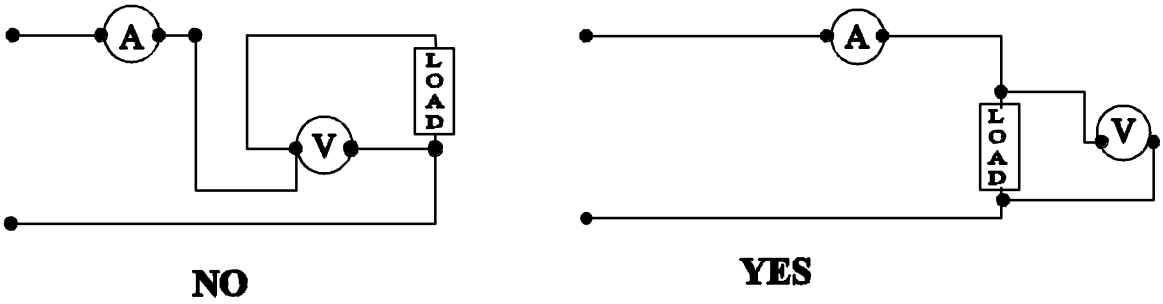
- Do not wear pendants, bracelets, loose ties etc., when in the laboratory. Food and drinks must not be taken into laboratories.
- Any voltage of 50 V and over is dangerous and must be regarded as lethal. At least two persons must be present when such a voltage is being investigated or exposed.
- All conducting surfaces at dangerous voltage should be insulated, shrouded or enclosed.
- Before making any change within a circuit, switch off and disconnect the main supply.
- Do not interfere with safety interlocks.
- Never disconnect earth connections in mains plugs. If an earth-free supply or detector is required, use isolating transformers, differential input units or batteries as appropriate. Note that most Variacs are auto-transformers and do not give isolation.
- Always use insulated probes with a voltmeter. (Never 'make-do' with connecting leads.)
- When in doubt about any procedure, consult a supervisor or demonstrator before acting.
- Do not look into the open end of a waveguide system unless the r.f. power is switched off. The maximum permitted power density for electromagnetic radiation is 10 mW/cm^2.
- Exercise the greatest care when working in the vicinity of rotating shafts. Safety covers must not be removed.

<u>Personal Safety is Greatly Enhanced by a Systematic Approach to Apparatus</u>

- Check position and action of main switch and ensure that it is OFF before beginning to connect apparatus.
- Always work from a clear circuit diagram, no matter how simple the circuit may appear to be.
- Arrange apparatus logically to correspond to the circuit diagram.
- Use connecting wires no longer than necessary and with suitable terminations. Connectors should be of sufficient gauge for the current to be carried. Shrouded

plugs and sockets must be used for all connections to equipment. Spade terminals should only be used when large currents are being carried.

- When using soldered connections make sure that the joint is mechanically as well as electrically sound.
- Take care to avoid heat damage to components, insulation and yourself or others. Use a stand for the soldering iron and switch off when not in use. Do not place soldering irons near the front of the bench where they may come into contact with clothing.
- Use coloured cables to distinguish between positive and negative or between live and neutral. Use phase sequence colours in 3-phase work.
- Wire the circuit methodically:
    - Complete current path
    - Add voltmeters
- Keep the current paths short and direct:



- Instruments. Estimate (or ask demonstrator for) expected readings; select suitable ranges or select highest range before switching on.
- Oscilloscopes: note – the ground clip of the oscilloscope probe is at Earth Potential and should not be connected to any potential directly derived, or referenced to mains.
  If you have any doubts, please contact your supervisor or the Electronics Workshop
- Ammeters and Current Coils of Wattmeters measure current and are connected in series with components. Wrong connections may destroy instrumentation: double check before switching on.

- If in doubt have your circuit checked by demonstrator before switching on.

Biological Safety

Work with Biological Agents, Cell Lines and Clinical Samples.

University Biological Safety Advisor – Mr Paul Cyphus, 0131 451 4668, **P.Cyphus@hw.ac.uk**
University GM Safety Adviser, Dr Peter Morris, 0131 451 3452, **P.C.Morris@hw.ac.uk**
EPS Biological Safety Adviser Dr Lynn Paterson, 0131 451 3068, **L.Paterson@hw.ac.uk**
EPS Ethics advisor, Dr Jonathan Shephard, 0131 451 4343, **J.D.Shephard@hw.ac.uk**

EPS Intranet Biological Safety information - https://intranet.hw.ac.uk/schools/eps/safety/Pages/Biological-Safety.aspx

IB3 Intranet Biological safety information – https://intranet.hw.ac.uk/schools/eps/ib3/Pages/Health-and-Saftey.aspx

Biological Agents

Biological agents comprise *micro-organisms* (bacteria, viruses, fungi, microscopic parasites), *cell cultures* and *human endoparasites*, including any which have been genetically modified, which may cause infection, allergy, toxicity or otherwise create a hazard to human health and the environment. The hazards posed by biological agents to workers include infection, pathogenicity, release of toxins and allergic reactions. It is therefore essential that workers appreciate the risks to themselves as well as to others.

