Durham University

Department of Chemistry

HEALTH & SAFETY POLICY AND CODES OF PRACTICE

2020-2021

Health and Safety Policy Statement September 2020

As Head of the Department of Chemistry, I accept my statutory duties to ensure (as far as is reasonably practicable) the health, safety and welfare at work of all the Department staff and students, and of other persons who may be affected by the Department's undertakings.

My objective is to achieve and maintain health and safety standards in line with the Higher Education sector's national best practice. The Department has adopted the Higher Education sector's Health and Safety Management Profile 'HASMAP' system as our health and safety management framework.

I would encourage all staff and students within the Department to set a high standard of safety by personal example, in order that all staff and students should adopt an attitude of mind which accepts good safety practice as normal.

This policy forms an integral part of the Durham University health and safety management system. As such, I will ensure that University Health and Safety policy is implemented within the Department of Chemistry. Responsibilities and arrangements for the effective management of health and safety in the Department are in line with USHA guidance document Leadership and Management of Health and Safety in Higher Education Institutions.

The Department of Chemistry is committed to:

- Compliance with relevant health and safety legislation.
- Provision of a safe and healthy working environment.
- Prevention of injury and ill health.
- Improvement of health and safety performance using measures of performance.
- Formal communication and active promotion of this policy to all staff and students.
- A formal and fundamental review of this policy in consultation with appropriate members of the workforce.
- Use of strategic plans and health and safety objectives.
- Making resources available for health and safety.

Professor Karl Coleman — Head of Department of Chemistry

Date: 14 September 2020 — Review Date: 14 September 2021

Note from the Safety Chair

With the exception of measures introduced in response to the Covid-19 pandemic, the Health and Safety policy document has undergone a small number of changes for 2020-21. With respect to Covid-19, the following points are of note:

1. The University Covid-19 page should be checked regularly for the latest guidance and policy information.

   https://www.dur.ac.uk/coronavirus/

2. **If you have symptoms of Covid-19, you should stay at home and self-isolate**.
3. Covid-19, including the potential need for self-isolation with short notice, should be included in all planning activities and risk assessments.
4. The University is operating a “2m+” social distancing rule.
5. Face coverings are strongly recommended in circulation areas such as corridors, and for face to face activities.
6. Where possible, activities should be planned to minimise the need for face to face contact.
7. First Aid assistance can be summoned by calling Security (43333).
8. All rooms have a maximum occupancy number, which must not be exceeded.
9. Sharing of chairs, desks, keyboards *etc* should be avoided where possible. Where avoidance is not possible, cleaning protocols must be developed to minimise the risk of contamination transfer between users.
10. When coughing or sneezing, you should cover your mouth and nose with a tissue or with your elbow.
11. Hands should be sanitised before *and* after contact with shared touch points.
12. More information on Covid-19 measures, including the Covid-19 risk assessment, is in Appendix I of this policy.

Dr John Sanderson 14 September 2020

AFTER READING THIS DOCUMENT YOU MUST COMPLETE THE DISPLAY SCREEN ASSESSMENT FORM (AVAILABLE ON THE CHEMISTRY SAFETY WEBSITE), SIGN THE DECLARATION ON PAGE 94 AND POST IT IN THE BOX BY THE MAILRACK.

DURHAM UNIVERSITY
BOARD OF STUDIES IN CHEMISTRY

CHEMISTRY HEALTH & SAFETY POLICY - 2020/2021

SECTION A: ORGANISATION, RESPONSIBILITIES & MANAGEMENT

1. Organisation and Responsibilities

The Department occupies Office, Teaching and Research buildings and facilities based at on the Science site, Durham. Health and safety arrangements are managed by the Head of Department and the Department Management Team who are advised by a single Health and Safety Committee. The **Chair of the Board of Studies**, Professor Karl Coleman, has overall responsibility for safety within Chemistry facilities and for authorising persons to use those facilities and the equipment therein.

Usage of facilities and equipment is limited to employees and Emeritus staff of the University paid by the Chemistry Budget Centre, to students paying chemistry tuition fees or visiting on exchange programs, to employees of other centres engaged in collaborative contracts and to employees of other institutions who are Senate's academic visitors. All users and visitors are required to avoid at all times any behaviour that introduces unsafe practice.

Every member of the University community has a responsibility to achieve good health and safety (H&S) practice; this responsibility increases incrementally through the levels of the University line management structure.

University Council
|
Deputy Vice Chancellor and Sub-Warden
|
Heads of Department/Colleges
|
Managers and Supervisors
|
Staff and Students
|
Visitors

It is the responsibility of all members of staff and students of the Department to ensure that they are fully familiar with the Safety Policies and particularly statements which affect their own working areas. All staff in a managerial or supervisory capacity are responsible for managing the health and safety of those they supervise.

All employees are personally responsible for:

- Taking reasonable care for their own health and safety and that of others.
- Not misusing anything provided for health and safety.
- Reporting all accidents, incidents and hazards and suggesting improvements.

2. Departmental Responsibility for Health and Safety

Health and safety is the responsibility of everyone. The Department seeks to ensure that health and safety accountabilities and responsibilities are clearly communicated. Health and safety accountabilities and responsibilities are in line with Higher Education Sector best practice as detailed in University Safety and Health Association (USHA) guidance document 'Leadership and management of health and safety in higher education institutions'. The detail from the USHA guidance document is incorporated into the University Health and Safety Policy that the Department adheres to. The University Health & Safety Policy can be found on the Health & Safety Service (**UHSS**) web site:
https://www.dur.ac.uk/healthandsafety/local/office/hspolicy

The "Topic A-Z" link from that page provides further detail on key topics (**UHSS Topic A-Z**, https://www.dur.ac.uk/healthandsafety/local/office/guidance/).

The Chemistry Health & Safety policy, revised annually, is read and signed by all staff, postgraduate students, masters-level students, and academic visitors who use Chemistry facilities. It is available online (in html and pdf formats) at:
http://community.dur.ac.uk/chem.safety/local/policy/policy_2019_20.html

3. Departmental Safety Role Holders

In addition to the core accountabilities and responsibilities described above, in order to manage key health and safety aspects in the Department, persons are allocated specific departmental safety roles. The responsibilities of the persons are in line with the University Health and Safety policy.

The **Departmental Safety Coordinator** is Dr Connor Sibbald. (**UHSS Topic A-Z/Health and Safety Co-ordinators**). Dr John Sanderson acts as Chair of the Board's Safety Committee. The membership of the committee (**Appendix A**) is posted on the **Safety Matters** noticeboard outside CG121.

Staff with Specific Safety Responsibilities

		Room
Biological Safety Coordinator	Dr Gary Sharples	CG240
Waste disposal	Dr John M Sanderson	CG112
Display-screen equipment	Dr Bryan Denton	MC008
Electrical equipment	Dr Bryan Denton	MC008
Inorganic research and teaching labs	Dr Philip W Dyer	CG114
Organic research and teaching labs	Dr John Sanderson	CG112
Physical research and teaching labs	Dr Eckart Wrede	CG142
Safety and Research Technician	Dr Connor Sibbald	CG004X
Lasers and other non-ionising radiation	Dr Eckart Wrede	CG142
Manual handling	Dr Connor Sibbald	CG004X

4. Management Arrangements

Management Commitment and Engagement within the Department are explained within the policy statement, the Organisation and Responsibilities section of this policy and The University Health & Safety Policy (see above).

The Department has a Hazard and Risk Register and a Risk Profile document which inform the risk assessment process and risk based priorities. A number of Responsible Safety Objectives are being worked on to further improve health and safety performance. These are detailed in the safety Action Plan.

SECTION B: EMERGENCY PLANNING

There is a University Management Standard on Emergency Planning and Management (**MS9**, **UHSS/Topic A-Z/Emergency Planning**).

The Chemistry Department has plans to manage critical incidents and procedures for immediate response / recovery. These plans are described in this section of the policy document and its appendices. Definitions used in the critical incident plan include:

Near Miss: an event not that does not harm or damage, but has the potential to.

Minor Incident: a separate, identifiable, unintended incident, that causes minor injury to a person, or damage to property that could result in injury or ill health.

Critical Incident: an unexpected event confined to one area of business *i.e.* a single College or single Department, which has the foreseeable potential to seriously disrupt the normal activities in that area of business and has resulted in or caused: serious harm to an individual; potential for harm due to damaged equipment or structures; reputational damage; significant damage to a building; significant financial loss; and loss of information or data.

Major Incident: any actual or anticipated event, or series of events, which significantly affects a number of Durham University students, staff or operations and where normal management arrangements are unlikely to be sufficient. The event may have resulted in a single death or an injury likely to lead to death or multiple major injuries.

Minor Injury: an injury sustained on University property or University business that requires the intervention of a First Aider, including minor fractures to fingers, thumbs or toes, contamination of the eye requiring use of an eye wash, minor burns (< 10% of the body), concussion, cuts or grazes caused by slips/trips.

Serious Harm: where due to an injury sustained on University property or business a student, staff member of visitor is unable to perform their normal daily activity for a period of more than seven consecutive days (not counting the day of the incident), or where the injured person is taken from the scene to hospital for treatment to that injury. It includes a significant fracture, amputation of a body part, permanent loss of sight, serious burns (> 10% of the body), scalping, unconsciousness, or any other incident that requires resuscitation or admittance to hospital for > 24 hours.

Contact Arrangements and Recovery Following an Incident

In the event of a minor incident or near miss, communication with the person involved and their supervisor will be undertaken verbally and/or by email by the departmental safety coordinator or the secretary to the safety committee.

In the event of a critical or major incident, communication with those directly affected will be by first responders and subsequently the Head of Department. Notification to others will normally be sent by email as soon as practical by the Head of Department or the secretary to the safety committee. This email will describe the current situation, what will happen next, and how individuals may be affected.

Specific details for emergency evacuations are in Section B, Part 2m. Out of hours evacuations and power failures are detailed in Section B, Parts 2p and 7g.

1. Fire Precautions

(a) Responsibilities

A list of names of staff responsible for individual laboratories, and their contact details, is provided in the Chemistry Fire Box housed at the Security Lodge at the main entrance.

(b) Training

(i) Fire safety training is provided annually by the University Fire Safety Adviser to all new starters (staff, postgraduate students, masters-level students, and academic visitors) in the Department.
(ii) Refresher training for staff is provided by the University Fire Safety Adviser when required.
(iii) Training records are maintained by the Secretary to the Safety Committee.

(c) Fire blankets and extinguishers are situated throughout the building. The types of fire extinguisher available include:

(i) Foam (Beige band, for liquid fires).
(ii) Carbon dioxide (Black band, for liquid and live electrical fires).
(iii) Dry powder (Blue band, for metal fires, liquid and live electrical fires).

Personnel trained to use fire extinguishers should be familiar with the locations and types of extinguisher in their area(s) of work.

Replacement fire extinguishers are available from Estates and Buildings. When an extinguisher has been used please notify **Mr Paul Hofmann**.

(d) Emergency exits and escape routes:

(i) Should be kept free from storage, obstructions and combustible materials **at all times**.
(ii) Should open correctly. Fire exits and fire doors are checked during the safety audit (**Appendix B**).
(iii) Should have the correct signage displayed.

Make sure you know where the emergency exits are located. The location of emergency exits is discussed with new starters by line managers and research supervisors during the induction process.

(e) Fire wardens:

(i) The Chemistry buildings are divided into Fire Zones. Each zone is allocated at least two Fire Wardens.
(ii) Each zone has a Warden's box containing a high visibility jacket, a map of the building outlining the Fire Zone, a check list and a no-entry sign for placement at the external entry to the zone.

(f) Actions to be taken in the event of a fire:

(i) In some cases, small fires may be extinguished by staff or postgraduate students who have received appropriate training. Tackle the fire **only if trained and it is safe to do so**.
(ii) Raise the Alarm at the nearest break glass call point In the event of an emergency.

(iii) Call the Fire Brigade (9999) followed by the University Emergency Number (43333) in order to advise security staff.
(iv) Evacuate the building. **The emergency evacuation procedure is described in Section B, Part 2**.
(v) Proceed to the assembly point.

(g) Other Arrangements:

(i) Fire alarm systems are situated throughout the Chemistry building and are normally tested every Wednesday between 08.00 and 08.55. If the alarm sounds for more than 3 minutes, the building should be evacuated.
(ii) Notices stating the 'action plan' in the event of a fire are placed in all relevant rooms.
(iii) A general fire practice, which is organised by the Safety Administrator, is held at least twice a year to check the smooth operation of the emergency evacuation plan.
(iv) Where staff or students require assistance in the event of an emergency evacuation a PEEP (Personal Emergency Evacuation Plan) must be completed in consultation with the Departmental Safety Coordinator. Guidance and templates are provided by the University Fire Safety Advisers (**UHSS Topic A-Z/Fire Safety/Guidance**).
(v) One laboratory, CG004, is fitted with gas alarms. The emergency response plan for CG004 is known by key members of the safety committee and trained users of CG004. The first stage alarm is a high-pitched continuous sound. The second stage alarm is a full beacon sound like a fire alarm. If the gas alarm sounds, security (ext 43333), the DSC, or the deputy DSC should be notified. Anyone in the immediate (audible) vicinity should leave the building by the nearest accessible exit that avoids going past the door to CG004. If an emergency evacuation of the building is required, the procedures documented below in Part 2 should be followed. The protocols described below in Parts 5 and 6 may also be applied.
(vi) In the event of a failure of the fire alarm system, notification will be sent to ch-all@durham.ac.uk with the action required. Fire wardens and members of the Safety Committee will also circulate to ensure that the appropriate information is communicated verbally.

(h) Special Arrangements for 2019-20: there will be a transition from the historic system of dynamic fire warden allocation to the arrangements described above. In interim, the old system will continue to operate.

For further information on fire safety visit **UHSS Topic A-Z/Fire Safety**.

2. Emergency Evacuation Procedure

(a) On hearing the alarm, where reasonably practicable, personnel should make their area safe (*e.g.*, turn off heating mantles, ensure reactions are left in a safe condition) before leaving the building.

(b) **All** personnel should vacate the building, by the nearest evacuation route, as quickly and safely as possible, checking rooms are cleared as they leave. Those using teaching laboratories should normally consider the teaching laboratory fire exits as their primary escape route.

(c) On leaving the building personnel must make their way to the nearest fire assembly point indicated by the **FIRE ACTION** notice in their room. A representative from any affected area(s) or room(s) should report to the main entrance (red atrium, by the Security Office).

(d) The first Fire Warden to arrive at the Warden's box in each zone should don the high visibility jacket and sweep that zone to ensure that all rooms have been vacated, ensure that items on the check list have been completed, and place a 'no entry' sign on the external exit from the zone upon leaving. The Chair of the Board of Studies (or nominated representative) should leave by, or meet at, the main entrance to communicate events as soon as possible.

(e) Each fire warden will be responsible for moving people away from their assigned exit to assembly points and ensuring no-one re-enters the building until the alarm has been silenced AND PERMISSION TO RE-ENTER HAS BEEN ISSUED *via* the Incident Manager.

(f) The first senior member of the Safety Committee (staff member with ≥ 3 years employment in the Department) arriving at the **main entrance (red atrium, by the Security Office)** should introduce themselves to security personnel and will put on the orange high visibility jacket, held in the Security Office, and become the Incident Manager, responsible for communication with staff, security and the Emergency Services.

(g) The person who sounded the alarm should report to the Incident Manager (by the Security Office) as soon as possible.

(h) Anything that could not be made safe must be reported at the main entrance to the Incident Manager, to a Chemistry Fire Warden, or a responsible member of Chemistry staff, so that the Emergency Services can be informed.

(i) A member of Security should contact the University electricians immediately. The response time is approximately 5 minutes before 16:00. The response time increases to greater than 20 minutes when the engineers are on emergency call out after 16:00.

(j) In the event of a false alarm the Incident Manager will instruct Security to silence the alarm. Security will liaise with the electricians, if available, to perform this task. The electricians will later reset the alarm and all other plant machinery that has been automatically shutdown during the alarm.

(k) In the event of an incident that does not involve fire, such as a hazardous materials spillage, the Incident Manager or the Emergency Services may instruct Security to silence the alarm to enable responders inside the building to work without distraction to make the building safe. Silencing of the alarm in these circumstances DOES NOT mean that it is safe to re-enter the building. **Fire wardens must not allow personnel to re-enter until instructed that it is safe to do so by the Incident Manager**.

(l) If no reasonable cause for a sounder going off can be found, a senior member of the Department (Chair of the Board of Studies or nominated representative) and the Incident Manager should make a joint decision on whether the alarm is false.

(m) Following a real incident, when the area is safe, Security will inform the Incident Manager, who will then appoint individuals to notify the Fire Wardens that it is safe to enter the building once no-entry signs have been removed. Note that there may be a significant delay in the case of a real incident and personnel may instead opt to leave the area. In this case they MUST ensure that a responsible person will make their work area safe.

(n) The Safety Administrator will check after the fire drills if anyone experienced any difficulties. Any personnel who do not leave the building during a fire alarm will be referred to the Departmental Safety Coordinator and/or Head of Department.

(o) Estates and Buildings will be informed if any problems are reported.

(p) **Out of hours**. Should the fire alarm sound outside normal working hours (07:00 to 19:00, Monday to Friday), personnel should vacate the building by the nearest available exit in accordance with points (a) and (b) of this procedure. Once outside, all personnel should walk around the outside of the building to the Security Office (red atrium) and await further instruction. Should any personnel choose to leave the site, they must still sign the out of hours book at the Security Office to indicate that they have left. Security staff will inform personnel if or when it is safe to re-enter the building.