As biological agents may pose a risk to workers, to the general public and the environment, it is essential that suitable control measures are taken to prevent accidental release of any biological agents. These control measures include written **risk assessments**, suitable and sufficient engineered control measures, a laboratory Code of Practice and the inactivation of any biological hazard before disposal.

All work with biological agents is governed by the COSHH Regulations (see HSE website http://www.hse.gov.uk/coshh/index.htm) and a University COSHH risk assessment form completed (EPS intranet at https://intranet.hw.ac.uk/schools/eps/safety/Pages/Biological-Safety.aspx)

The academic supervisor responsible for the work being carried out, should ensure that a written COSHH risk assessment is carried out for each process involving biological materials. When completed, the form must be signed by the person responsible for the work, or in the case of a student, the supervisor.

Copies of the assessment must be given to the Building Safety Officer, to all persons working on the process, and any others who need to know details of the project. This latter category includes technicians and visitors, who may come into contact with the process for extended periods of time.

Any change to the process as described on the COSHH risk assessment form, or to the personnel working on the process, must be notified to the Building Safety Officer.

In addition to the above, all processes will be re-assessed and the COSHH risk assessment updated on an annual basis.

Pathogens

The Advisory Committee on Dangerous Pathogens (ACDP) provides guidance on the safe use of pathogens, which have been categorised into four groups based on the inherent hazard of the organism.

Hazard Group 1: Low Individual and Community Risk
An organism that is most unlikely to cause human disease.

Hazard Group 2: Moderate Individual Risk and Limited Community Risk
An organism which may cause human disease and which might be a hazard to laboratory workers but is unlikely to spread to the community. Laboratory exposure rarely produces infection and effective prophylaxis or effective treatment is usually available.

Hazard Groups 3: High Individual Risk and Moderate Community Risk
Hazard Group 4: High Individual Risk and High Community Risk
Hazard Groups 3 and 4 contain organisms more dangerous than those in Group 2.
At present EPS has no facilities for handling Hazard Group 3 and 4 material.

The number of the Hazard Group of a particular organism indicates the level of containment under which it must be handled. The requirements for organisms of Hazard Groups 1 and 2 (Containment Levels 1 and 2) are listed in the section below.

Cell Lines

All work with clinical samples or human cell lines should be approved by the School Ethics Advisor in advance of work starting.

All cell lines should be assessed for possible risks to employees before they are used. As many cell lines are human or primate in origin means they can carry adventitious human infectious agents and care should be taken when culturing them.

Laboratory workers must not cultivate cells from their own body. This is because in-vitro transformation or genetic modification could occur which may result in malignant disease or expression of an unusually pharmacologically active protein if the cells are accidentally re-inoculated into the worker.

Certain permanent cell lines may have been transformed using viruses e.g. Epstein-Barr Virus (EBV). These cell lines may shed small numbers of viable virus particles when being cultured, exposing workers to the risk of infection with these viruses. It is therefore important that appropriate containment facilities are used when culturing these cell lines.

The above hazards should be taken into account when performing the COSHH risk assessment and in determining the necessary containment facilities required. Assessment of the risks that specific cell lines pose should include the origin of the cell line, possible infectious agents (particularly any oncogenic viruses which may be present), any containment facilities required and the disinfection procedures required before disposal.

Clinical Samples

All work with clinical samples or human cell lines should be approved by the School Ethics Advisor in advance of work starting.

All clinical samples should be treated as potentially infectious and hazardous People regularly involved with the handling of human material should seek a Hepatitis B vaccination and maintain a sufficient titre (via booster doses). A written risk assessment of the foreseeable risks involved in working with specific clinical samples must be produced and made available to all relevant employees. There should be a specific Code of Practice produced for collection, processing and disposal of clinical samples which emphasises the specific hazards of the samples (e.g. Hepatitis B infection from human blood samples). Personnel who work with clinical samples should receive the necessary information, instruction, training and supervision. Clinical samples should be stored securely. Any biological hazard associated with a particular clinical sample must be inactivated before disposal. It is essential that any sharps contaminated with clinical samples are stored in the appropriate sharps containers to be sent for incineration.

The following good laboratory practice and procedures should be observed and be sufficient to avoid infection:

1. Saliva, blood (and serum/plasma) and tissue should be handled within a clean, designated area.

2. The storage of experimental and biological material must always be segregated from any food or drink for human consumption.

3. Ensure all samples are correctly labelled and stored at the appropriate temperature.

4. Impermeable gloves (e.g. powder-free latex) must be worn when handling human material and any open cuts or lesions present on the operator must be covered with a waterproof dressing. Once used, gloves should be disposed of into an incineration bag (see point 5).

5. Use only disposable plastic syringes, pipette tips and tubes and dispose of immediately after use into a plastic bag (yellow) marked 'FOR INCINERATION'.

6. All sharps must be placed in a yellow sharps bin and disposed of by incineration when the box is 2/3 full. Needles can be removed from syringes using the notch on the sharps box, or by using forceps. Needle and syringe can be disposed of intact into the box.

7. Do not re-sheath needles.

8. Clean any saliva, blood (and serum/plasma) or tissue spillages immediately with 1% sodium hypochlorite solution or 2% Virkon and dispose of wipes into an incineration bag.

9. After spillages, non-disposable equipment (e.g. glassware/powdering implements) must be completely immersed in Perasafe solution 16.2gm powder per litre of warm water.

10. Any injury involving a potentially contaminated sharp must be washed immediately, encouraged to bleed (do not suck) and reported both to the experimental supervisor and University Health Service as soon as possible. A report must also be submitted though SHIELD by icon on desktop – *Report a Hazard*.

11. If a subject oozes blood following a finger prick or venepuncture, apply a waterproof dressing and have the subject exert digit pressure through it onto the site.

12. Contamination of the eyes or mouth should be treated by immediate irrigation with copious amounts of water and saline. Disposable face masks should be worn when powdering samples.

13. Wash hands after any procedure involving human samples, and immediately if the skin becomes contaminated with splashes of fluid.

Genetic Manipulation

Work on genetic modification is governed by the Genetically Modified Organisms (Contained Use) Regulations 2014.
Before any work of this nature is started, approval must be obtained 30 days in advance from the University GM Safety Adviser, Dr Peter Morris, 0131 451 3452, **P.C.Morris@hw.ac.uk** (SLS Room JM T18).

Transporting samples

All samples transported within Riccarton campus must be double sealed to prevent spillages. If spillage does occur this must be immediately brought to the attention of cleaning staff and cleaned using 2% Virkon solution. Carpeted areas should be avoided if possible.

Samples must be prepared using disposable gloves, but gloves (and lab coats) must not be worn when transporting samples between labs or University buildings as dangerous substances may be transferred to door handles and other surfaces en route.

Waste & Disposal of Samples

Please see waste disposal section of this manual.

Emergency Spills and Accident procedures

Before starting any procedure part of the risk assessment must be the emergency spills procedures. Biological and Chemical Spill kits are available in laboratories across the School – familiarise yourself with their location before commencing work.

Health Screening

All staff and students who will be involved in laboratory work with Hazard Group 2 or 3 pathogens, or Class 2 or 3 genetically modified organisms, or human blood or tissue samples that may contain group 2 or 3 pathogens must complete health screening before beginning this work. This is to identify anyone who may be at particular risk from infection, if exposed, in order to advise on appropriate precautions to help.

The University Health Screening form can be found on the Schools intranet at https://intranet.hw.ac.uk/schools/eps/safety/Pages/Biological-Safety.aspx

and should be completed and sent to the University Biological Safety Advisor, Mr Paul Cyphus. Confidential information on health screening can be discussed with the Riccarton Medical Centre on site.

Advisory Committee on Dangerous Pathogens ACDP) containment levels

ACDP Containment Level 1

This level applies to the handling of hazard group 1 pathogens. Level 1 containment does not require any special design features beyond those suitable for a conventional well designed and functional laboratory. Containment cabinets are not required. Work may be carried out on an open bench top and containment is achieved by the use of good microbiological technique and practices. All laboratory personnel should receive suitable information, instruction, training and supervision.

Containment level 1 is achieved by following the standards:

- A laboratory Code of Practice should be produced and posted in a prominent position within the laboratory.