(q) **Covid-19**. In the event that an emergency evacuation is required, the arrangements described above still apply. The nearest evacuation route should be used. Social distancing should be maintained where this is possible.

3. First Aid

The persons currently qualified in first aid at work are listed with their photos on the **Safety Matters** board and online at:
http://community.dur.ac.uk/chem.safety/local/docs/Current_First_Aiders.pdf

Covid-19. Until further notice, in order to obtain First Aid assistance, Security should be contacted (**43333**), giving details of the incident an its location. Security will use Channel 1 on the hand held radios to contact a First Aider.

First Aiders attending an incident will wear gloves, face coverings, and visors (if appropriate).

Specialist First Aid. The persons currently qualified in the treatment of cyanide poisoning and injuries from hydrofluoric acid are listed on the safety matters noticeboard, first-aid boxes and the Chemistry Safety website.

The first-aid boxes are checked and replenished by Miss Kerry Strong. A list of all first aiders including specialist first aiders can be found on the front of each box.

Injuries of a more serious nature are referred to the Accident Unit of the University Hospital of North Durham. Transport should be by ambulance for serious injuries, or by taxi. Security office staff will assist with arranging a taxi.

Out of hours. In the first instance, if first aid is needed outside normal working hours, the security office (43333) should be contacted. Members of security office personnel are trained in first aid at work.

4. Accidents, Incidents and Near Misses

All accidents, incidents and near misses that could have led to serious injury or fires MUST be reported using the appropriate form. Serious accidents, dangerous occurrences and life threatening incidents must be reported to the Health & Safety Office immediately using Incident report (IR1) forms. Blank forms are kept in CG018. The log at the front of the book should be updated whenever an IR1 form is completed. Please inform Lizzie Amies when IR1 forms need to be replenished. Following an incident in a teaching laboratory, a staff member who was working in the laboratory at the time should complete the IR1 form. Following an incident in a research laboratory, either the person involved, or a witness to the accident, or the research supervisor, should complete the IR1 form. IR1 forms for all other incidents should be completed by the line manager of the person(s) involved. Completed IR1 forms should then be handed to one of the currently serving reporting officers: Dr Connor Sibbald, and Dr John Sanderson.

If an incident leads to any personal contact with a substance, it should be dealt with immediately, by safe and effective decontamination A Diphoterine® MICRO DAP is available in each First Aid box to help with relieving the effects of acid or alkali splashes on the skin or eyes. This is suitable for splashes that cover no more than 3% of the body surface and should be used within 1 minute of the splash. See **Appendix H** for more information. If Diphoterine® is unavailable, risk assessments and safety data sheets should be consulted for details of treating exposure. In most cases, this will involve washing liberally with water.

More trivial near misses that are not immediately life threatening can be reported verbally or by email to a member of the Safety Committee, or by completion of a simple form online at:
http://community.dur.ac.uk/chem.safety/local/near_miss.html

5. Procedure Following a Hazardous Material Release or Spillage

Immediately following an incident, the following steps should be taken:

(a) evacuate all non-essential personnel from the immediate area around the incident and place a barrier or sign to prevent people re-entering the area;

(b) if anyone has been injured, provided that it is safe to do so, follow the first aid procedures described in the departmental policy (http://community.dur.ac.uk/chem.safety/local/contacts.html);

(c) if the incident involves a fire, major release of volatile toxic or flammable materials, or an ongoing leak of flammable gases, the fire evacuation alarm should be sounded and the standard emergency

procedures adopted (Tel. 9999 for the Fire Brigade, 43333 for the University emergency number);

(d) if the incident is a spillage that is not spreading rapidly, is not endangering people or property except by direct contact, and does not endanger the environment, deploy the spillage response measures identified in the risk assessment;

(e) once the spillage has been made safe, inform the Departmental Safety Coordinator or Safety Committee chair if there has been any damage to property, a spill kit has been used, or there has is material that requires disposal. Contaminated waste should be disposed of by the usual routes (Section I). Spares for spill kits are available from stores;

(f) notify personnel when it is safe to resume work in the area;

(g) complete an IR1 form (even if the incident was a 'near miss').

(h) **If any of the following conditions apply, all personnel must be cleared from the area around the incident and a member of the Chemical Hazard Response Team (CHRT) called**:
   (i) the material released or spilled cannot be identified;
   (ii) the material released is a gas that is non-flammable and is still being released but not spreading beyond the area of the incident;
   (iii) personnel experience any of the following toxic effects as a result of the incident: breathing difficulties, skin irritation, eye irritation.

(i) How to contact the CHRT: The best method to raise the alarm is to phone security (42222) and ask them to contact the Chemistry Hazard Response Team (radio channel 1). Alternatively, a list of members of the CHRT, together with their contact details is posted at each of the three locations where the apparatus is located, just off the central landing on the ground floor, first floor and second floor of the main chemistry building. The following have been certificated for use and general inspection of the sets:

Mr Douglas Carswell, Dr Philip Dyer, Mr Paul Hofmann, Mr Malcolm Richardson and Mr Paul White, from 12/1/2017.

Dr Matthew Kitching, and Mr Peter Stokes, from 27/4/2017.

Miss Kerry Strong, Dr Connor Sibbald and Mr Gary Oswald from 7/11/2018.

(j) **Covid-19**. Until further notice, the Chemical Hazard Response Team is suspended. In the event of a spillage, follow steps (a) to (g).

6. Dealing With Spillages

Spillages must be dealt with immediately. Spill kits should only be used when they have been identified as the most appropriate and safe means for dealing with a spillage.

(a) Solids and Liquids: In most cases, appropriate methods for treating spills of liquids or solids will involve either the use of a spill kit, or deployment of a substance to neutralise the spillage before disposal. Guidelines are

given in the table below. Note: these are general and not a substitute for consulting safety data sheets and other sources of information. It is the responsibility of the researcher to make sure that appropriate neutralising agents are available before commencing a procedure.

Acids	Neutralise with sodium bicarbonate
Alkalis	Neutralise with citric acid or ascorbic acid
Hydrocarbons	Spill kit
Mercury	Consult Mr Paul Hofmann (policy, **Code of Practice I**)
Reactive Metals	Inert adsorbent (*e.g.* sand)
Other Liquid	Consult SDS; Spill Kit
Other Solid	Materials in a fine dusty form should not be cleared up by dry brushing

(b) Gases. In many cases, the most effective means of dealing with the release of a gaseous material is to isolate the source of the gas and allow the local exhaust ventilation to clear the release. However, this should only be undertaken if it involves no risk to any personnel in the laboratory. In all other cases, the area should be evacuated and the procedures documented below followed.

(c) Spill kits (Ecospill, 15 litre) are provided for all locations where chemicals are stored and manipulated. A larger capacity spill kit is available in the COSHH room (CG018) if required.

(d) Biological spill kits are available in all laboratories where GM work is undertaken. All workers in these laboratories should either be trained in their usage, or be supervised by somebody who has been trained. A code of practice for use of the kit is in each box.

(e) The Ecospill kits are packed in distinctive yellow holdalls. Each kit contains:

- 1 Absorbent boom for use to contain a spill.
- 8 Absorbent pads for use directly on a spill for absorption.
- 2 Hazardous waste bags & ties for disposal of contaminated booms and pads.
- 1 Instruction leaflet.

The pads and absorbent boom are of the yellow 'Chemical' or 'C' type for spills involving water, oils, and aggressive liquids (*i.e.* acids and bases). These kits do not contain chemically-resistant gloves, acid/base neutralising agents and other equipment such as a dustpan and brush or pH paper.

(f) The British Standard colour coding for absorbents is:

- **Maintenance, Grey/Black (M)**: for use inside on spills of non-aggressive water and oil-based fluids and mild chemicals.
- **Oil Only, White (O)**: for the preferential absorption of oil-based liquids on land or water, including vegetable oil, mineral oil and most hydrocarbon derivatives.

- **Chemical, Yellow (C)**: for use on spills of aggressive liquids *i.e.* acids and alkalis. Can be safely used on water- and oil-based spills. For use on land only.

An absorbent compatibility guide is given in **Appendix F**.

(g) Procedure for using a spill kit:

(i) Before using a spill kit, make sure that it is appropriate for the spillage to be treated, considering the chemical compatibility of the adsorbent and SDS for the spilled material(s). This should have been considered as part of the risk assessment before starting a process.

(ii) Appropriate PPE (gloves, lab coats, safety glasses, footwear) must be worn, in accordance with the departmental safety policy on Good Laboratory Practice (GLP, **Code of Practice A**). The SDS and risk assessments for the material(s) involved must be consulted beforehand.

(iii) Spills involving hazardous materials should first be contained if necessary using an absorbent boom (also referred to as a *sock*) or pad (also referred to as a *pillow*) to prevent spread of the material to other areas. Special attention should be paid to preventing the material from reaching any drains.

(iv) Working from the outside in, the spilled material should either:
  (a) be absorbed using one or more absorbent pads; or
  (b) be neutralised with an appropriate agent (*e.g.* citric acid for bases, sodium bicarbonate for acids). Once neutralised, absorbent pads should be used to clear remaining liquids.

(v) Once absorbed, the treated material should be placed into a hazardous waste bag and sealed with a cable tie; this bag should then be placed inside a further bag ('double bagged') and again sealed with a cable tie.

(vi) The material should then be removed to a safe place for disposal in line with the departmental safety policy on waste (**Section I**), or further treatment as appropriate.

(vii) The parts of the spill kit that have been used should be replaced from stores.

7. Power Failure

In the event of a power failure, fume cupboards and air handling will no longer function. No work should be conducted in synthetic or teaching laboratories under these circumstances. Personnel may remain in offices and write up areas where there is no chemical hazard for as long as necessary, provided that there is sufficient illumination and the fire alarm is not sounding. In the event that there is insufficient light, you should leave the building.

Supervisors are responsible for ensuring that measures are in place to protect the safety of researchers in their laboratories in the event of a power failure. In undergraduate teaching laboratories, senior demonstrators are responsible for ensuring the safety of undergraduate students and junior demonstrators.

(a) **Telephones**. Should the network also fail, IP telephones will no longer function. In order to report the power failure, summon assistance, or report an emergency, use one of the red emergency telephones.

(i) In the main building, these are located on each floor in close proximity to the lifts. One is also located at the back of the physical chemistry teaching laboratory (CG127).
(ii) In the materials chemistry building, one is located in the communal area by the entrance opposite the Calman lecture theatre block, and one is next to the entrance from the courtyard.

(b) **Emergency lighting**. In the event of a power failure during the hours of darkness, most laboratories and main circulation spaces have emergency lighting that should automatically trigger. This power is expected to last for up to 3 hours. If power has not been restored after 3 hours, the building should be vacated. Do not remain in areas without emergency lighting.

(c) **Fire alarms**. The fire alarm system has an emergency power supply and should therefore continue to function in the event of a power failure. Unless you hear the fire alarm, there is no immediate need to leave the building. This emergency supply lasts for 24 hours. If the power has not been restored after this time, you should not re-enter the building until you are informed (by email) that it is safe.

(d) **Lifts**. If a lift has an emergency telephone, it should still work during a power failure. If you are trapped in a lift during a failure, inform Security using this phone. If this method fails, and the alarm button in the lift does not work, make yourself heard by making a loud noise or shouting.

If you hear someone in a lift, contact Security using the emergency phone nearest the lift. Do not leave unless remaining is hazardous to your own safety; remain and communicate with the person in the lift to provide reassurance until either a member of Security staff or the Departmental safety team arrive.

(e) **In laboratories**, following a power failure:

(i) make experiments safe. At the socket, turn off all heating apparatus and equipment that may pose a safety risk, or be damaged by a surge, when power is restored;
(ii) seal solvent Winchesters and cover or seal all vessels containing volatile solvents to avoid an accumulation of toxic/flammable vapours;
(iii) if a vacuum line has a liquid nitrogen trap: turn off the pump at the socket, isolate the trap from the rest of the line, remove the nitrogen and then open the trap to the air. **Do not leave traps cooled by liquid nitrogen open to the air, or under vacuum**. Do not leave a sealed system containing volatile liquids;
(iv) avoid opening fridges and freezers if possible and do NOT turn them off at the socket;
(v) **leave the laboratory**.

(f) **Long power cuts**. Supervisors are responsible for sensitive materials in their laboratories, including those placed in fridges, freezers and glove boxes. Emergency power supplies from a backup generator are available in some locations. These are low power for systems such as fridges and freezers. Supervisors are responsible for provision of the appropriate

cables to use these emergency sockets. Emergency sockets are normally powered from the normal mains supply. In the event of a mains power failure, the power will disappear until the generator starts. This can take up to 30 seconds. They are then powered by the generator.

(g) **Out of hours power cuts**. General power failures that occur out of hours will be reported by email. During normal working weeks, overnight failures in specific parts of the Chemistry buildings will be reported by Security staff using the green forms on laboratory doors. If power fails to return within a short period, research supervisors are responsible for ensuring that any sensitive items are made safe.

(h) **Brown outs**. In the event of a short-duration power outage, work may continue as normal after running equipment has been checked. Particular attention should be paid to ensure the correct operation of any equipment that either:
   (i) contains a printed circuit board; or
   (ii) is thermostatically controlled, including hot plates.

(i) **Power resumption**. When power has been restored, gradually turn electrical items back on. If you think any equipment is not functioning correctly, turn it off at the socket and inform the electrical workshop.

8. Incidents involving Metal Sharps ('Needlestick' Injuries)

(a) In the event of an incident involving needles or other sharps:

   (i) Any injury caused by a contaminated sharp must be dealt with **immediately**.
   (ii) The wound should be encouraged to bleed and then washed thoroughly using soap and water. If appropriate, cover with a waterproof dressing.

(b) In cases where the sharp has been used with biological agents (*e.g.* blood or body products):

   (i) Any visual contamination with blood or body products to broken skin should be washed immediately with soap and water.
   (ii) Any contamination of the conjunctivae or mucous membranes (mouth/nose) should be rinsed thoroughly with copious amounts of running water.
   (iii) All such incidents should be reported immediately to the line manager/supervisor and an Incident Report form IR1 completed.
   (iv) If possible the source of the blood or body fluid should be identified in the event that testing is required for evidence of infection.
   (v) If it is known to have been an "infected" or "high risk" sample, the injured person should be advised to attend their own General Practitioner for further advice, counselling and possible treatment.
   (vi) If the "source" is unknown then it should be regarded as "high risk".

   All staff working with blood and body products must know this procedure.

   Ensure that all staff who are working with blood and body products are vaccinated in accordance with University Policy.

(c) In cases where the sharp has been used with chemical agents:

(i) Any visual contamination to broken skin should be washed immediately with soap and water.
(ii) Any contamination of the conjunctivae or mucous membranes (mouth/nose) should be rinsed thoroughly with copious amounts of running water.
(iii) The incident should be reported immediately to the line manager/supervisor and an IR1 Incident Report form completed.
(iv) If possible the sample should be identified. If it is known to have been a “high risk” sample, the injured person should be advised to attend Accident and Emergency with information about the accident for possible treatment.

SECTION C: RISK ASSESSMENTS

Before beginning work in Chemistry facilities for the first time, each person must complete a **personal health and safety record** (form PR1). This form includes a description of the planned project work and identifies the training, risk assessments and other documentation required. Undergraduates are included at the start of their final-year project, if undertaken. For laboratory work a **project risk assessment** must be completed before work commences. Two forms are available for this purpose, form CRA1 for the risk assessment, and form CRA2 for **project COSHH assessments**. The researcher must be able to produce the countersigned form(s) on request (see also **Code of Practice A, Part 2(b)**). All forms are available from the Chemistry Safety website: http://community.dur.ac.uk/chem.safety/local/Forms.html
In addition, researchers undertaking biological projects should complete a risk assessment using the forms on the **Department of Biosciences website**:
https://www.dur.ac.uk/biosciences/local/staff/safety/

A new PR1 form is required for existing workers who take up new contracts or change supervisors, or where there is a significant change in their work. For laboratory work, a new project risk assessment (forms CRA1/CRA2) must be undertaken before the new project is started. Any other training and documentation requirements identified in the new PR1 form should also be completed.

The following matrix is provided by UHSS to assist with making risk assessments:

RISK LEVEL Key: DAFW, Day Away From Work		***Likelihood of Occurrence***			
		Very Unlikely Little or no chance of occurrence	**Unlikely** A rare combination of factors would be required for an incident to result.	**Possible** Not certain to happen but an additional factor may result in an accident	**Probable** More likely to occur than not
Hazard Severity	**Minor** No or minor injury (first aid)	**CARE**	**CARE**	**CARE**	**CAUTION**
	Moderate Off-site medical treatment or DAFW*	**CARE**	**CARE**	**CAUTION**	**ALERT**
	Serious More than one DAFW, long-term absence	**CARE**	**CAUTION**	**ALERT**	**STOP!**
	Major Permanent disability or harm, fatality	**CAUTION**	**ALERT**	**STOP!**	**STOP!**

CARE	Minor harm possible, serious harm very unlikely to occur; implement controls and ensure care is taken when performing activity.
CAUTION	Minor harm probable, major harm unlikely to occur; follow all control measures, increased level of competence required and ongoing self-assessment of risks identified.
ALERT	Moderate degree of harm probable but major harm unlikely; critically assess the risks and appropriate controls. Specific competence required and ongoing assessment of risks by individual and/or supervisor.
STOP!	Serious or major harm will probably occur; stop the activity and critically assess the risks, review safety aspects of activity and implement further controls. Consider referencing HSE or other Best Practice, consider involving UHSS.