- The laboratory should be easy to clean. Bench surfaces should be impervious to water and resistant to acids, alkalis, solvents and disinfectants.
- Effective disinfectants should be available for immediate use in the event of a spillage.
- If the laboratory is mechanically ventilated, it is preferable to maintain an inward flow of air while work is in progress by extracting room air to the atmosphere.
- All procedures should be performed so as to minimise the production of aerosols.
- The laboratory door should be shut when work is in progress.
- Laboratory coats or gowns should be worn in the laboratory and removed when leaving the laboratory suite.
- Personal Protective Equipment, including protective clothing, must be:
  stored in a well-defined place
  checked and cleaned at suitable intervals
  when discovered to be defective, it must be repaired or replaced before further use.
- Personal Protective Equipment which may be contaminated by biological agents must be:
  removed on leaving the working area.
  kept apart from uncontaminated clothing.
  decontaminated and cleaned or, if necessary, destroyed.
- Eating, chewing, drinking, taking medication, smoking, storing of food and applying cosmetics is forbidden.
- Mouth pipetting is strictly forbidden.
- The laboratory should contain a basin or sink that can be used for hand washing. Hands should be decontaminated immediately when contamination is suspected and before leaving the laboratory.
- Bench tops should be cleaned after use.
- Used glassware and other materials awaiting disinfection should be stored in a safe manner.
- Contaminated materials, whether for recycling, incineration, autoclaving or disposal, should be stored and transported in robust and leakproof containers without spillage.
- Waste sharps should be stored in yellow sharps containers.
- All waste material, if not to be incinerated, should be rendered non-viable before disposal.

- Accidents and Near-Miss/Dangerous Occurrences must be reported via SHIELD.

ACDP Containment Level 2

This level applies to the handling of hazard group 2 pathogens. All laboratory personnel should receive suitable information, instruction, training and supervision.

Containment level 2 is achieved by the addition of the following standards to those required for containment level 1:

- Access to the laboratory is to be restricted to authorised persons.
- There must be specified disinfection procedures.
- If the laboratory is mechanically ventilated, it must be maintained at an air pressure negative to atmosphere while work is in progress. In most laboratories operating at Containment Level 2 where there is mechanical ventilation simply to provide a comfortable working environment, it may not be practical to maintain an effective inward flow of air. The often constant traffic in and out of Containment Level 2 rooms may interfere significantly with attempts to establish satisfactory airflow patterns. However, where a laboratory is ventilated specifically to contain airborne pathogens in the event of an accident, then engineering controls and working arrangements must be devised so as to counter the risk of airborne transmission to other areas. Maintaining an inward flow of air is necessary only when work is progress. "Atmosphere" in this context may be taken to mean either the external air and/or other parts of the laboratory suite or building.
- There must be safe storage of biological agents.
- Laboratory procedures that give rise to infectious aerosols must be conducted in a microbiological safety cabinet, isolator or be otherwise suitably contained.
- There must be access to an incinerator for the disposal of infected animal carcasses.
- There should be adequate space ($24m^3$) in the laboratory for each worker.
- Laboratory coats or gowns, which should be side or back fastening, should be worn and removed when leaving the laboratory suite. Separate storage (for example, pegs) apart from that provided for personal clothing should be provided in the laboratory suite.
- Bench surfaces should be regularly decontaminated according to the pattern of the work.
- When undertaking procedures that are likely to give rise to infectious aerosols, a Class I microbiological safety cabinet (BS 5726: 1992 or unit with equivalent

protection factor or performance) should be used. Some other types of equipment may provide adequate containment in their own right but this should be verified.

- The laboratory should contain a wash basin located near the laboratory exit. Taps should be of a type that can be operated without being touched by hand.
- When gloves are worn, these should be washed or preferably changed before handling items likely to be touched by others not wearing gloves, for example telephone, paperwork. Computer keyboards and, where practicable, equipment controls should be protected by a removable flexible cover that can be disinfected.
- An autoclave for the sterilisation of waste materials should be readily accessible in the same building as the laboratory, preferably in the laboratory suite. Materials for autoclaving should be transported to the autoclave in robust containers without spillage.

Radiation Safety

The use of ionising radiation and of radioactive material is governed by the Ionising Radiations Regulations 1999 and the Radioactive Substances Act 1993.

The use of radiation and the relevant safety legislation comes under the jurisdiction of the Radiation Protection Supervisor (for the individual responsible see the Safety Committee structures given in the first section of this Handbook) who also keeps a register of all radiation sources and usage within the buildings.

Anyone working or planning to work with radiation in EPS buildings must:

- Complete a 'Scheme of Work' and submit it to the Radiation Working Group via the Radiation Protection Supervisor. Work shall only be allowed to proceed on written approval from the Working Group.
- Have completed appropriate radiation safety training in order to operate within the guarded area when a radiation source is in use.
- Have been issued with and wear a dosemeter. Dosemeters are collected by the Radiation Protection Supervisor at regular intervals for processing and the user is issued with a fresh dosemeter.