General Risk Assessment for Work in the Chemistry Department

Location(s): *(where will the activity or task take place?)*	All areas of the Chemistry (CG) and Materials Chemistry (MC) buildings	**Ref:**	CGRA2020

Description of task or activity	**Hazards** *(things with the potential to cause harm)*	**Those at risk** *(people who could be harmed)*	**How could they be harmed?**	**Uncontrolled risk level** *(level of risk without control)*	**Required controls** *(how the risk can be removed or reduced by for example engineered methods, safe systems of work, training and/ or personal protective equipment)*	**Controlled risk level** *(when controls are in place)*	**Relevant sections of Chemistry or UHSS policy**
Transport of chemicals (deliveries, waste)	Hazardous chemicals, liquid spills, broken glass	All in department (including general public in circulation areas)	Chemical exposure, fire, slips, cuts	**Alert**	Codes of practice that include: i. the transport of materials, and; ii. general conduct in public areas. Emergency evacuation procedures. No running, or use of mobile phones or headphones in public areas.	**Care**	Section B Section D Section I,K
Computer work	Incorrect posture	All in department	Strains, back pain	**Alert**	Ensure appropriate furniture, monitor(s), keyboard and mouse are used; take regular breaks; perform DSE assessent and review following any changes.	**Care**	Section D
Circulation and work in Chemistry facilities	Liquid spills, obstructions, trip hazards	All in department (including general public in circulation areas)	Slips and trips	**Caution**	Ensure all areas are free from slip and trip hazards; adoption of safe patterns of working and behaviour; risk reduction methods; respond to changing conditions (*e.g.* weather); reporting of problems.	**Care**	Section D
Manual handling	Heavy or bulky items	Personnel moving heavy items	Musculo-skeletal injury, crush injury	**Caution**	Wearing of appropriate PPE, including safety shoes; risk assess infrequent or difficult loads (MAC tool); code of practice for moving items by hand; movement of heavy or awkward items using a handling aid.	**Care**	Section D Section H
Out-of-hours and lone working	Accident, illness	All in department	Undiscovered person needing medical help	**Stop**	Register for those in the department outside normal work hours; another worker within earshot; lone lab. working prohibited; no undergraduates in labs outside normal work hours and outside term unless supervised.	**Care**	Section E
Work with electrical items	Unearthed or live equipment	All in department	Electric shock, fire	**Stop**	Inspection of equipment before use; regular PAT testing of all electrical equipment by an authorised tester; Live Electrical Work only permitted by authorised personnel.	**Care**	Section B Section F
Legionella	Water stored 20-45 °C able to form spray	All in department	Legionellosis	**Caution**	Nominated Manager for the control of Legionella. Assessment oif outlets at risk. Outlets at risk need to be run regularly to flush stagnant water.	**Care**	Section D UHSS, MS15
Offsite Activities	No access to medical care, crime, threats to own safety	All personnel travelling on University business	Illness, inability to continue travel, personal injury	**Caution**	Provision of emergency contact details; for medium/high risk activities, risk assessment + checks on controls and SSoW. For overseas travel: risk assessment (including CRG alerts); travel cover approval through Viator.	**Care**	UHSS, Guidance G36
Covid-19	Covid-19 infection	All in department or on University business	Illness	**Stop**	Covid-19 policy, including arrangements for building access, social distancing and cleaning. Personal responsivility for reporting and self-isolating. Hand hygiene and face coverings where appropriate.	**Care**	Appendix I

Assessment prepared by		**Head of Department acceptance**		**Review date**
Name:	Chemistry Department Safety Committee	Name:	Prof. Karl Coleman	30 September 2021
Signature:	Dr John W. Sanderson 2020.10.01 12:30:48 +01'00' (Safety Committee chair)	Signature:	(Head of Department)	
Date:	01 October 2020	Date:	01 October 2020	
Assessment read and understood by				
All signatories to the Chemistry Department safety policy.				

1. A risk assessment for general work in the department (Ref: CGRA2020) is presented on the previous page. Note that:

(a) by signing the policy, you accept that you have read and understood this risk assessment, and agree to implement the required controls;

(b) separate risk assessments will be required for work extending beyond the scope of the general assessment;

(c) this assessment does not contain all the Covid-19 measures. The Covid-19 risk assessment is in **Appendix I**.

2. All new projects (form PR1) must be endorsed by the Chair of the Safety Committee, Chair of the Board of Studies, or in their absence, a member of the Safety Committee with the relevant expertise and experience to approve the project. Forms awaiting endorsement should be emailed in PDF format to chem.safety@durham.ac.uk.

3. A risk assessment **must** be made for all work and work-related activity conducted in the Department. These assessments may involve one or more of the following:

(a) The general risk assessment for work in Chemistry (**Section C, Part 1**).
(b) The Covid-19 risk assessment (**Appendix I**).
(c) A project risk assessment for laboratory work (form CRA1), including COSHH (form CRA2) if appropriate, for repeated work activities.
(d) A risk assessment associated with a code of practice or a standard operating procedure (SOP) for a process or activity.
(e) Individual assessments in laboratory or electronic notebooks for one-off experiments.

Covid-19. Consideration should be given to the following when planning experiments:

(f) Social distancing measures may be required at short notice. Experiments that present a high risk should an experimentalist be unable to return will require contingency planning. The DSC and/or the safety committee chair should be consulted in such circumstances.

(g) The Chemical Hazard Response Team may not be available.

4. Anyone authorising a risk assessment must have the necessary skills, experience, training and knowledge to manage health and safety and critically assess the work described in the assessment. Those conducting the task(s) in the assessment must have the skills required to complete the task(s) safely. The competencies for each role should be included in the risk assessment (see Section C, Part 4(a)). More information is available from the UHSS (**UHSS Topic A-Z/Training and Competency).**

Competencies for authorising risk assessments in the Chemistry Department are outlined below:

Risk Assessment	**Those competent to authorise**

General assessment for work in the Chemistry Department (Section C)	Head of Department
Risk assessments for research activities (experiments, processes, codes of practice)	Research supervisors with relevant expertise and experience
Risk assessments for Special Codes of Practice	Nominated representative indicated in Section L of this document
Risk assessments for undergraduate laboratory classes	Academic members of the safety committee with relevant expertise and experience, academic laboratory leaders
Risk assessments for technical services and workshops	Technical service managers

Anyone who does not have the skills to complete a task safely should seek an alternative approach or ensure that the training required for the task is undertaken.

(a) Competency Levels.

(i) Level 1: Can train others and work without direct supervision. The individual has sufficient training, experience and technical knowledge to train others to conduct particular techniques, processes and use of equipment effectively and safely. This includes identification of hazards, assessment of risk, and identification of appropriate control and emergency measures. **All risk assessments must be authorised by someone with Competency Level 1**.

(ii) Level 2: Can work without direct supervision. Has had sufficient training or experience to demonstrate a level of technical competence, including the identification of hazards, assessment of risk, and identification of appropriate control measures.

(iii) Level 3: Can work supervised. An individual has basic knowledge of technical aspects of the task but needs supervision and hands-on training from someone with Competency Level 2 or better to reinforce the key aspects and ensure safe operation. Most undergraduates are in this category.

(iv) Level 4: Can observe and participate. Requires close supervision from someone with at least Competency Level 2. Summer students of school age are typically in this category.

The competency level is task-dependent. For all tasks it is expected that the supervisors will be of competency Level 1. Most postdoctoral researchers and postgraduate students will be at Level 2 for the work they undertake, undergraduates will be at Level 3 and school-age summer students will be at Level 4. Risk assessments should assess the competency of those undertaking and supervising the work. If a risk assessment identifies that an individual does not possess the correct attributes to conduct work safely, either the task should be amended or suitable training and observation undertaken.

(b) Assessment of competency: competency can be assessed using a number of criteria. Some of these include the level of experience and qualifications of an individual, and their employment status. Note that:

(i) a record of attendance at a training session for a particular task, or the successful completion of a course of study related to the task, is not guaranteed to provide evidence of competency for that task;
(ii) skills decay over time, so an individual may no longer be sufficiently competent to carry out a task for which they once had the requisite level of competency. In this instance, competency should be reassessed and retraining undertaken if required.

The following are useful means of competency assessment in the Chemistry Department:

(iii) Observation. Undertaken continuously as part of day to day work by a supervisor (usually with Competency Level 1) and includes:
- direct evidence, such as the checking of risk assessments or direct observation;
- indirect evidence, such as the assessment of the performance track record of an individual; and
- third party evidence, such as verbal feedback from colleagues.

In some cases competency may be assessed against performance standards. Observation also forms the basis for assessing competency during emergency measures (*e.g.* fire drills).

(iv) Set tasks or tests. Can be useful as part of an interview process, or as part of undergraduate training (*e.g.* conducting a risk assessment). In some instances it may be desirable to retest individuals with key roles at regular intervals.

(v) Oral questioning. Useful as part of an interview process (*e.g.* to establish whether an applicant is competent to work safely on a particular task).

(vi) Qualifications and Role. Although not direct evidence of competency, a minimum level of academic achievement and job seniority is usually required for each competency level. For example, risk assessments for research would normally be authorised by academic staff with training to at least PhD level.

Evidence needs to be relevant, authentic, up to date or recent, and sufficient to make an appropriate judgment.

5. An assessment of the hazards associated with work in the Chemistry Department is in **Appendix C**. Please note that:

(a) **Appendix C** is an assessment of hazards, not risks. The ***risk level*** for any particular work will depend on the details of the project (*e.g.* scale), other activity in the location where the work is to be carried out (*e.g.* who else

will be affected), and other details specific to the location (*e.g.* room size, services available).

(b) The hazard assessment in **Appendix C** and the risk assessments in Section C (Ref: CGRA2020) and **Appendix I** form the basis for the rest of this policy.

SECTION D: GENERAL SAFETY ARRANGEMENTS

1. The **Safety Matters board** is located on the First Floor landing just past CG121. Staff will be informed by e-mail and through the Safety Website about amendments to the University Health & Safety Policy and the issue of new University Health & Safety notes.

2. Reporting Concerns

The Department operates a policy towards whistleblowing that is in accordance with The Public Interest Disclosure Act 1998. This protects the rights of workers against detriment or dismissal after raising concerns on dangerous activities with the enforcing authority (HSE), and encourages the resolution of problems within the workplace before they are raised externally.

(a) You are strongly encouraged to report any matters that endanger the safety of any individual. You should report your concerns to one of the following, listed in order of preference:

(i) your line manager or supervisor;

(ii) a member of the Safety Committee (Appendix A), either in person, or by email to chem.safety@durham.ac.uk;

(iii) the Chair of the Board of Studies (chemistry.hod@durham.ac.uk);

(iv) the University Health and Safety Service (health.safety@durham.ac.uk).

If for any reason you cannot disclose your concern to one of these, *e.g.* because it implicates them, or if you are not satisfied with the response to your concerns once raised, you should use the next contact in the order of preference.

(b) **Anonymous reporting**. Concerns expressed anonymously may be harder to verify, but will be considered at the discretion of the UHSS, particularly if they are of a serious nature. An online form for anonymous reporting of safety concerns to the UHSS is available on the Chemistry Safety website. Information entered into this form is sent by anonymous email. No information about the sender is included in any part of the message, including the header. The form can be accessed at:

http://community.dur.ac.uk/chem.safety/local/anon_reporting.html.

(c) **False reporting**. Any reporting that is intentionally false or malicious may result in disciplinary action being taken.

(d) **Response to a concern**. The action taken after a concern has been received will depend on the nature of the concern. Anything that is an immediate threat to life, or is assessed as having a high probability of leading to injury, will be classed as ‘serious’. Serious matters, once verified, will be taken up with the personnel involved and their line manager, if appropriate. Remedial action will then be agreed. Less serious matters, such as minor infringements of the safety policy or minor infrastructure problems, will usually be dealt with by a direct approach to the relevant personnel, and/or the issue of an alert to all personnel.

3. General Protective Measures

(a) **Users of display-screen equipment (DSE)**, including laptop and office-based workstations, must assess whether it satisfies the legislation concerning eyestrain and posture. A written assessment of each station must be made at the start of a project or when circumstances change. An external keyboard and mouse must be used with a laptop computer. DSE training and the form for making DSE assessments is available on DUO under **My Organisations & Online Training** ("Health and Safety All Staff Training"). See also the UHSS website (**UHSS/Topic A-Z/DSE**).

If you experience visual discomfort when using DSE make an appointment with Occupational Health (occupational.health@durham.ac.uk, ☏42662).

(b) **The moving of a load by hand** must comply with regulations governing manual operations. The need to move loads by hand should be minimised, mechanical aids must be used fully and a load that is very bulky or heavy must be assessed in writing before it is lifted or moved. See **Appendix D**.

(c) **Slips, trips and falls** are common causes of workplace injuries. The Department has management systems in place to eliminate or minimise the risks from these. These risks must also be considered during planning, construction and refurbishment or any changes of use within buildings.

The reduction of injuries from slips, trips and falls can only be achieved when managers, staff and students are committed to taking personal responsibility. In order to achieve this the Department will:

- provide a safe working environment for users of Chemistry facilities that is free from slip and trip hazards, as far as reasonably practicable;
- adequately control or reduce the risk of slips and trips, by a combination of a safe environment and safe behavior;
- ensure that appropriate risk assessments and risk reduction methods are in place;
- encourage all staff and students to take personal action to reduce the risk of slips and trips as far as possible;
- ensure that there is an effective response to changing conditions such as weather and the environment, *e.g.* during refurbishment.

All staff and students should ensure that if a slip or trip risk is identified it is reported to a suitable manager, or Estates and Buildings (*via* Mr Paul Hofmann) for the matter to be addressed.

(d) It is a legal requirement that everyone is protected from the effects of hazardous materials (the legislation comes under the title *Control of Substances Hazardous to Health 2002* - COSHH for short). Users must also consider the hazards associated with substances which could cause harm by *fire, explosion and similar energetic events*, as required by the Dangerous Substances and Explosive Atmospheres Regulations 2002, DSEAR. The approach is comparable to that used in the COSHH Regulations for managing substances with the potential to cause harm to health (**UHSS/Topic A-Z/COSHH**).

The COSHH and DSEAR Liaison Officer for the Chemistry Department is Dr John Sanderson who, as Chair of the Safety Committee, is responsible for monitoring workers' compliance with all aspects of the Chemistry Department Health & Safety Policy. If you are to use any chemical in your work, you have to inform yourself about its toxicity and the safety precautions to be taken when acquiring, storing, using and disposing of it. THIS INFORMATION MUST BE RECORDED AND PRESERVED IN DEPARTMENTAL RECORDS (see also **Code of Practice A**, **Part 2**). A strict procedure is laid down for compliance with this section of COSHH regulations and is as follows.

(i) Order requests for chemicals are submitted through the LabSafe system. When ordering a chemical from a supplier, a material safety data sheet (SDS) MUST be obtained from the supplier **before** the order is placed. Note that the "Global Harmonised System (GHS) of Classification and Labelling of Chemicals" is currently being used in place of the old CHIP (R/S) system, which ceased to be legal from 1 June 2015. The hazard and precautionary statements in the SDS are included with the order information and will be associated with the material in the LabSafe database until its disposal. It is the responsibility of person placing the order to read the SDS and check that the details in the order are correct.

(ii) Your Research Supervisor checks the details of the request, including the hazard and precautionary statements and processing information, before approving the order.

(iii) Upon delivery of the chemical, staff in the Central Store will add a bar code or QR code to the container and you will be informed through LabSafe that it is available for collection.

(iv) If you are have acquired a chemical that has been:
   (1) purchased from new;
   (2) acquired from another research group in the Department (chemicals covered by an end-user agreement are not transferable);
   (3) supplied by another research group outside the Department;

   you **must** ensure that the container has an appropriate label and transfer the chemical to your laboratory on the LabSafe database.

(v) All compounds and materials must be kept in APPROPRIATELY LABELLED containers that are stored in an appropriate manner.

(vi) Every chemical that you intend to use must be subject to a risk assessment beforehand, either as part of the project risk assessment, or as part of a specific code of practice, or as part of a one-off experiment recorded in your laboratory notebook (see **Code of Practice A**, **Part 2**).

(vii) Each year the Department must declare chemicals used, manufactured or held in the Department which have a potential use in chemical weapons (**UHSS Topic A-Z/Chemical Weapons and Drug Precursors**).

   Lists of scheduled chemicals can be found by following the links at:
   https://www.opcw.org/chemical-weapons-convention/annexes/annex-on-chemicals/

   Research group leaders will be asked regularly by the Departmental Manager to verify their usage. Schedule 1 chemicals require a special license and should not be used in the Department.

(viii) There are limits on the amount of Category 2 drug precursors held by the Department during a given period. (**UHSS Topic A-Z/Chemical Weapons and Drug Precursors**). Category 2 drug precursors should be flagged automatically during the LabSafe ordering process, but please check that this has occurred correctly before submitting the order. The Departmental Safety Coordinator is responsible for ensuring the correct paperwork is in place if limits are exceeded.
Any work involving Category 1 drug precursors requires a Home Office license. Any persons requiring such a license should contact the Departmental Safety Coordinator to discuss this.

(ix) Where end-user certificates are required these should be signed by the principal investigator/group leader and copies retained by Stores.

(e) It is a Departmental rule that all persons in laboratories, whether or not they are actually doing practical work, MUST wear safety spectacles in designated areas, and, when judged necessary, safety visors. Supervisors should ensure that all visitors, including undergraduate students, to their laboratories comply with this rule.

Persons are encouraged not to wear contact lenses when working in a laboratory. Spectacles covered with plastic eye shields or prescription safety spectacles can be used instead.

Anthony Baxter (CG010A) arranges for the provision of prescription safety spectacles for staff and students (undergraduates at their own expense).

(f) All persons whose work takes them into laboratories where chemicals are stored or handled must wear laboratory coats. They are available from the Central Store. Laboratory coats should be stored in the laboratory in close proximity to the door. They should never be stored on the back of a chair or other piece of furnishing in the immediate vicinity of an area where experimental work is conducted.

(g) Safety shoes are provided (at their supervisor's expense) for all postgraduates and members of staff whose work could involve handling heavy objects, including cylinders and liquid nitrogen Dewars. All persons whose duties might lie in the Department's laboratories and workshops must ensure that their footwear incorporates flat heels, slip-resistant soles and uppers fully enclosing the foot.

(h) Hands at risk from exposure to chemicals or mechanical injury alone (bruising or laceration from work with heavy or rough-surfaced objects or where hot or cold objects are used) must be protected by gloves. Guidance on the protection of hands is in **Code of Practice A, Part 3c**.

(i) Smoking, or the use of e-cigarettes, is not allowed in Chemistry accommodation or adjacent public-circulation areas.

(j) In workshops and in all laboratories, hair should be secured so that it does not hang below the neck.

(k) The following rules apply to the abatement of noise.

(i) Radios and players of prerecorded sound may not be used in corridors and circulation areas if they speak through headphones.
(ii) Radios, and players of prerecorded sound that have open speakers, may not be used in a public area.
(iii) Audio equipment as defined above may be used in rooms not mentioned in (ii), but not to produce sound audible in adjacent rooms or public areas. As a matter of courtesy, such equipment must be switched off at the request of any occupant who objects to the noise.

Information on protecting employees from noise whilst engaged in University-related activities can be found at **UHSS Topic A-Z/Noise**.

(l) Mobile phones, or other portable electronic devices for personal use, should not be taken into a teaching or research laboratory under any circumstances, switched on or off. There is a risk of contamination and of damage to both the phone and electronic equipment within the laboratory.

Covid-19. Whilst covid-19 measures are in place, mobile phones may be used in laboratories for contact tracing and other welfare measures, such as lone worker check-ins. Phones must remain in pockets when not in use and must be cleaned with an appropriate wipe on leaving the laboratory.

(m) Mobile phones, or other portable electronic devices for personal use, should not be used in general circulation areas. It is important that users of general circulation areas are fully aware of activities in their vicinity.

(n) No person of age ≤ 5 is allowed in Chemistry accommodation or adjacent circulation areas unless closely supervised by an adult and kept in close proximity to that adult at all times. Older children up to the minimum school leaving age must be accompanied by an adult responsible for their behaviour. For children attending organised activities (*e.g.* for work experience or outreach), the Department will ensure that suitable risk assessments are in place and adequate supervision is provided in line with published guidance (**UHSS Topic A-Z/Children and Young Persons**).

(o) The University Radiation Protection Committee has banned the use of laser pointers with an output of > 1 mW. Users should consult the Departmental laser and non-ionising radiation officer, before use, if they have any doubts about the safety of a laser pointer. More information is at **UHSS/Radiation/Non-Ionising Radiation/Guidance/Laser Pointers**.

4. **The Mechanical Workshop** is in the charge of Mr Neil Holmes, who supervises the usage of its equipment by other authorised users and ensures that all moving machinery is guarded.

5. **Liaison with Contractors and Service Staff**

Mr Paul Hofmann liaises with service staff and outside contractors. He informs them of Departmental Health & Safety policy and makes them aware of any hazards or potential hazards in areas where they are working (in consultation with the appropriate research supervisor(s)). Laboratory workers should make the area safe for work and also ensure that any visitor or contractor working in their area is aware of the hazards present and is working safely (including wearing safety glasses at all times and lab coats as appropriate).

6. Reports of Infrastructure and Building Hazards

Reports should be made using the form on SharePoint (http://chem-sp.dur.ac.uk/sites/chemistry), for action by Estates and Facilities.

7. Training/Supervision

A departmental safety induction, 'Risk Management in Chemistry', is given twice annually by the Departmental Safety Coordinator, with support from other members of the Safety Committee. An online version of the training for short term workers, such as visitors, is available on DUO. The induction covers basic health and safety, including: hazards *vs* risk; making risk assessments; waste disposal; PPE; good laboratory practice; fire safety; and emergency measures. **Health and Safety Management Standard 3** gives further information on training and competency (**UHSS/Topic A-Z/Training and Competency**).

(a) Undergraduate students with ≤ 3 years study who have not completed a safety induction must be accompanied at all times in the laboratory by a postdoctoral researcher or member of academic staff.

(b) Undergraduate students undertaking 4th year research projects (MChem or MSci) who have completed a departmental safety induction may work independently, provided that other researchers are in close proximity (in addition to the lone working regulations). Outside undergraduate terms, written conformation that appropriate supervision is available, along with details of the student and the dates of work, must be sent beforehand to the Departmental Safety Coordinator and the Director of Teaching.

(c) The training of undergraduates in good experimental technique and safe systems of work is provided by academic staff during laboratory classes. Undergraduates starting 4th year research projects attend a departmental safety induction. Training in the use of fire extinguishers is optional ('opt in'). Additional project-specific training is provided by project supervisors.

(d) All other personnel using Chemistry facilities are required to attend a departmental safety induction, and are required to receive the specialist safety training identified in the 'training requirements' section of the new starter (PR1) forms. Academic supervisors take responsibility for day-to-day training in safe working practices.

(e) In advance of a planned absence from Durham of **two or more** working days, research supervisors **must** nominate another member of academic staff to provide research group supervision ('cover'). An email outlining the cover arrangements must be sent to the replacement supervisor, group members **and** ch-k@durham.ac.uk. Staff members providing cover must be competent to authorise any new risk assessments required during the period for which cover is provided (see **Section C, Part 4**).

8. Asbestos

The use of asbestos is strictly forbidden in the Department of Chemistry.

9. Legionella

Legionella is a naturally occurring bacterium found in water systems that can produce potentially fatal pneumonia like illnesses such as Legionnaires' disease if it is inhaled into the lungs. This can happen when it finds its way into droplets of water that become airborne, for example where water sprays from an outlet. This can be produced in certain hot and cold water supplies and also some types of air conditioning systems.

The Director of Estates and Facilities is the Nominated Manager for the control of Legionella and ensures that formal arrangements for oversight and monitoring are in place. However, some of the responsibilities and actions rest with the Heads of Departments, Colleges and Services (or equivalent).

There is a reasonably foreseeable legionella risk in your water system if:

- water is stored or re-circulated as part of the system;
- the water temperature in all or part of the system is between 20–45 °C;
- there are sources of nutrients, *e.g.* rust, sludge, scale, organic matter;
- it is possible for water droplets to be produced and, if so, if they can be dispersed over a wide area, *e.g.* showers and spray taps; and
- personnel are more susceptible to infection and could be exposed to contaminated water droplets.

Systems that may not be the direct remit of Estates and Facilities include:

- some showers including safety showers;
- eyewash stations/fountains;
- some aspects of hot and cold water distribution systems;
- saline/brine/experimental tanks; and
- little-used outlets (for example remote taps) as these are not always known or accessible to Estates and Facilities.

For other systems, you should consult with Paul Hofmann and Estates and Facilities to see where the responsibility lies.

10. Occupational Health

Occupational Health is a 3-way partnership between an individual, their line manager and the occupational health professional and is about ensuring that the individual is fit for the job and the job is fit for the individual. You should contact occupational health if you feel that any aspect of your work is contributing to a medical condition, or a risk or COSHH assessment has indicated that health monitoring may be required (see *e.g.* **COP-A, Part 2(c)**). Occupational health can be contacted at occupational.health@durham.ac.uk, ☏42662. Further information is available on the occupational health website:

https://www.dur.ac.uk/hr/occupationalhealth/

11. Information Storage

DUO (‘Chemistry Safety’ module) is used for storing shared training material such as SOPS and induction material. The ChemSafetyRecords SRS is used for the storage of records (*e.g. ad hoc* operating procedures and codes of practice, training records, laboratory self-inspections). All other document templates are available through the Chemistry Safety website.

SECTION E: OUT OF HOURS WORKING

1. Out of Hours Working

(a) **Undergraduate students** are not allowed in research facilities (*e.g.* laboratories, analytical services) outside the period 08.45 to 18.30 on Monday to Friday unless they are accompanied by a member of academic staff who has agreed to act as their supervisor.

(b) **Research workers** must not undertake experimental procedures outside normal working hours (07:00 to 19:00, Monday to Friday) unless their supervisor or the Chair of the Board of Studies authorises the work. If work outside normal working hours is permitted and undertaken, another research worker ('buddy') **must** be nominated to be within earshot and aware of the experimental work. The name of the nominated person must be indicated in the out of hours record book at the Security Office (see paragraph (c) below). Hazardous work **must** be avoided.

Further information can be found on Health and Safety Services web site, **Health and Safety Guidance 13** (**UHSS/Topic A-Z/Lone Working**).

Postgraduate students should normally leave the science site by 22.00. Any work between 22.00 and 07.00 needs specific permission from the supervisor and the Chair of the Board of Studies, as well as a separate risk assessment.

Covid-19. Researchers should be extra vigilant concerning the potential for lone working. Should lone working be unavoidable, the Covid-19 MS Teams App should be used to manage this scenario. If this App cannot be used, consult the Safety Chair (Dr John Sanderson) for alternative measures. For more information, consult in **Appendix I**.

(c) Postgraduate students and staff members must use the entrance next to the Security Office (red atrium) and record their presence in the Departmental out of hours book (located in the Security Office) if:
(i) arrival is before 07:00 on a normal working day (Monday to Friday);
(ii) arrival is after 19:00 on a normal working day;
(iii) it is a weekend or other statutory day when the Department is closed.

A person who is already in the Department at 19.00 on a normal working day and plans to stay in the Department beyond that time, must telephone the Security Office (ext 42222) to report their whereabouts and to name any undergraduate students being supervised.

(d) **Covid-19**. Out of hours working should not be undertaken without approval from the Safety Committee.

2. Apparatus Working Overnight

(a) **Apparatus working overnight**. Yellow forms, available in CG018, must be completed to give information about the services used, the nature of the experiment, emergency procedure and an emergency contact. The yellow card is left in the card holder on the laboratory door and the fume cupboard light housing the experiment must be left on. Authorisation by a member of academic staff is required.

In addition, a green form, available in CG018, must be completed to give information about the services that are being used **that would present a safety risk in the event of their failure.** The card must include the name of the research supervisor to contact in the event of a service failure (no other contact details are necessary). The green card is left in a separate card holder on the laboratory door. More information is on the Chemistry Safety website under **Key Topics/Out of Hours Working**.

Covid-19. Overnight experiments should be avoided unless absolutely necessary whilst covid-19 measures are in place. Should apparatus need to run overnight, the following protocol should be followed:

(i) Follow the usual rules (set up must be stable for at least half an hour before you leave, temp. regulation on hotplates, condenser tubing secured and flow at minimum needed *etc*).

(ii) Complete the yellow form as normal, in pencil if possible. Photograph both sides, then wipe/disinfect the form and place it in the door holder.

(iii) Photograph the experimental set up.

(iv) Send all photos (both sides of yellow form, plus set up) to the supervisor (or person who is providing research cover).

(v) If the authoriser is satisfied that the set up is safe, an email should be sent stating this to chem.safety@durham.ac.uk, including the photographs (set up + yellow forms) as attachments. If the authoriser is not satisfied, steps (i) to (iv) should be repeated.

(b) **Permanently running electrical equipment.** Permanent running cards should be displayed on laboratory doors. The Security Office has a list of staff responsible for each room and their contact details. A shut down procedure for each item mentioned on the card should be displayed in a prominent position so that anyone should be able to shut down the instrument safely.

SECTION F: ELECTRICAL SAFETY

1. Electrical Safety

Electrical safety is managed in the Department by working to the policies set out on the Health and Safety Service web page (**UHSS/Topic A-Z/Portable Electric Equipment**), and Departmental codes of practice.

(a) Live Electrical Working is only allowed to be undertaken by competent persons who have received training in Live Electrical Work and who agree to follow the Safety Policy guidance (**Special Code of Practice G**, Dr Bryan Denton). A copy of this is kept in the Electronics Workshop and is available on the Chemistry Safety website (under Policy/Special Codes of Practice).

(b) Each **user** is responsible for assessing equipment before using it, and **must not** use equipment with cable, plug or mechanics looking unsound or with a test-expiry date that predates the date of use. Equipment not fit for use must be taken immediately to the electrical/electronic workshop MC009 for repair. Users must comply with any requests made by workshop staff concerning their equipment.

(c) High risk items, including block adapter plugs, plug in air fresheners and fan heaters, must not be used in offices. Toasters and other cooking items may only be used in designated food preparation areas.

(d) Extension leads must not be daisy chained or overloaded.

(e) Dr Bryan Denton schedules regular testing of all electrical equipment (some 5000+ items). A test comprises: a check of insulation; earth continuity and mechanical soundness. The user is responsible for ensuring all electrical equipment is available in a clean state for the agreed period of testing.

The testing of computers connected to equipment in laboratories is carried out by under external contract. New computers for offices are inspected by CIS on purchase.

Visitors and Undergraduates must ensure that any chargers used for portable devices are inspected before use in the Department.

2. PAT procedure for Designated Person

For Portable Appliance Test (PAT) purposes, each laboratory supervisor nominates a ‘designated person’ whose job is to help testing to proceed efficiently and safely. The following procedure is required to ensure compliance.

(a) In line with the Chemistry Department Health and Safety Policy, it is an accepted rule that all persons have a responsibility to ensure that their work does not create a risk for any other person working nearby. It is therefore required that during Portable Appliance Testing (PAT) **all work should be suspended**, and that all electrical equipment (including all equipment in cupboards), should be **made safe**.

This means that it should be **switched off** and **disconnected** from the mains supply, any **chemical** or other **contamination** should be **removed, and** the equipment should be placed in a position in the lab where the test person can **easily** and **fully** examine it and carry out the required test procedures to assess the safety of that item. Any equipment that is in use or cannot be switched off shall be labelled to show that it was not available for test on the due date, and it will be the **responsibility of the user** to ensure that it is tested as soon as possible afterwards. It is accepted that some equipment cannot be switched off, and the owner should notify the electronics workshop (MC009, ext. 42015) when it is switched off for maintenance, or other reason and testing can be carried out on request at this time. Equipment that is not used or is in storage will be **labelled** as **Out Of Commission and disabled** until such time as it is required for use, when it MUST be tested **before use**.

(b) **Important note**:

If during testing the designated person or substitute is not present, then the work will immediately stop for safety reasons.

Rescheduling of testing of the remainder of the equipment will depend on workload, and may result in equipment being switched off in the interim due to expiry of test date.

*Please make the test person aware of any equipment which you know to be unsafe or not working correctly, and as he is not a chemist please make him aware of any specific hazards in the lab.

3. **The Electrical/Electronics Workshop** is in the charge of Dr Bryan Denton, who supervises the usage of its equipment by other authorised users.

4. **Covid-19**. Anyone needing the services of the electrical workshop are advised to contact Dr Denton in the first instance.

SECTION G: WORK IN CONFINED SPACES

1. Definition of a Confined Space

Under the Confined Spaces Regulations (1997), a confined space is defined as "any place… which, by virtue of its enclosed nature, there arises a reasonably foreseeable specified risk". For work in the Chemistry department, the predominant risk is loss of consciousness or asphyxiation arising from gases, fumes, vapours, or lack of oxygen in wholly or mostly enclosed spaces.

Atmospheres containing < 18% oxygen are potentially dangerous. The risk of unconsciousness followed by brain damage or death due to asphyxia is greatly increased at oxygen concentrations below 10%. Concentrations of CO_2 of 10% will lead to loss of consciousness in a few minutes. Concentrations of CO_2 of 20% and above are an immediate risk to life even when oxygen levels are normal.

Key factors to consider are the potential volumes of gas or vapour that could be released and the likely rate of release. For example, most cryogenic liquids have an expansion ratio close to 1:700, *i.e.* 1 litre of liquid will produce approximately 700 litres of gas. During transfer from a non-pressurised Dewar, 10% of a cryogenic liquid will typically be lost as gas. For compressed gases, guidelines on how to calculate the effects on oxygen content for various scenarios are published by the British Compressed Gas Association (note GN11, 2002, http://www.bcga.co.uk/pages/index.cfm?page_id=73).

In most laboratories in the Chemistry department, fume cupboards and make-up air prevent the accumulation of toxic fumes or vapours. Such ventilated spaces are not confined. Two scenarios that can produce confined spaces are:

(a) a small room or space without significant ventilation in which chemicals, cryogens, or laboratory gases are used and operations are conducted with the door and windows closed (even if this not essential), *e.g.* some of the small rooms that open onto the corridors in the main building;

(b) a space or room without ventilation that requires the door to be closed during normal operation, *e.g.* controlled temperature rooms and lifts.

2. Protocols for Work in Confined Spaces

(a) Before beginning work in a confined space, consideration should be given to alternative modes of operation that eliminate or reduce the risks. Note that in the instance described in 1(a) above, the simplest solution is to work with the door or a window open, so that the room is no longer classed as confined.

(b) Work in a confined space with hazardous or toxic chemicals that are released into the atmosphere requires respiratory protection. The Chemistry department has no provision for work of this nature. This work is **therefore not permitted in a confined space in the department**.