All activities associated with the use of radiation must be formally risk assessed. Radiation warning signs should be fitted in an easily identifiable location so that people can be warned when the radioactive sources are in use. Those operating with radiation sources **must** read the local rules for operating with radiation **before** use.

Any incident or accident involving radiation sources must be reported to the Radiation Protection Supervisor **immediately.** After an initial inspection, the Radiation Protection Supervisor will determine whether work should be suspended pending a full investigation.

Further guidance can be found in the Association of University Radiation Protection Officers Guidance Notes on Working with Ionising Radiations in Research and Teaching[12].

[12] https://intranet.hw.ac.uk/schools/eps/safety/Pages

Laboratory and Workshop Safety

Only authorised persons should enter laboratories or restricted areas of buildings. If you do not know if you are authorised or not, that means you are not – DO NOT ENTER.

General Safety in Laboratories and Workshops

Make sure you have read all the safety literature relevant to the Building in which you are working.

Observe and obey all warning signs.

Eating and drinking are not permitted in any laboratory, classroom or workshop area.

The consumption of alcohol is not permitted within the buildings unless it is associated with a formally organised School event, e.g. Graduation Receptions etc. The possession or use of illegal drugs / substances is strictly forbidden and may lead to prosecution under law. Supervisors should be advised if you are taking any medication which could affect your ability to work safely.

The use of personal music players and headphones is forbidden in all practical teaching and research labs unless required as part of the teaching course.

Clean tools, benches and machines after use and deposit scrap material in the bins provided. Keep classrooms, public areas, laboratories and workshops tidy.

WALK, DO NOT RUN! Horseplay is forbidden and potentially dangerous.

Avoid loose clothing and badly fitting footwear. At moving machinery, long hair must be tied back, well out of the way of rotating parts. If in doubt, use a hair net - hair caught in rotating machinery can cause serious disfigurement.

Use protective goggles, protective footwear and clothing where instructed or where common-sense dictates. Check these requirements before you enter. High heeled shoes are forbidden during laboratory sessions. Inappropriate footwear in workshop areas would include open toed sandals and other lightweight footwear.

Keep all chemicals and hazardous substances in suitable storage.

Switch off all gas cylinders, water, gas and other taps when not in use.

Keep floors clean and free of oil and grease spillages.

Do not obstruct passages, doorways and other thoroughfares.

Keep clear of overhead lifting gear when it is in use. Students are not allowed to use this equipment or any other heavy lifting machinery within the buildings; accidents with this type of equipment are likely to cause serious injury and may be fatal.

Always use machine or equipment guards where provided.

Do not overload electrical power points.

Trip hazards, such as cables, hoses, etc. should not run across working areas.

Solvents should only be used after considering the necessary precautions, particularly ventilation.

Teaching Lab Safety

Undergraduate students are not permitted in any laboratory or workshop area without permission, which can be assumed in the case of supervised activities forming part of their degree programme.

In the Undergraduate Laboratories a member of staff[13] must be present at all times during laboratory classes. There should be a minimum of one supervisor, including demonstrators, per fifteen students. Final year project supervisors are responsible for the students assigned to them.

The experiments must be risk assessed and have been constructed to an appropriate standard of safety for the skill of the students being trained in the laboratory. In practice, this means, for example, that a first year experiment should conform to the safety standard expected of school laboratories, whereas a final year project would reasonably have applied to it the safety standards of industry or of a research laboratory.

New experiments in a laboratory must be checked by another person for safety before being approved and introduced into a laboratory.

Students should be advised of and wear the appropriate safety clothing and equipment for each laboratory. Any student failing to meet these requirements should be excluded from the class.

Students working on fourth/fifth year projects may work without direct supervision if justified by the risk assessment for the activity, although they should not work alone in isolated environments. It is the responsibility of the academic supervisor to ensure that risk assessments are carried out and any necessary training is provided to students working in the area.

[13] For this purpose, a member of staff includes postgraduate research students whilst employed as demonstrators.

For all laboratory and project work, due attention should be given to the layout of the apparatus, especially pipes and electrical cables which should be adequately tied back or protected so that accidental contact is not possible. All wiring, fasteners, joints, etc. used should be suitable and approved for the purpose for which they are being used. All mains powered electrical test or computer equipment must be fully tested for electrical safety before use.