(c) In a confined space, work that produces small amounts of volatile substances may be conducted safely using a recirculating or ductless fume hood fitted with a suitable filter. It is essential that the filter material is

appropriate to absorb or filter for the substances produced, and has ample capacity for the quantities of substance produced. Filters must be inspected and changed regularly. **Work must not be undertaken if a filter is out of date or unsuitable in any other way**.

(d) In instances where the use of gases, cryogens or chemicals in a confined space is unavoidable, a code of practice should be written by the staff member(s) responsible for the space in consultation with the Departmental Safety Coordinator and must describe the procedures and protocols to be followed for safe working. This should include an assessment of the potential volumes of gas released and consequently the potential for a dangerous atmosphere to result. The use of oxygen monitors should be considered, if appropriate. The code of practice should be placed on the entry point to the space so that it is seen by all persons who enter the space and anyone who might be called to the room during an emergency procedure.

3. Emergency Measures

(a) Anyone discovering a person who is unconscious in a confined space **must not enter the room**. The emergency services should be called immediately, before seeking assistance from the Chemical Hazard Response Team (breathing apparatus) (**Section B**).

SECTION H: MANUAL HANDLING

Manual handling refers to an activity that requires manual effort to be applied to a load being pushed, pulled, picked up, lowered down, carried, supported or otherwise moved. Activities involving equipment used to reduce the effort are included, *e.g.* the use of trolleys, barrows and levers. A number of loads that are moved within the Department may require assessment under the manual handling regulations, depending on how they are manipulated *e.g.* Dewars of cryogenic liquids, gas cylinders, centrifuge rotors and drums of silica. Additional information is in **Appendix D** and online at **UHSS Topic A-Z/Manual Handling**.

1. Responsibilities

(a) **All Employees**: follow the method agreed for the particular task and observe the rules.

(b) **Supervisors**: consider handling implications before ordering new equipment and taking delivery. Monitor tasks to ensure that approved methods are followed and that relevant rules are obeyed.

(c) **Chair of the Board of Studies in Chemistry**: appoint persons to be assessors for significant manual handling operations. Ensure that formal assessments are carried out and reviewed on a regular basis.

(d) **Handling Assessors**: carry out assessments in accordance with the training provided by the University Health and Safety Service.

(e) **Assessment Officers**: organise awareness sessions. Keep a record of formal assessments and make them available to all interested parties.

2. Rules For Persons Involved In Manual Handling

(a) Examine the load to be moved for hazards and study how best to tackle the problem. This will mean giving consideration to the height, shape, and position of the load.

(b) Follow the appropriate safe system of work in which you have been trained for the handling of loads and use kinetic handling techniques where appropriate to avoid injury.

(c) Before moving a load, ensure that it does not obstruct your view.

(d) Inform your immediate supervisor/line manager of any personal condition that may require review of your manual handling activities, *e.g.* medical condition, pregnancy.

(e) Consider whether there will be any obstacles in your path, any slipping, tripping or falling hazards, any stairways to be negotiated.

(f) If there is any doubt as to the correct manual handling arrangement, seek advice from your immediate supervisor or line manager.

SECTION I: WASTE DISPOSAL

1. Waste Disposal

The Department has strict procedures for the disposal of liquid waste, solid waste, waste gases, unwanted chemicals and waste equipment. The arrangements are designed to comply with the University's Health & Safety policy, and the practices described are binding on all workers in the Department.

Some substances, termed 'Red List Substances', must never be disposed of down the drain. These are listed in **Appendix G**.

(a) A flow chart should be located prominently in each laboratory.

(b) When staff and/or research workers leave the Department it is their responsibility to clear away or destroy unwanted chemicals.

2. LIQUID WASTE

The Department's non-radioactive liquid waste is handled in four categories:

(A) aqueous liquids;

(B) non-aqueous liquids that are miscible with water;

(C) non-aqueous liquids immiscible with water that give non-poisonous gases when burned;

(D) non-aqueous liquids immiscible with water that give poisonous gases when burned.

(Dr Gary Sharples oversees the disposal of all radioactive liquid waste.)

The following procedures should be used by all persons in the Department needing to dispose of liquid waste.

(A) Aqueous liquids. Each person producing aqueous waste must render it harmless and close to pH neutral before disposing down a laboratory sink.

(i) If the solute is known to be harmful it should be either:
  (a) treated chemically by a standard method (*e.g.* cyanide with 15% aqueous hypochlorite) to render the solute relatively harmless. Any precipitate separated and dealt with as 'Lab Smalls' solid waste. Remaining solute to be returned to the waste store in a suitable container - to be bulked with aqueous toxic / heavy metals waste;
  (b) or, if valuable (*e.g.* precious metals), concentrated, labelled and retained for specialist precious metals recovery.

(ii) If the solute is unknown it should be returned to the waste store in a labelled 2.5 litre Winchester bottle only. Labels are available from stores.

If in doubt, the Waste Disposal Coordinator, Dr John Sanderson (CG112), should be consulted.

(B) Non-aqueous liquids miscible with water. Such liquids (*e.g.* ethanoic acid, propanone, ethanol) should be diluted at least tenfold with water and poured down a laboratory fumehood sink, if the nature of the solute allows. Liquids hydrolysed by water should be treated similarly. 'B' Waste considered toxic or harmful to the environment should be reclassified as either 'C' or 'D' waste, depending on whether it contains halogens or sulfur, and it should then be labelled and treated as this type of liquid waste. Large volumes of waste (> 100 ml), *e.g.* from high performance chromatography systems, should be taken to the solvent waste store in a Winchester labelled as 'C' or 'D' waste (plus lab number and group initials).

(C) Non-aqueous liquids immiscible with water that give non-poisonous gases when burned. All of the common water-immiscible organic solvents containing only the elements carbon, hydrogen, nitrogen, and oxygen are in this category. Liquid waste of this type is retained for incineration. The temporary storage of the waste is supervised by the Safety and Research Technician and Mr Douglas Carswell in the waste store.

Each laboratory should provide a 'C' labelled glass Winchester for this category of waste. This waste bottle should be stored within a fume hood, within a spill tray or leakproof solvent carrier wherever possible. Red colour-coded 'C' waste labels are available from stores. **They must be adhered to the Winchester bottle and filled-in with lab number and group initials.**

Everyone who adds waste to a Winchester should take all reasonable steps to ensure that the solute in the waste is of very low chemical reactivity or of low concentration: waste that might fail to meet those specifications must be notified to the member of academic staff associated most closely with the work that produced the waste. For researchers producing significant volumes of waste, personal waste Winchesters are recommended.

It is recommended that a large plastic funnel be used in the neck of the bottle in place of a stopper, and left there until the bottle is ready for transfer to the waste store. The use of such a funnel provides an escape route for potential build-up of gases in the event of unanticipated chemical incompatibilities. Winchesters should not be stoppered until they are ¾ full, whereupon they should be stoppered and brought to the waste store in a Winchester carrier.

Waste Winchesters should be brought to the waste solvent store at either 09:30 – 09:45 or 14:15 – 14:30 when someone will be available to receive it. The waste bottle should be labelled with its category, and your group name or laboratory number. Under no circumstances should waste of any description be left unattended at the waste store. The Safety and Research Technician and Mr Douglas Carswell arrange the temporary storage of bottles pending their transportation by a waste-disposal organisation to a special site for incineration.

Note that any aqueous acids/alkalis MUST be separated from 'C' waste prior to disposal *via* this route. If necessary, use a separating funnel to separate off the aqueous phase and dispose of it separately according to route A above.

(D) Non-aqueous liquids immiscible with water that give poisonous gases when burned. All of the common water-immiscible organic solvents containing halogens or sulfur are in this category. They are accumulated separately, as they must be incinerated separately, but otherwise they should be handled as described for category-C waste in a 'D' labelled glass Winchester. White colour-coded 'D' waste labels are available from stores. **They must be adhered to the Winchester bottle and filled-in with lab number and group initials.** Again, bottles should be stored within a fume hood, within a spill tray or leakproof solvent carrier wherever possible, and should only be stoppered when ¾ full and ready for transfer to the waste store.

Any aqueous acids/alkalis MUST be separated from 'D' waste prior to disposal *via* this route. If necessary, use a separating funnel to separate off the aqueous phase and dispose of separately according to route A above.

Other types of liquid waste: The service operated by Dr Connor Sibbald and Mr Douglas Carswell is restricted to disposal of chemical waste where the procedure for disposal has been established as safe. When a research programme produces waste requiring a disposal procedure where the risk is large or unknown, the member of academic staff supervising the programme is expected to devise the procedure, in consultation with the Departmental Safety Coordinator, and to be present at the disposal.

3. SOLID WASTE

The Department's non-radioactive solid waste is handled in five categories using the following procedures for disposal:

(a) Non chemical solids:

Uncontaminated paper should be consigned to recycling bins or general purpose waste bins as appropriate. Confidential documents may be shredded in CG137 or CG160 and disposed of similarly.

Uncontaminated laboratory consumables and other chemically inert or environmentally harmless solid material (not loose powders or chemicals) are also suitable for general purpose waste bin disposal.
All solid material that is contaminated with toxic or hazardous chemicals (again not loose powders or chemicals) must be accumulated in a sealed polythene bag (A3 sized or smaller), labelled as 'Toxic Waste' with group identification and laboratory number. Once full, the bags should be moved to a yellow hazardous waste bin in the laboratory and not allowed to accumulate in fume cupboards. Yellow bins should not be overfilled, but the yellow bags may be transported to the waste store during the waste store opening times, whether almost full or almost empty.

(b) Glass:

Glassware that is broken should be decontaminated (washed with water or solvent) and repaired or salvaged if possible. If washed with solvent, please ensure that the glassware is dry before leaving the laboratory. Clean non-repairable glassware or redundant empty glass containers **with**

all labels removed or defaced should be consigned to a glass bin for recycling.

(c) Sharps, including metal sharps and pipette tips:

All redundant, small **metal items that are capable of inflicting a puncture wound**, (*e.g.* a syringe needle, a razor blade, a scalpel, a metal pipette tip) should be rinsed if contaminated and then discarded into a yellow plastic 'Sharps Bin'. After cleaning, needles may be disposed of whilst still attached to disposable syringes. Plastic pipette tips can also be disposed of in sharps bins. Sharps bins should be positioned on a solid surface, not balanced on other objects, and preferably located towards the rear of a fume hood. When three-quarters full they should be sealed with the attached plastic flap and returned to the waste store at the appropriate time for specialist disposal and replacement. See also **Code of Practice A**, **Part 7**.

(d) Non commercial toxic solids:

Most toxic solids can be disposed of by one of the following methods:

(i) chemical treatment to give a harmless precipitate, or a harmless water miscible solution;
(ii) dissolution in water before transfer to the waste store in a suitable container to be bulked with aqueous toxic/heavy metals waste;
(iii) dissolution in an organic solvent to give category 'C' or 'D' liquid waste.

A more expensive disposal route for insoluble solid chemical waste that cannot be disposed of by other means, such as aluminium backed TLC plates and chemicals held in glass or plastic containers or in zip-lock polythene bags, is to collect the waste in a clear sealed polythene bag (approx. A4 sized or smaller) that is labelled as 'Lab Smalls' with group identification and laboratory number and to transfer the bag to the waste store at the appropriate time.

(e) Used silica:

Individuals using column silica should retain all used material separately in a fume hood, remove all traces of flammable solvent (*e.g.* by evaporation) and then collect the used silica in a sealed polythene bag (A4 sized or smaller). This bag should be labelled as 'Silica', with group identification and laboratory number, before transfer to the waste store at the appropriate time. Alternatively, bags of used silica can be accumulated in the original 50 litre shipping drums, but for safety and cost reasons it is still essential that no flammable solvent vapours are present. Loose used silica must not be placed in 50 litre drums.

4. UNWANTED COMMERCIAL CHEMICALS

All chemicals, (liquids, solids and gases) in containers or cylinders that retain the commercial manufacturer's label and specification should in the first instance be advertised internally and the LabSafe database updated if the material is transferred to another laboratory.

Remaining containers of chemicals can often then be economically reduced in number by utilising existing disposal procedures as appropriate (Parts 2 and 3, above).

A final inventory of any outstanding items is then prepared and submitted to the waste store for eventual specialist disposal. In the first instance, please contact Mr Douglas Carswell for assistance. Individual commercial chemicals can be disposed of by this route at any time.

Empty containers can be disposed of by the normal routes only if they have been washed free of their former contents, caps or lids removed and all labels defaced or removed.

In general, the Department expects each research worker, in consultation with their research supervisor, to treat the disposal of unwanted reaction products as an essential part of each piece of experimental work undertaken. The Department is not equipped to undertake disposal of outdated research samples and other unwanted or unlabelled material.

A research supervisor or the Chemistry Health & Safety Coordinator should be consulted in dubious cases, or when dealing with the following solids:

- calcium carbide and other substances that in contact with water liberate an insoluble gas;
- mercury, cadmium and their compounds;
- cyclic chlorocarbons;
- organotin compounds;
- other schedule-1 solids.

5. WASTE GASES

Waste gases are extracted and discharged from the Chemistry Building at roof level by roof-mounted electromechanical fans acting on ducts. Most laboratories have an independent system of fume cupboards served by the roof-mounted fans with their own variable-volume supply of fresh air.

A plenum system of ducts, fans and grilles brings outside air into the Building at basement level, warms the air and circulates it to heat offices and freshen the respiratory atmosphere. In rare weather conditions, a small proportion of waste air can be drawn back into the basement or into rooms with open windows. Consequently, the fume-cupboard extract system should be treated as a secondary method for removing harmful waste gases arising from the handling of chemicals, or evolved during a reaction. The primary method should be part of the equipment used for the handling. For example:

- gas evolved from a chemical reaction or released from a bottle should be passed through a solvent or reagent in a trap (“scrubbed”) so that a negligible proportion of the gas enters the fume cupboard;

- an all-glass ampoule of volatile liquid should be cooled to give a low rate of evaporation when opened to the atmosphere of a fume cupboard;

- exhaust gases from a vacuum pump vented to a fume cupboard should be checked regularly for contamination and the oil changed where appropriate.

If any vented gas can be smelled outside the Department a public nuisance exists and the Department risks a ban on the work producing the smell.

6. BIOLOGICAL WASTE

Biological waste is dealt with using a specific protocol. Details can be found in Special Code of Practice K, Biological Material Safety Policy.

7. ELECTRICAL ITEMS

Disposal regulations mean that the University is charged for the disposal of electrical goods.

Any electrical goods that are no longer required should be decontaminated so as to be free of any chemical residues. All mains operated equipment that has been used in the Department has a barcode sticker, which is used to identify the item for electrical safety testing purposes. This sticker should be removed and returned to Dr Bryan Denton in the electrical workshop so that the item can be struck off the inventory.

Waste electrical and electronic equipment should be disposed of according to University regulations as follows:

WEEE Procedure Colleges/Departments

- For all items other than computers and related hardware, contact Gary Southern (gary.southern@durham.ac.uk).
- For computers and related hardware, contact CIS *via* the service desk (servicedesk@durham.ac.uk).

8. COVID-19

Appendix I should he consulted for interim waste disposal measures during the covid-19 pandemic.

SECTION J: POLICY MONITORING AND REVIEW

1. **A Safety Audit** is performed each year by Mr Paul Hofmann, who reports to the Safety Committee. Any repairs or maintenance requests are reported to Mr Hofmann (CG127C), the member of technical staff who deals with building-maintenance workers. The list of items checked is in **Appendix B**.

   A **safety inspection** of part of the Chemistry accommodation is carried out in each of the three University terms, such that the entire accommodation is inspected annually. Responsible persons are notified of deficiencies and asked to respond within 10 working days. A report of each inspection is sent to the University Health & Safety Adviser. In cases where significant deficiencies are found (*e.g.* a risk of serious injury) the inspection team will make more frequent visits to ensure that the policies are being complied with.

2. Annual 'Tidy Up'

One day each year, usually on a set date in September, is reserved for carrying out departmental housekeeping, including: transfer or disposal of unwanted chemicals; chemical database checks; disposal of unwanted paper documents; removal of clutter from all areas of the department; and self-checks on the safety provision and signage in laboratories and offices. These self-checks will be used to identify matters that need attention and initiate remedial action.

3. Annual Review of Policy and Codes of Practice

There is University management standard on Monitoring and Review (**MS6, UHSS Topic A-Z/Monitor and Review**).

The Safety Committee meets 3 times annually and monitors progress against health and safety objectives and plans. The committee receives reports of Health and Safety meetings, Departmental Health and Safety Inspections, Trade Union Health and Safety inspections, Accident and Incident Data, Occupational Health Referrals and notable Health and Safety activities. The minutes of this committee are used to inform changes to the policy document and Action Plan on an ongoing basis.

The Action Plan, and the Chemistry Health and Safety policy, codes of practice and appendices are reviewed annually by the Departmental Safety Coordinator and Secretary to the Safety Committee and are available on the Chemistry Safety website. The date of the next review is 31 August 2020. Policy and Action Plan amendments made before this date will be made available on the Chemistry Safety website.

4. Major Review of Policy and Codes of Practice

A major review of the policy is undertaken each time a new Chair of the Board of Studies is appointed, normally once every 3 years. The review is led by the Chair of the Safety Committee (in consultation with committee members) and receives input from the Chair of the Board of Studies, key representatives of technical support staff, and the Chemistry lead contact from UHSS. The review covers: changes in University policy; major changes to legislation; the structure of the safety policy document and changes to the general risk assessment. The date of the last major review was 1 August 2017.