Visitors to Laboratories and Workshops

All visitors to the laboratories and workshops should be accompanied by a member of staff. They should be given the necessary safety instruction and equipment where required. All members of staff should inform the Building Superintendent before they enter any area with visitors. In the main workshop they must stay within the designated walk-ways highlighted by yellow markings on the shop floor.

Specific Areas within Buildings

As stated previously: Only Authorised Personnel are allowed in Laboratories and Workshops. If you are unsure of your authorisation, then DO NOT enter. This is due to both the health and safety implications and protecting delicate equipment set-ups.

<u>EM High Voltage Lab:</u>

Any activity to be carried out in the HV Lab must be risk assessed with particular attention to the electrical hazards present. Although there are various safety interlocks present in this lab, no person may start to work in the High Voltage Laboratory until he/she has read and understood the special rules which apply.

<u>JN Mechanical Workshop:</u>

Undergraduate students are not permitted in any Workshop area without permission, which can be assumed in the case of supervised activities forming part of their degree programme. At least one qualified member of staff should be present to supervise while Workshop undergraduate activity is underway. The experiments should be constructed with appropriate regard to safety and a suitable risk assessment carried out.

There are designated walkways around the Workshop areas and these should be adhered to at all times. As previously stated, all safety warning signs must be read and adhered to. Hard hats must be worn when in the basement of the Workshop.

Manual Handling

Manual handling is covered by the MHO regulations, which require that a risk assessment is carried out for all areas of work where manual handling of objects above certain limits occurs. For occasions when the work activity is non-routine, such as the installation of new equipment or moving large items from one laboratory to another, a risk assessment and scheme of work is required. In this case, the operation must be discussed with the Building Superintendent well in advance so that they may organise the personnel required.

Manual handling operations account for a disproportionately large number of injuries, including strains, bruises, cuts and back problems. Manual handling is also a cause of many chronic ailments, which develop not as a result of one specific incident, but as the result of many repeated operations.

It is the duty of staff to consider the risks involved before carrying out any manual handling or instructing any other person to do so.

Reducing Risks Due to Manual Handling Operations

If there is a way to avoid lifting a heavy object manually, it must be used wherever practicable. Obtain help and advice from experienced members of the technical staff wherever possible.

There are a large number of devices available in EPS to help with lifting and carrying of objects, such as portable cranes and trolleys. These should be used whenever possible. Contact your Building Superintendent to arrange the use of these devices.

There are other safety issues related to the transport of any object within the buildings, however light, which must be considered:

- When transporting an object, make sure that you can see where you are going.
- Use the lift when appropriate to move objects between one floor and another, but do not travel in it.
- If you have to wedge open fire doors, remember to come and close them afterwards.
- Ensure that liquids are carried only in sealed containers. Even if the liquid itself is not hazardous, any spill could subsequently cause an injury to someone else if they slip. Ensure that all spills, however small, are removed.
- Ensure that hazardous liquids are carried within sealed containers in the appropriate baskets. Never carry a bottle of a hazardous chemical in your hand.
- Wear the correct protective clothing for dealing with any chemicals even when collecting them from the stores, but gloves should not be worn in corridors.

Appendix A – Responsibilities for Safety in EPS

Everyone in the School has responsibility for the health and safety of themselves and others, but only the posts with major health and safety management elements have been listed in this statement.

Whenever a member of staff, student, supervisor or manager notices a health or safety problem which they are not able to put right, they must immediately inform the person responsible for safety in that area.

They may also report the matter to a member of the appropriate Building Safety Committee (see EPS Safety Committees and Consultation - appendix b).

The Head of School

The Head of School is responsible for health and safety in the School. He is responsible for providing an organisation with clearly defined responsibilities for health and safety within the School. The Director of Administration is responsible in the absence of the Head of School.

In addition to the responsibilities given in the University Health and Safety Policy, the Head of School will:

- receive regular health and safety reports on the performance of the School
- ensure that adequate resources are made available to enable compliance with the requirements of the University Health and Safety Policy
- if required, make decisions on matters of health and safety after consultation with the EPS Safety Officers and/or the University Head of Health & Safety Services
- promote greater safety awareness amongst employees in the School by example
- monitor the effectiveness of the organisation and arrangements for health and safety in the School

EPS Safety Officers

The School has a number of Safety Officers, each identified with one or more buildings. One of these EPS Building Safety Officers is also designated as the EPS School Safety Officer.

The School Safety Officer has specific responsibilities as laid out in the University Health and Safety Policy as well as the full authority to manage safety throughout the School buildings on behalf of the Head of School.