SECTION K: GENERAL CODES OF PRACTICE FOR LABORATORY WORK

These codes of practice are updated annually by designated members of staff with experience of the relevant protocols. It is expected that the practices described by these codes will be adhered to when conducting work in the Department. Specific training in these codes of practice is not required beyond the safety induction. Signature of the policy document indicates agreement to their terms.

Code of Practice A: Good Laboratory Practice

This section must be read thoroughly

1. Good Laboratory Practice (GLP)

You should pay particular attention to: cleanliness in communal work areas (Parts 6d to 6h); ensuring good ventilation during the transfer of liquids and rinsing with volatile solvents such as acetone (Part 6i); the use and disposal of metal sharps (Part 7); handling of gases (Part 8); and requirements to avoid eating, drinking and applying cosmetics (Part 6n).

The aim of Good Laboratory Practice (GLP) is the protection of people against the hazards of substances encountered at work and the maintenance of high standards of work and professionalism. This aim is achieved by appropriate means of hazard control and working practices. No work should be started until due consideration has been given to the means of minimising the hazards, through appropriate choice of chemical reaction, reagents, conditions, solvent, and management, *i.e.* risk and COSHH assessments have been completed and authorised. In addition, no new work should be introduced into a laboratory if it is not possible to adequately control the hazards within the existing facilities or until the necessary improvements have been made. The risks posed by work depend very much on the appropriateness and effectiveness of the arrangements and practice of the person(s) at work. Good and appropriate facilities can be ineffective or valueless if improperly used!

Specific procedures and relating to named chemicals, activities, equipment, *etc*. are issued separately as special codes of practice. A list of these documents is given in **Section L** of the safety policy.

Personal protective equipment (including gloves) is not a substitute for other control measures. The purpose of personal protection is normally to prevent **accidental** exposure to hazardous substances, and should be considered as the final level of protection.

Further information can be found on Health and Safety Services web site, **Health and Safety Guidance 9** (**UHSS Topic A-Z/COSHH**).

Section 2	is concerned with planning experimental work.
Section 3	is concerned with personal protection.
Sections 4–7	embody the protection of everyone.
Sections 8 & 9	are unclassified.

2. Planning and Recording Experiments

All laboratory work must be planned in advance, with consideration of avoiding unnecessary hazards, identifying the risks that are unavoidable, and determination of the appropriate control measures to minimise the risks. Details of the risk assessment and the subsequent work undertaken must be recorded. These records are the property of the University and will remain so at the end of the project.

(a) Plan in detail the work to be undertaken, taking account of the nature of the chemicals to be used, the conditions required for reaction, the most suitable equipment, the nature of the products and the waste materials. Also, consider possible actions in case of accidental spillage.

Experimental chemistry, including chemical reactions and vacuum distillations, should normally be carried out in a fume cupboard. Specific risk assessments should be undertaken if a fume cupboard is not used.

(b) All laboratory work **must** be recorded in a hardbound laboratory notebook or electronic notebook. Three different versions of paper notebooks are available from the Chemistry Stores, one more suited for synthetic work, one for measurements, and one for biological chemistry. All are available in 150 page or 50 page versions. For one-off experiments, that is, individual reactions or procedures that differ from one another, an individual risk assessment must be made and recorded for EACH experiment in these books. This assessment must consider the hazards to health posed by the materials to be used (COSHH), the risk of fire or violent/uncontrolled reactions (DSEAR) and other sources of risk posed by equipment use and operating procedures. Laboratory notebooks have space for both COSHH and procedure-based risk assessments. Reference to project risk assessments (forms CRA1/CRA2) may be made in laboratory notebooks using the user-generated reference for the assessment; in these circumstances, a copy of the project risk assessment should be appended to the notebook. Supervisors must countersign and date risk assessments **before** the work is started. If a reaction or process is deemed to have high risk, a separate more detailed risk assessment is required.

(i) The COSHH assessment must take account of the properties of all the chemicals to be used or generated, and the precautions which need to be taken. Consider less toxic alternatives.

(ii) Consider the worst-case scenario that could arise during the experiment, considering the sizes of the containers that are to be manipulated, not just the amount that is to be used or generated. Take precautions to ensure that measures are in place to deal with any problems. This should include consideration of spillage, unexpected exotherms or release of gaseous materials, and known chemical incompatibilities. Some of this information will be included in the safety data sheet (SDS) for each chemical, but other sources of information should be consulted, including Bretherick's Handbook of Reactive Chemical Hazards (available electronically at http://library.dur.ac.uk/record=b2873482~S1) and the UK Chemical Reaction Hazards Forum (http://www.crhf.org.uk/). The European

Chemicals Agency has a useful tool for obtaining agglomerated SDS information on chemicals and materials that is available at: https://echa.europa.eu/advanced-search-for-chemicals
The ACS provide a useful guide for identifying hazards in research laboratories which is available at: https://tinyurl.com/y9uyfgem

(iii) Consider waste products, and their disposal (see Section I). Gases should be efficiently scrubbed before venting to the atmosphere.

Where repeated experimental procedures are used, a project risk assessment should be used.

(c) **Sensitisers and Irritants**. A sensitiser is a chemical or material that can produce an allergic response following exposure. Sensitisation is an immunological response following exposure to a sensitiser. Once sensitised, individuals can have severe reactions to further exposure, even in small amounts. In the most extreme cases, after respiratory or skin exposure, individuals may develop asthma and/or dermatitis respectively. Contact dermatitis can also be caused by exposure to irritant materials. **Anyone who experiences any form of adverse reaction after using chemicals (including detergents, cleaning materials, and research chemicals) should inform their supervisor and Occupational Health**.

If chemical sensitisers are being used, *e.g.* if R42, H334 or H317 appears during a project COSHH assessment, or if a user of irritant materials has an existing condition such as atopic eczema or asthma, health monitoring may be required. The work will be subject to a specific risk assessment (UHSS Health and Safety Guidance 9; **UHSS Topic A-Z/COSHH**) and occupational health should be contacted to discuss any monitoring arrangements that may be required based on this assessment.

Schedule 6 of the COSHH legislation (2002) indicates that medical surveillance is appropriate for the use of the following: vinyl chloride monomer, nitro or amino derivatives of phenol, potassium or sodium chromate or dichromate, o-tolidine, dianisidine, dichlorobenzidine, auramine, carbon disulfide, benzene, carbon tetrachloride, trichloroethylene. Other Materials with high toxicity that produce cumulative effects, such as carcinogens, toxic metals and respirable crystalline silica may also require monitoring.

Further details are available on the Chemistry Safety webpages:
http://community.dur.ac.uk/chem.safety/local/Sensitisers.html

(d) Ensure that you have sufficient time available to supervise the experiment from start to finish, or to ensure that the experiment may safely be left unattended. For overnight reactions: tubing carrying water, *e.g.* for a condenser, **must** be secured with cable ties at both ends; a temperature regulator **must** be used if a reaction is being heated; and any reaction carried out above ambient temperature overnight **must** be stable at its regulated temperature for at least one hour before being left. See also **Section E, Part 2** of the Departmental policy.

(e) **Avoid heating sealed systems**. If you need to heat a sealed system a specific risk assessment is required.

(f) Work **must** always be carried out within the hearing of another proficient person. Research workers should be aware that at certain periods during normal working hours, such as graduation days or during seminars, there might not be another worker within earshot. In such circumstances, work **must not** be carried out.

3. Personal Protective Equipment (PPE)

(a) **Safety spectacles** must be worn all the time in designated laboratories, even when no work is being done. For most general laboratory applications, safety spectacles should meet the EN 166-F standard (capable of withstanding impacts against small objects travelling up to 45 meters per second). These offer some splash protection against chemicals, but do not have a seal to prevent, for example, liquids running down to the eyes from the forehead. Where there is a risk of material splashing at head height, either safer working practices should be sought (preferably), or otherwise eye protection of a different standard (*e.g.* goggles) should be used. For any laboratory activity, suitable eye protection should be identified in the risk assessment for that activity.

Very occasionally, the use of safety spectacles is not compatible with the work being undertaken, for example during the use of microscopes. In these circumstances other activities undertaken in the vicinity should be restricted such that the wearing of safety spectacles is not required for safe working. A risk assessment, together with a standard operating procedure or code of practice, should be prepared by the research group leader or facility manager or other person competent to authorise the work, and must be followed by all undertaking the work.

(b) **Laboratory coats**. A suitable laboratory coat or overall should be worn to protect personal clothing from contamination and should be changed before becoming excessively soiled. If protective clothing is liable to become heavily contaminated, a heavy-duty plastic or rubber apron should also be worn. In some instances, for example when handling pyrophoric materials, consideration should be given to the wearing of a flame-retardant laboratory coat. Chemistry Stores keep a small stock of these.

(c) **Gloves.** Hands at risk from mechanical injury (bruising, laceration, or extremes of temperature), and/or chemical exposure (including cleaning fluids), must be protected by gloves. The two principal routes by which hands may be exposed to chemicals in the Department are **immersion** (intentional direct contact with a liquid, *e.g.* in an acid or base bath) and **splash** (unintentional contact with a liquid, *e.g.* following a spillage). Appropriate gloves must be worn by anyone handling chemicals that are either hazardous to the skin or have properties that are unknown. It should also be noted that some solvents are able to carry solutes through the skin. Longer sleeved gloves (gauntlets) must be worn if the arms are also at risk of contact with chemicals. Consideration should be given to the chemical resistance of the glove material against the chemicals to which it will be exposed, the duration and frequency of exposure, and the precision of grip required.

(i) **The type of glove that should be used, and its compatibility with the chemicals involved, should be included in the risk**

assessment for a given procedure or experiment. This is especially important if the work involves immersion or if the risk to health from exposure is very high. **Some chemicals, most notably chlorinated solvents, can penetrate most standard glove materials**. In some cases, 'double gloving' can be used to afford extra protection. Consult **Appendix E** of the safety policy and glove manufacturers' specifications to select the correct glove.

(ii) Gloves that meet the EN 374-1 standard are classed as 'low chemical resistant' and only suitable for splash protection against chemicals. Gloves meeting the EN 374-3 standard are 'chemical resistant' and will give > 30 min before chemical breakthrough for at least 3 different non-halogenated solvents. A more detailed description of the chemical compatibility of gloves is given in **Appendix E**. **Safety data sheets normally provide details of recommended gloves**.

(iii) Chemistry Stores stock a range of gloves and gauntlets that provide protection against chemical, mechanical and thermal injury. Chemistry Stores can provide manufacturers' specifications for the hand protection products they stock.

(iv) For chemical protection, Chemistry Stores stock both **single-use** and **reusable** gloves. Other types of glove are available commercially if Chemistry Stores do not stock a suitable glove.

(v) **Reusable gloves** offer good protection for routine practices such as washing glassware, but poor grip precision. Chemistry Stores stock both natural rubber (yellow) and nitrile (green) marigold gloves with cotton flock linings and similar levels of chemical resistance. Although nitrile is often the first choice of glove material, both nitrile and natural rubber can provoke adverse reactions in some people (see also paragraph (xi)). You should avoid any glove material to which you are sensitive and seek medical help if you think a glove material is causing any adverse effects.

(vi) **Single-use gloves** offer good grip precision for more exacting manipulations and are available from Chemistry Stores in a range of materials. They should be discarded after one wearing.

(vii) Gloves should be checked for holes before use.

(viii) **Glove removal**. Before removal, reusable gloves should be washed in warm detergent solution (preceded by a specific cleansing agent, if necessary) and dried. It is essential that gloves are removed in a manner that does not transfer contaminants onto your skin. One glove should be used to remove the other. With disposable gloves it is best to turn them inside out as they are removed. Pictorial guides are available at:
http://www.hse.gov.uk/skin/posters/singleusegloves.pdf
http://www.hse.gov.uk/skin/posters/reusablegloves.pdf

(ix) Gloves should be removed before leaving a laboratory and **must not be used on door handles**. Biological chemistry workers are permitted to use the 'one-glove' rule, whereby one glove is kept on whilst transferring a sample between laboratories. Other exceptions may be applied for specific cases following discussion with a research supervisor. Whilst in the laboratory, gloves should be removed before handling objects that could transfer materials, such as telephones, pens and keyboards.

(x) **Manipulations of carcinogenic substances**. Gloves that have been exposed to an undiluted carcinogen or toxic substance should be

treated with a chemical that destroys the contaminant, or placed in a thick polythene bag, and disposed as contaminated waste.

(xi) **Latex (Natural Rubber) Gloves**. All use of gloves that place latex in direct contact with the skin should be avoided and appropriate glove alternatives sought. If unavoidable, the use of disposable latex gloves must be subject to an individual, additional risk assessment, in which justification for the use of these products is specified. The use of powdered and/or high protein content latex gloves is forbidden due to the increased risk of sensitisation and allergic reactions associated with these gloves.
Further information can be found on the HSE website:
http://www.hse.gov.uk/skin/employ/latex.htm

(xii) For more information about protecting skin at work, visit:
http://www.hse.gov.uk/skin/index.htm

(d) **Footwear** worn in laboratories should incorporate flat heels, slip resistant soles and uppers that fully enclose the foot.

(e) Outdoor clothing and personal effects including food and drink should not be taken into a laboratory. Secure lockers or offices are provided outside the laboratory for the storage of these items.

(f) Eye protection and suitable footwear with toe protection **must be worn (and gloves if necessary)** when handling heavy objects, such as gas cylinders, or filling and transporting containers of cryogenic liquids. Safety spectacles and suitable footwear **must be worn** when changing gas cylinders and cylinder heads.

(g) Since the principal method for the control of airborne hazards is to contain the substance, respiratory protection should only be necessary in emergency situations. The use of respiratory protection must be discussed with the Department Safety Coordinator/University Health & Safety Adviser so that the correct type is used, changed and maintained.

Covid-19. Face coverings are not recommended for use within well ventilated laboratories due to the risks of chemical and biological contamination and potential issues with combustibility. The use of face coverings and face masks (with an approved safety rating) must be supported by a risk assessment.

(h) **Before leaving the work area** it is most important that hands are washed and all protective clothing removed. **Nobody should wear a laboratory coat in a general circulation** (tea/coffee room; canteen or the central and reception offices) **or office area**.

(i) Protective clothing contaminated with hazardous substances will require special laundering arrangements. Laboratory coats and towels can be taken to the stores at designated times to be sent for cleaning.

(j) All personal protective equipment should be stored in a location that minimises both the risk of chemical contamination of the equipment during storage, and the risk of contaminated equipment transferring materials to locations outside the laboratory.

4. Storage of Chemicals

Recommended storage of liquid chemicals in the laboratory:

(a) The quantity of flammable solvent allowed in each laboratory is normally limited to 50 litres. When not in use, these solvents must be kept in fire-resistant metal cabinets that are able to contain spillage. (Checks are made by Dr Philip Dyer, Dr John Sanderson and Dr Eckart Wrede in the inorganic, organic and physical laboratories respectively).

It is particularly important to ensure **all** solvent Winchesters are placed in these cabinets when not in use, **and** when the laboratory is unoccupied.

During the course of 2019/20, a new form for laboratory doors will come into effect that will detail the volume of solvent in each room and a justification for quantities > 50 litres.

(b) Non-flammable solvents and chlorinated solvents should be stored separately from flammable solvents.

(c) Acids should be stored separately.

(d) Alkaline materials should be stored separately.

(e) Peroxides, *e.g.* hydrogen peroxide, should be stored separately and away from carbonaceous material if possible and in plastic containers. Strong oxidising agents can react explosively with acids, flammable liquids, metals and their salts.

5. Fume Cupboards

Fume cupboards are a control measure designed to capture and remove air-borne hazardous substances generated during laboratory experiments. Fume cupboard provision and use is covered by the COSHH Regulations 2002 (as amended) and the Provision and Use of Work Equipment Regulations 1998 (PUWER). It is essential that users understand how to use them effectively, and that they are maintained, inspected and tested by competent persons.

General Points:

(a) Work with substances that produce or generate toxic or harmful fumes, vapours, gases, dust or chemical aerosols should be carried out in a fume cupboard to eliminate or reduce the risk of exposure to an acceptable and safe level. Any material with a workplace exposure limit (WEL) documented in the SDS should be used in an appropriate fume cupboard.

(b) Every fume cupboard must have an annual face velocity test. For ducted cupboards that are part of the building infrastructure, this is normally arranged by Estates and Facilities. However, individuals may need to arrange their own tests for temporary or free-standing cupboards that are not maintained by Estates and Facilities. **Cupboards that fail the face velocity test will be marked as failed and must not be used until the failure has been rectified**.

(c) Most fume cupboards have a monitor to provide an indication of normal function. This may take the form of a simple indicator light (red/green) or a flow monitor. **Flow alarms must not be deactiviated when a cupboard is in normal use**.

(d) A cupboard with insufficient flow will usually be indicated either by a red light or low velocity measure. Visual alarms are usually accompanied by an audible alarm. If a cupboard is failing to give sufficient flow, first ensure that the sash is closed sufficiently and that there are no major obstructions inside the cupboard that could hinder flow. If poor or failing performance cannot be resolved, the matter should be raised with Paul Hofmann.