The EPS Building Safety Officers have such authority within their designated buildings. All Safety Officers have the authority to halt any work in the EPS buildings that they deem to be unsafe.

The EPS Building Safety Officers will:

- chair the EPS Building Health and Safety Committees and report to the School Safety Committee
- advise Supervisors on setting up safe operating procedures to cover all aspects of work and see that these are understood and implemented by staff and students

- advise Supervisors on providing staff and students with sufficient training, information and instruction to enable them to carry out their activities in a safe manner
- arrange through Supervisors that all equipment, machinery and workstations are safe and inspected at a frequency relative to the risks involved in their use
- arrange through Supervisors that all persons using equipment are authorised to do so and are trained in its use
- advise Supervisors on assessing all risks involved in the work, identifying the potential hazards and implementing controls to ensure that the risks are reduced to the lowest level reasonably practicable; all assessments are reviewed as necessary
- periodically monitor operating systems and carry out inspections of all workplaces in the School Buildings
- ensure via Supervisors that all accidents, incidents and dangerous occurrences are properly reported to the Health & Safety Services through Safeguard
- assist in the investigation of accidents, incidents and dangerous occurrences as requested by Health and Safety Services including instituting remedial actions
- complete the relevant sections of the annual report, and submit them to the School Safety Officer for collation and submission to the University Health & Safety Services

The Director of Administration, and the Heads of Research Institute, have no direct role in the management of safety-related activities within EPS. However, they are line-managers for those staff in the Supervisor role, as well as having that role themselves and as such have the following responsibilities:

- to promote safety awareness by example
- to give support to the recommendations of the EPS Safety Officers
- to ensure that channels are available for the flow of safety-related information

In addition to the above responsibilities the Director of Administration also has specific responsibilities stated in the University Health and Safety Policy.

Supervisors and Activity Supervisors

The title Supervisor, within this document, refers both to all Academic Staff and to those Support Staff whose immediate line-manager is the Director of Administration. These staff are themselves involved in unsupervised activities and/or supervise others. Each teaching or research activity undertaken by students within the School has an Activity Supervisor. The same is true for research activities undertaken by contract staff, or visiting researchers, and for all activities undertaken by supervised support staff.

In the case of teaching activities, the Activity Supervisor might be a member of the Academic Staff, a Research Assistant assigned a teaching duty by a “Demonstrator Co-ordinator”, or a member of the Support Staff who has been assigned a teaching duty. Activity Supervisors in charge of classes are responsible for the appropriate training and safety of students during these classes.

In the case of research activities, Academic Supervisors of all research workers have primary responsibility for all aspects of safety in the research groups they manage. For support activities (technical, IT, administrative or secretarial), staff will often be working in the area

of responsibility of other Support Staff (usually their line-managers), who are not at the level of the Supervisors as defined above. Such staff are also defined as Activity Supervisors.

Academic Staff and other Supervisors will ensure that within their areas of responsibility:

- prior to issuing any work instruction, sufficient assessment is made of the risks involved and that the assessment is submitted to the local Building Safety Officer for monitoring, to enable information on the precautions necessary to be issued
- laboratories/workplaces are maintained in a safe condition
- safe operating procedures are in place to cover all aspects of work and that staff and students are trained to conduct themselves in a safe manner
- only those who are deemed competent to use equipment and to carry out any hazardous tasks are permitted to do so
- all staff and students are provided with suitable protective clothing and equipment to enable them to carry out their duties in a safe manner and that these items are correctly used
- regular safety inspections are made and action is taken to rectify unsafe conditions including completion of the Self-Inspection Checklist
- they liaise with Safety Officers, staff and students on matters of concern, and carry out joint inspections with representatives of these groups where necessary
- they make certain that all accidents, near misses and safety related incidents are correctly reported via Safeguard
- they co-operate fully with the investigation of any incidents whether they involve injury or not and take action to prevent a recurrence

Activity Supervisors will:

- prior to issuing any work instruction confirm that a risk assessment has been made, submitted to the local Building Safety Officer and is available locally
- ensure that the supervised staff and/or students are aware of the risks and of the location of the assessments
- confirm that the laboratory/workplace is in a safe condition, that safe operating procedures are in place, and that protective clothing is used where appropriate
- confirm that staff and/or students are competent in the area of activity
- report all accidents, near misses and safety related incidents to the relevant Supervisor and/or the Building Safety Officer for reporting via Safeguard
- co-operate fully with the investigation of any incidents

All Staff and Students

In addition to the responsibilities detailed in the University Health and Safety Policy, all staff and students will ensure that they:

- are aware of the risk assessments made for all activities in which they are involved
- abide by all local rules governing working arrangements in their area and use safe methods of work at all times
- use the correct equipment and maintain it in good order
- only operate equipment/machinery for which they have been given appropriate training

- make full use of all protective clothing and equipment provided
- place no-one at unnecessary risk by their actions or omissions
- when visiting or working in areas other than their normal place of work make themselves known to the persons in charge or their representatives and abide by those persons' requirements for safety at those locations

Appendix B - Safety Consultation Procedures in EPS

The Head of School demands the maximum consultation on all matters of health, safety and welfare at work. A School Safety Committee comprising representatives of management and staff will meet quarterly or more frequently if appropriate. Prior to these meetings there will be Building Safety Committee meetings. The purpose will be to allow an open exchange of advice and views on all occupational health and safety matters throughout the School.

School Safety Committee

Composition

- Director of Administration (Chair)
- All EPS Safety Officers
- All EPS Building Superintendents
- Members of University Health & Safety Services
- School specialist safety representatives as required
- Head of School ex officio
- Heads of Research Institute & Teaching ex officio
- Trade Union Representatives of staff working in EPS
- Clerk to the EPS Safety Committee

Function

To enable effective consultation on safety between all members of the School and to ensure that the organisation and arrangements for safety in the School are suitable and sufficient.

Activities

- agree local subject-specific safe-working practices and procedures throughout the School where required
- oversee the production and dissemination of School safety information
- propagate best practice in health & safety across the School
- receive reports from the Building Safety Committees and make decisions on questions raised at these committees
- receive advice from the University Safety, Radiation and Laser Protection Advisors on Health & Safety Regulations and on proposed School procedures
- agree School-wide staff training needs

Building Safety Committees

Composition

- Building Safety Officer (Chair)
- Building Superintendent
- Heads of Research Institute & Teaching ex officio
- Representatives from other Schools occupying the building
- Radiation Protection Supervisor as appropriate
- Laser Safety Supervisor as appropriate
- Technical section heads from identified areas operating within the Building as appropriate
- Trade Union Safety Representatives as appropriate
- Research Associate and Postgraduate Representatives as appropriate
- Any other member of staff co-opted for a specific purpose, for example to co-ordinate the Risk Assessments required as a result of specific regulations or legislation

Function

To enable effective consultation on safety between all staff within a building, and to ensure that the organisation and arrangements for safety in the building are suitable and sufficient.

Activities

- propose changes to common safety procedures for the School, and to agree any additional procedures appropriate only to the locality of the Building
- ensure that local procedures are documented (in paper or electronic format as appropriate) and disseminated
- proactively monitor safety within the building by participating in the EPS Safety Inspection Schedule, primarily arranging the Annual Tour of their building of responsibility and the cross building inspection with the appropriate personnel
- monitor safety performance by consideration of accidents, incidents and inspection reports
- consider suggestions, comments and complaints from members of staff or students within the Building
- assist in the identification of safety training needs and to agree local needs
- provide the School Safety Committee regular reports (by way of minutes)
- consider the effectiveness of safety and security systems in the Building
- disseminate information on new legislation, new procedures and School safety initiatives

Health and Safety Complaints

All members of the School are encouraged to play an active part in maintaining and improving safety in the School buildings (and elsewhere). Complaints about health, safety and welfare at work should be pursued through the supervisory and management channels described in the Responsibilities for Safety in EPS procedure. The regular School Safety Committee Meeting will also provide a forum for discussion and resolution of safety matters.

However, it is recognised that on occasion it might be that the appropriate action is not seen to be done and in such an event the following course should be pursued.

1) The member of staff or student brings a complaint to the attention of the Activity Supervisor who should inform the relevant Supervisor
2) If the complaint is not resolved satisfactorily, then the member of staff or student should directly involve the Supervisor of the area in which they work, and the Building Safety Officer should be informed
3) If the complaint is still not resolved, the Building Safety Officer should be involved and the School Safety Officer informed
4) If the complaint is still unresolved, the Head of School should be involved
5) If the complaint is still unresolved then it should be discussed at the School Safety Committee and on to University Health & Safety Services.

At any stage in the above procedure the member of staff or student may bring into the consultation procedure, or seek advice from, their Union representative.

N.B. The initial complaint should be in writing and all subsequent discussions and decisions documented. It is anticipated that nearly all complaints will be resolved at stage 1 or 2, but is recognised that all five stages of the above procedure might be required. The time taken to move from stage 1 to stage 5 will be relative to the degree of risk involved and could be as little as hours.