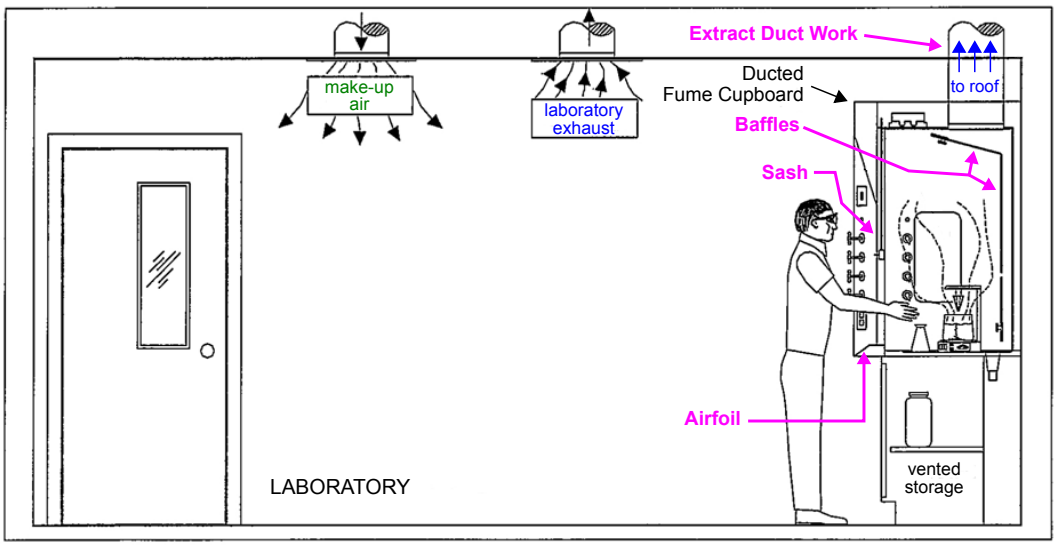
(e) Because of the risk of mixing between fumes and respiratory air, the traps in the drains for waste water in all sinks should be kept full of water. It is good practice to run water down all sinks at least once each week. Smells detected in corridors and other non-experimental areas must be reported immediately to the Safety Committee or the Departmental Manager and an incident report form filed if judged necessary.

(f) Users must be trained in the correct use of fume cupboards, including the matters described above and the correct sash height, the optimal working area, emergency procedures and good housekeeping.

(g) Ducted fume cupboards in synthetic laboratories must NOT be used for the containment of biological materials. Where such containment is required a microbiological safety cabinet must be used.

Fume Cupboard Operation:

(h) Ducted fume cupboards are integrated within the air management of the building:

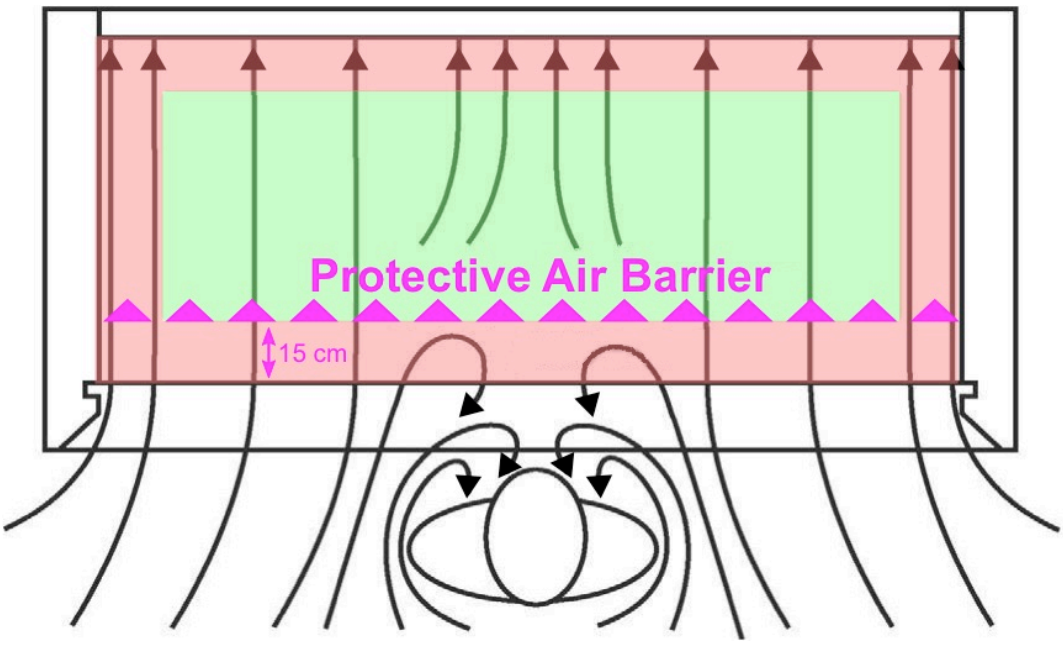


They operate by drawing in laboratory air to contain and dilute the contents before discharge without filtration 3 m above roof level. Ducted fume cupboards either work at constant air volume (*i.e.* as the sash is raised the air current decreases and *vice versa*) or constant face velocity. Fume cupboards have a sash (the transparent screen between the user

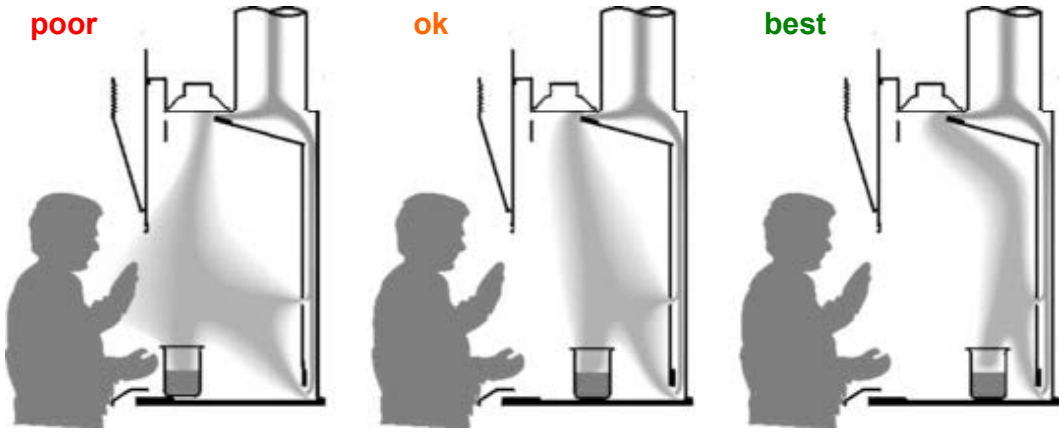
and the work space), baffles (panels within the cupboard to optimise air flow), an airfoil (along the bottom and sides of the cupboard to reduce turbulence and allow operation at low sash heights), a work surface, and extract duct work.

(i) Recirculating filtered fume cupboards are designed to reduce the airborne concentration of a defined range of chemical vapours, fumes, smells and dusts in the air to acceptable levels. Materials suitable for use in a recirculating fume cupboard are determined by the nature of the filters and the specifications of the cabinet. All filtered cabinets should have a label to indicate the dates of the last filter change and when the next one is required. **A cabinet must not be used if the filter is out of date**.

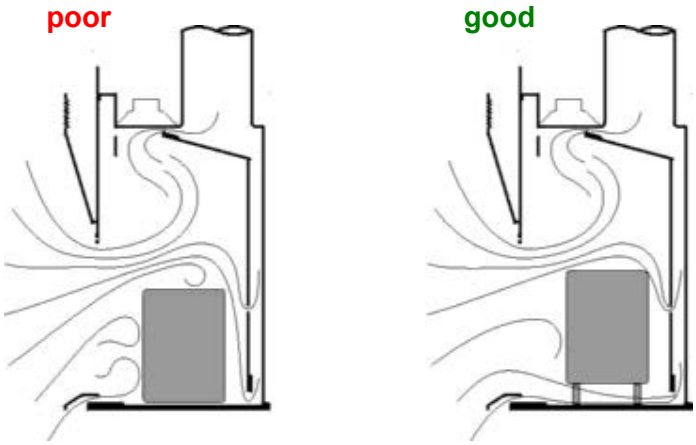
(j) A protective air barrier for a safe work area is formed by the air flow into the cabinet. When a worker stands directly in front of the cupboard, an area of low air pressure is formed in front of the user. This zone of low pressure extends into the fume cupboard for approximately 10 cm. Objects placed on the sides and back of the cupboard also hinder normal flow. **In order to ensure safe working a 15 cm wide 'unobstructed zone' should be maintained between all sides of the cabinet**:



(k) Most of the air entering a fume cupboard travels across the work surface and behind the baffle at the back. **Do NOT block the back baffle opening just above the base.** Optimum protection is offered approximately 15 cm in front of the baffle:



(l) If it is absolutely necessary to store material or instruments in the cupboard, a shelf or legs should be used to raise the obstruction by at least 5 cm to allow airflow underneath to the baffle opening:



(m) The floor area in front of a fume cupboard must be unobstructed with furniture or equipment that may interfere with the performance of the fume cupboard.

(n) All chemicals placed inside a cupboard must be clearly labelled. Do not allow waste materials (*e.g.* solid waste bags, waste solvent bottles) to accumulate. Do not leave objects in the fume cupboard that are not required for the current experiment(s).

(o) Before using a fume cupboard, the user must check as far as possible that the cupboard is fit for purpose (*i.e.* the inner 'unobstructed zone' is clear, there are no obstructions in front of the cupboard, air flow is as expected, the cupboard has an in-date face velocity test, and the cupboard is appropriate for the work to be undertaken, in line with the risk assessment).

(p) The sash should be lowered whilst an experiment is in progress and the fume cupboard is unattended. Fume cupboards with horizontal sliding panes should be used with the sash all the way down, with as small an open area as possible.

(q) **Never put your head inside the fume cupboard enclosure at any time whilst hazardous substances are present.**

In the Event of an Emergency:

(r) if the air flow fails, make the contents as safe as possible and stop work. Pull the sash as low as it will go and label the front of the cupboard to indicate that it has failed. Notify other workers in the vicinity if there is an on-going risk from hazardous materials. Notify Paul Hofmann of the failure.

(s) Deal with spillages promptly in line with the emergency measures in Section B of the Departmental policy.

(t) Fires must be treated with caution. When using a CO_2 extinguisher, care is needed to avoid ejecting the contents of the cupboard into the laboratory or sending flames into the duct work. Safe deployment can often be achieved by directing the extinguisher at the top of the cupboard. If a fire cannot be controlled, close the sash and raise the alarm in line with the emergency measures in Section B of the Departmental policy.

6. Handling of Chemicals by Individuals

(a) Do not inhale vapours or make skin contact with any substances.

(b) Pipetting by mouth **is not allowed**. Use a bulb or automatic pipette.

(c) Direct contact between a chemical and the body must be avoided. Since most experiments use **measured** amounts of materials, good practice in the weighing area is essential to avoid spillage and/or accidental contact.

(i) **SOLIDS** (except very toxic solids)

Transfer of solids to a weighed stoppered container must be carried out on an adjacent bench covered with paper which can be removed and, if spillage has occurred, be disposed of as solid waste.

(ii) **TOXIC LIQUIDS, FINE POWDERS, AND VERY TOXIC OR VOLATILE SOLIDS**

Transfer of material and any adjustment to the amount of material into a pre-weighed stoppered container must be carried out in a fume cupboard. Place the balance in the fume cupboard where possible. This avoids contamination of the weighing area. Pipettes used to transfer the liquids must be washed with an appropriate solvent into the correct "Waste Solvents" bottle - in the fume cupboard. Spatulas used to transfer solids must be cleaned in the appropriate way.

(d) Experiments must be conducted on scrupulously clean working surfaces. (Should any subsequent spillage occur, there is at least the possibility of 'mopping up' for the recovery of materials). This requirement applies particularly in **fume cupboards** where most work is carried out. A high standard of tidiness must be maintained at all times. The use of trays/containment vessels is recommended.

(e) Contaminated surfaces and equipment must be cleaned as soon as is practicable after use. The equipment should then be **put away**. Do not clutter bench-space with unused equipment and bottles of chemicals.

(f) Chemicals not in use should be returned **promptly** to their correct storage container. Please note especially: stock bottles of flammable solvents (including "Wash" acetone) **must be returned immediately** to the fire-resistant metal cabinet after use. It is important to ensure that solvent bottles are not filled above the shoulder of the bottle as small changes in temperature can have a catastrophic effect on overfilled bottles.

(g) Containers or bottles containing ≥ 100 ml or 100 g of material and all containers of hazardous materials **must** be transported in special carriers. When transporting materials in carriers, the lift should be used to move the carriers between floors. Personnel **must not** travel in the lift with chemicals, gases, or other dangerous materials. Each lift contains a yellow bollard that should be used to warn other personnel that the lift is being used to transport materials and should not be entered. The correct handling equipment should be used to transport and manipulate cans, drums and gas bottles.

(h) Do not leave bottles of chemicals, Dewars or other items on floors where they may cause a trip hazard.

(i) Where there is a risk of the inhalation of fumes and vapours or the generation of an explosive atmosphere (from highly flammable liquids and gases) local exhaust ventilation must be used. Thus, do your decantation in a fume cupboard, *e.g.* when filling up wash bottles. Exhausts from vacuum lines, gloveboxes, *etc*. should be vented to a fume cupboard, laboratory extract system, or to the outside atmosphere and not into the open laboratory.

(j) At the end of an experiment there will remain the required product, waste solvent and other residues. **Waste must be disposed of safely (see Section I of the safety policy for more detailed instructions)**.

(k) Work involving naked flames is strictly controlled and must be adequately risk assessed. Work that requires manual control to be conducted safely should never be left unattended. Flames and compressed gas supplies should be shut off when not in use and on leaving the laboratory.

(l) Flammable substances must be kept well away from sources of ignition, including naked flames, electric hot plates and non-flameproofed electrical equipment.

(m) Ensure that all sinks remain free from clutter and blockages. All pipework *e.g.* reflux condenser tubing, should be securely connected to prevent leakage and floods. Where possible, water-free condensers or recirculating cold baths should be used.

(n) Foods, drinks, cosmetics and cigarettes **must not be taken into, or used in** areas where chemical substances are used or kept. These materials can readily become contaminated if kept and used alongside chemical

substances. It is possible to transfer dangerous substances to the mouth or other sensitive areas of the body.

7. Metal Sharps

All personnel involved in the use, collection and disposal of "sharps" (used needles and scalpel blades *etc*) should be trained in the correct technique for the safe use, removal and disposal of these items.

(a) Sharp items must only be disposed of in an approved yellow sharps container, using the procedure described below.

If the needle/syringe/blade has been used for the transfer of chemical samples, it should be washed and decontaminated using an appropriate solvent. If an infective material was used, the syringe should be washed three times with an aqueous solution containing 10% (v/v) Trigene, followed by three washes in water.

Needle/blade covers should ***NEVER*** be replaced, as this increases the likelihood of a needle-stick injury.

Likewise syringes and exposed needles or blades must ***NEVER*** be left on a working surface. They should be disposed of immediately after use.

(b) **Procedure for safely removing syringe needles**:

- ***NEVER*** remove a syringe needle by hand;
- hold the syringe with needle facing away from you;
- insert into the clasp on the opening of the sharps container;
- slide towards the narrow end until needle is held firmly;
- pull up to release the needle directly into the container.

A Needle may be disposed of whilst attached to a disposable syringe if this is the safest mode of disposal, provided that the container is sufficiently tall. Sharps containers should be disposed when two thirds full as per the University Health and Safety manual.

Further information can be found at (**UHSS Topic A-Z/Sharps**).

(c) **Incidents involving sharps**

The emergency procedures for injuries involving sharps are described in **Section B, Part 8** of the Safety Policy.

(d) **Work with blood and body products**

All researchers who are planning work with blood and body products should determine beforehand whether any vaccinations are required. Work must not commence until any required vaccinations have been done.

All researchers working with blood and body products should be aware of the procedures for safe use of sharps and the actions to be taken in the event of an incident (**Section B, Part 8** of the Safety Policy).

8. Gas Regulators and Manifolds

Most laboratory gases are piped into laboratories using low pressure pipelines and regulators from cylinders located in external cages. Less common gases may require the use of cylinders within laboratories. All cylinders must be secured to prevent falling by using chains or bench clamps. When using a gas cylinder with a regulator, **it is essential that**:

(a) the correct regulator for the gas is used;
(b) the inlet pressure of the regulator is correct for the cylinder;
(c) the regulator is in date;
(d) the maximum outlet pressure of the regulator is compatible with the reaction/process vessel to which it will be attached.

All regulators are replaced after 5 years of service. The replacement date is indicated by a yellow 'tag' attached to the regulator. Regulators and hoses require a visual inspection for damage and to ensure that the threads and contacting surfaces are clean before attaching to cylinders. **Do not use damaged or out-of-date regulators or hoses**. Report any defects to the Safety and Research Technician who will arrange for a replacement unit. When fitting a new regulator, the use of PTFE tape as a thread lubricant is **not recommended**. In addition, normal PTFE tape must **never** be used with oxygen cylinders (oxygen-safe PTFE conforming to EN 751-3 must be used instead). When performing leak tests, the leak detect solution must be compatible with the materials used in the equipment construction, including the gas itself. Solutions containing hydrocarbons (including soapy water) must **never** be used for leak tests with oxygen.

Cylinders of flammable gases should not be kept in laboratories for any longer than necessary and must only be used as a temporary measure.

9. Use of Lasers and UV Equipment Outside Dedicated Laser Laboratories

(a) All handheld UV lamps used for the visualisation of thin layer chromatography (TLC) plates should be used in conjunction with a cabinet fitted with a suitable UV-filter.

(b) UV transilluminators, for the visualisation of fluorescent markers in gel electrophoresis, should be guarded (enclosed in an absorbent polymer) with an interlock that will make the device safe if the guard is opened. Instrument failsafe mechanisms should be inspected regularly. Those using transilluminators should be trained in the risks involved and procedures for their safe operation. Time-weighted exposure limits given in the manufacturers' specification must be respected. Eye and skin exposure should be avoided by seeking alternative working practices.

10. Shipment or Transfer of Chemicals

Before chemicals or other materials are supplied to a recipient outside the University:

(a) a risk assessment must be provided by the recipient that describes what the materials will be used for, who will use them and what control measures are in place (*e.g.* for transport and disposal);

(b) the risk assessment must be checked and approved by a competent person employed by the University and the approval indicated (*e.g.* by a dated signature or stamp);
(c) a valid safety data sheet must be provided with the shipment.

If a LabSafe order accompanies the shipment, a copy of the paperwork described above should be attached to the order. The order will not be approved without an authorised risk assessment. Copies of the paperwork should be stored on DUO ('Risk Assessments' tab, 'Material Transfers' folder).

For transfers within the University, no approval is required but the LabSafe database must be updated after the transfer has been made.

Dr John Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

Code of Practice B: Procedure for Obtaining Solvent

1. Personal protective equipment must be worn ***at all times*** when in the solvent store. Laboratory coat and safety spectacles are obligatory. Gloves are available in the solvent store. You will be turned away if not properly equipped. **Electrical devices (*i.e.* anything with a battery) should never be taken to the solvent store**.

2. Bottles must always be transported to and from the store in Winchester carriers. This applies not only to filled bottles, but also to empty bottles being carried for filling.

3. Bottles to be filled must be **labelled** with the solvent name and your laboratory number.

4. Place an order in LabSafe for the solvent(s) you need in advance. Print the order details and take them with you when you go to collect your solvent.

5. ***Only enter the solvent store if a member of the technical staff is present.***

6. When filling empty bottles from the drums:
    - **only use the dispensing tap** at the front of the drum
    - **do not turn either of the other two taps** that connect the drum to the gas line
    - **do not overfill** the bottles: leave a gap of at least 4 cm between the solvent and the base of the neck, to allow for expansion
    - **turn off** the tap when finished.

7. If you find that no solvent comes out of the drum, or if the flow of solvent stops while filling:
    - **turn off** the dispensing tap
    - **do not turn any other taps** or attempt to rectify the problem yourself
    - inform the member of technical staff on duty.

8. ***Never leave the dispensing tap open after use,*** even if you think the drum is empty.

9. If the solvent store is very busy, wait until others have exited before you enter, even if the drum you need appears to be free.

10. **Never** carry Winchesters under your arm or by the neck of the bottle. **Always** use a suitable carrier.

11. Please refer to Appendix I for interim measures during the Covid-19 pandemic.

Dr John Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

Code of Practice C: Peroxides

1. Several commonly-used organic solvents containing the ether linkage are susceptible to peroxidation by atmospheric oxygen. Serious accidents have occurred in the past due to the explosion of these peroxide-containing solutions during distillation. These solvents include diethyl ether and other dialkyl ethers, 1,4-dioxane, tetrahydrofuran, triethyl orthoformate, monoglyme ($CH_3OCH_2CH_2OCH_3$), diglyme ($CH_3OCH_2CH_2OCH_2CH_2OCH_3$), 2-methoxyethanol, 2-methoxyethyl acetate, 2-butoxyethanol and propionaldehyde. Peroxide in diisopropyl ether is particularly dangerous because of its tendency to separate as a solid on the neck and upper parts of bottles. Other classes of compound, including alcohols and alkenes (particularly dienes, homoallylic polyenes and chloroalkenes) are also susceptible to autoxidation reactions that lead to the formation of explosive products. In many cases, commercial materials that are susceptible to autoxidation are supplied with stabilisers to decrease the rate at which dangerous levels of peroxides accumulate.

Use only peroxide-free solvents.

Wherever possible, avoid evaporating ether-based solvents to dryness.

2. Testing for Peroxides

Ethers obtained from the Central Store should be tested for peroxide before use. They should be retested at fortnightly intervals thereafter. Particular care and attention should be paid to any other materials described above in Part 1, in particular any material that does not contain a stabiliser or has been stored for a lengthy period of time.

(a) Test papers for peroxides are available from the Chemistry Stores.

(b) To a sample of the ether add an equal volume of 2% KI solution and one drop of hydrochloric acid (2 mol dm^{-3}). A brown coloration of iodine in the ether layer (blue when starch is added) indicates the presence of peroxide.

3. Emergencies

(a) In the event that a solvent contains high levels of peroxides, do not allow the solvent to evaporate. If the solvent is miscible with water, add at least 5 parts water to 1 part solvent and seek the advice of your supervisor, the Safety and Research Technician, or the Departmental Safety Coordinator.

(b) In the event that an explosion has occurred, evacuate uninjured personnel from the vicinity, switch off any equipment involved and deploy the emergency measures outlined in Section B (summon first aid for minor injuries, dial 9999 for major injuries and then notify the University on 43333).

Dr John Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

Code of Practice D: Vacuum Line Procedures

1. Vacuum-Line Procedures

(a) VACUUM LINES

(i) High vacuums (very low pressures) are used routinely in the Chemistry Department for carrying out distillations, sublimations, the removal of residual traces of solvents from solids, the removal of air/oxygen from apparatus prior to refilling with an inert gas and for preparing vessels containing reactants free from oxygen/nitrogen/carbon dioxide *etc*, *i.e.* the usual components of air.

(ii) The high vacuums are provided by a mechanical pump, sometimes in conjunction with an additional oil diffusion 'pump' or a turbomolecular pump. Always ahead of this system of pumps is at least one (but often two) vessels cooled in liquid nitrogen to trap volatile materials in the system which would be harmful to the pumps. **The major safety hazard** in using a vacuum line in conjunction with **liquid nitrogen** as the cryogen is the strong likelihood of **CONDENSING OUT *OXYGEN-ENRICHED LIQUID AIR*** when the system is opened up to atmospheric pressure [see Code of Practice E].

(iii) The pumping system in (ii) above is connected to the vacuum 'line' which is constructed of glass tubing having a thickness appropriate to the diameter of the bore so as to be safe from the possibility of *implosion*. It is worth recording that over the past 50 years in the Chemistry Department in Durham there has never been an accident involving *implosion* through the mechanical failure of the fundamental parts of a standard vacuum line. Any *large* vessel attached to a standard vacuum line will require special protection. Access to the vacuum is provided *via* greased taps or Young's taps having a Teflon plunger.

(b) VACUUM-LINE PROCEDURES

(i) <u>SWITCHING ON</u>

With the vacuum line closed and **the traps spotlessly clean,** the mechanical pump is switched on and the traps are surrounded by liquid nitrogen contained in Dewar vessels. When the pressure gauge has reached a steady minimum, any oil diffusion pump in the system may be switched on after first ensuring a good flow of water through their condensers if appropriate*. At this point any cryogenic traps may be put in place.*

(ii) <u>SWITCHING OFF</u>

(a) First switch off the heater for the oil diffusion pump and allow 5 minutes for the unit to cool down.

(b) It is now vitally important that the vessels containing the cryogens surrounding the traps are removed: the potentially **very dangerous hazard** is that with liquid nitrogen surrounding the trap, liquid oxygen will condense quite rapidly into it and the possibility exists for any organic material in the trap to be converted to the dangerous hydroperoxides/ peroxides.

Furthermore, if someone inadvertently decides to close the tap on the vacuum line later, as the liquid nitrogen subsequently evaporates, the closed glass system containing liquid oxygen will also warm up and an **explosion** will take place!

(c) Open up one tap on the vacuum line, or a specially designed bleed valve, to allow air into the apparatus and switch off the mechanical pump immediately.

(d) The correct procedure is to **remove the traps completely** and thoroughly clean and dry them in readiness for their next use

(iii) Distillations under HIGH Vacuum
It is necessary to assess the possibility of an implosion due to faulty glassware or the size of the glassware.

(a) Glassware should be inspected for cracks, chips, or signs of damage beforehand and rejected if faulty.
(b) The possibility of an implosion increases as the size of the apparatus being evacuated increases. Nevertheless, when **any** vacuum distillation is to be carried out in the laboratory, a protective blast screen **must** be used.
(c) PTFE taps in vacuum equipment must not be allowed to become cooled below 15ºC by liquid nitrogen as this can cause leakage of air down the barrel of the tap to the atmosphere and the dangerous condensation of liquid oxygen into the apparatus.

2. Emergencies

(a) In the event that a nitrogen trap has been left open to air or a vacuum line has allowed air ingress, and the liquid in the trap has a blue colour:
(i) evacuate the laboratory.
(ii) If possible place a blast screen in front of the trap.
(iii) Open the line including the trap fully to air and then immediately remove the cooling.
(iv) Leave the area and allow the condensate to evaporate. Do not allow re-entry to the area until all the condensed gas has evaporated and the remaining liquid is at room temperature.

(b) In the event that an explosion has occurred, evacuate uninjured personnel from the vicinity, switch off any equipment involved and deploy the emergency measures outlined in Section B (summon first aid for minor injuries, dial 9999 for major injuries and then notify the University on 43333).

Dr John Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

Code of Practice E: Use of Cryogens

1. Gases and Cryogens in Enclosed Areas

Suitable ventilation should be ensured when using gases and cryogens to prevent oxygen depletion. Atmospheres containing < 18% oxygen are potentially dangerous. The risk of unconsciousness followed by brain damage or death due to asphyxia is greatly increased at oxygen levels below 10%. Cryogens produce large volumes of gas. For example 1.5 litres of liquid nitrogen will reduce oxygen levels to below 18% in a typical lift (see **Section G**).

Do not travel or allow anyone else to travel in a lift with cylinders of gases or cryogens.

2. The Use Of Liquid Nitrogen As A Coolant

(a) LIQUID NITROGEN - PERSONAL PROTECTION

(**UHSS Topic A-Z/Cryogens**)

The Department supplies liquid nitrogen, which boils at 77 K (–196 °C), chiefly in metal vacuum flasks (Dewar vessels), each holding 25 dm^3.

(i) Burns

Prevent splashes reaching your face and hands by wearing goggles and gloves. The gloves: (a) should be loose-fitting, so that you can shake them off if coolant finds its way to your hands; and (b) should not be rubber (which becomes embrittled at very low temperatures). Clothing should be worn such that spilled coolant runs off immediately; do not allow the coolant to come to rest long enough to burn your skin. Visors or face shields with appropriate EN166 classification may also be used for added protection.

(ii) Vaporisation in a confined space

Do not cork or seal any vessel containing liquid nitrogen. It is boiling continually and the vaporisation produces a seven-hundredfold increase in volume, so a sealed vessel will explode.

(iii) Asphyxiation

A room where liquid nitrogen is evaporating should have a good supply of fresh air so that the proportion of oxygen in the atmosphere is kept above the minimum (19.5%) for normal human comfort. Oxygen monitors should be used if the ventilation is insufficient.

Do not travel or allow anyone else to travel in a lift with liquid nitrogen.

(iv) Thermal shock to vessels

Introduce coolant around or into a glass vessel slowly so that sudden thermal stresses are not set up in the glass. In time, Dewar vessels of glass that are subjected often to coolant will succumb to the repeated stress by imploding, so you should guard in advance against flying glass from an implosion by covering all exposed glass surfaces of such vessels with adhesive tape or appropriate plastic netting.

(b) CHEMICAL HAZARD

Liquid nitrogen-cooled **open vessels** are cold enough to condense oxygen from air in the atmosphere. You should be aware that liquid oxygen, despite its coldness, is chemically reactive, particularly towards some organic substances.

Further information on freeze-pump-thaw/degassing solvents, which involves liquid N_2 and vacuum lines, can be found in Code of Practice F.

3. The Use of Solid Carbon Dioxide ('Dry Ice')

1 kg of solid CO_2 will produce 0.45 m^3 of gas and the sublimation rate is approximately 1% of total mass per hour in an insulated container, rising to 14% per hour at room temperature in the open.

(a) In order to avoid burns, wear insulated gloves. Do not handle with bare hands.

(b) When adding solid CO_2 to organic solvents, for example when preparing traps or cold fingers, the initial rate of CO_2 addition to the warm (room temperature) solvent should be slow to avoid solvent being expelled from the trap by the vigorous boil off.

(c) Carbon dioxide differs from other asphyxiant gases in that raised levels can be sensed and will cause discomfort or more serious consequences. The normal CO_2 level is 0.0003%. At 1% CO_2, there will be a slight, unnoticeable increase in breathing rate; at 5–10%, breathing becomes laboured at a rate up to twice the normal rate, hearing ability is reduced, headaches develop, blood pressure and pulse rate increase, and sensory disturbances (visual, auditory) develop, leading to confusion and ultimately a loss of consciousness within minutes. **Concentrations of 20% and above are immediately hazardous to life, even without oxygen depletion**.

Never take solid CO_2 into a confined space, such as a lift, a controlled temperature room or the passenger compartment of a car (see **Section G** for the definition of a confined space).

4. Emergency Measures

(a) In the event that you discover someone unconscious in a confined space (**Section G**) that contains cryogens or gas cylinders, **do not enter the room**. First, call the emergency services (9999) and then seek assistance from the Chemical Hazard Response Team (if available, **Section B**).

(b) Unprotected parts of the body that come into contact with uninsulated, cold equipment may be freeze-welded to it and be torn on removal. Because of the rapidity of damage to nerves, there may well be little warning through localised pain. All cold burns should be checked by a first-aider or by a medical expert in extreme circumstances, to confirm the extent of damage.

Dr John Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

Code of Practice F: Solvent Degassing

1. Degassing Solvents

For some reactions bubbling N_2, Ar or He gas through the solvent for about 20 minutes is sufficient. Be aware that bubbling gases through solvent can lead to significant solvent loss due to evaporation. For applications where sensitivity of the reaction to O_2 is a concern, degassing can be achieved by a Freeze-Pump-Thaw technique in an appropriate glass vessel.

2. Procedure for Freeze-PUMP-Thawing DEGASSINGS of solvents

(a) Transfer the solvent into an appropriate vessel. It is recommended that either a Schlenk tube or round-bottom flask fitted with a Young's tap be used; vessels should be no more than half-full. Caution: some polar solvents (*e.g.* water, acetonitrile, methanol) expand on cooling, which can lead the glass vessel to shatter) and hence freeze-pump-thaw should not be used. **Do not** use modified Erlenmeyer-type or conical flasks. Ensure that all taps to the vessel are closed.

(b) Check the glass vessel for any star cracks before beginning the process and fit appropriately sized protective stretchy plastic mesh around the vessel. This will help with the containment of the glass debris in the event of an explosion or implosion.

(c) Prepare and test an appropriate vacuum line, making sure there are no leaks in the vacuum line; the line must be equipped with a vacuum/pressure gauge that indicates a vacuum of < 1 mbar. A line operating above this pressure could lead to the possibility of O_2 condensation. A line equipped with a rotary pump should normally operate at < 0.1 mbar. Ensure you **know** what inert gas (typically either nitrogen or argon), if any is used on your line.

(d) Be especially careful when using a vacuum line that is supplied with argon; argon condenses readily into a vessel cooled by liquid nitrogen (b.p. 87 K, *c.f.* liquid nitrogen, b.p. 77 K).

(e) Connect the glass vessel *via* the tap to the vacuum line. Keeping the tap closed evacuate the tubing between the vacuum line and the tap of the solvent-containing vessel. Before proceeding, ensure that a vacuum of < 1 mbar has been achieved.

(f) Slowly insert the glass vessel into a Dewar flask containing liquid nitrogen (usually only immerse the vessel to the level of the solvent) and leave until the solvent has completely frozen. Note that the tap should not be allowed to cool during this process. (This includes ensuring that the tap is above the level of the neck of the Dewar and so it is not cooled by the boil-off gas.)

(g) Open the tap on the solvent-containing glass vessel to the vacuum and leave until the pressure in the vacuum line reaches its base pressure, (*i.e.* < 1 mbar), which may take several minutes, then gently close the vessel's tap.

(h) Remove the glass vessel from the liquid nitrogen Dewar and allow it to warm to room temperature slowly, ensuring the protective stretchy plastic mesh stays in place.

(i) During the thawing process use a small blast shield to protect the face, neck and body. The use of a Face Visor is also recommended. If this thawing procedure is carried out in a fume hood, lower the sash as far as possible.

(j) You must not use a hot air gun to speed up thawing. Heating a sealed glass vessel containing solvents could increase the internal pressure and could result in an explosion.

(k) Repeat steps (e)-(h) a further two times. The sample is degassed once no rise in pressure is noted when the tap is opened after freezing in liquid nitrogen.

(l) After the final degassing procedure the vessel can be back-filled with inert gas, **but only once the vessel and the liquid have reached ambient temperature.**

The solvent is now degassed and ready to be used.

P W Dyer
7 September 2020 (Review date: 7 September 2022)

Code of Practice G: Disposal of Lithium Aluminium Hydride and Grignard Reagents

1. Recommended procedure for the disposal of $LiAlH_4$

(a) Powder (1 g quantity) or ether solution (10 ml quantity)

The disposal must be carried out in a fume hood, free of clutter, flammable materials, and solvents. To a flask, equipped with a stirrer bar, a condenser (connected to a nitrogen inlet and a bubbler *via* a T-piece), an addition funnel, a Quick-fit thermometer, and containing a dry (supplied through the departmental SPS) low reactivity, high boiling solvent such as toluene (20 ml) or heptane (20 ml), slowly and cautiously add $LiAlH_4$ (1 g); see Note 1. Cool the flask containing the suspension in an ice bath. Maintaining the system under a nitrogen atmosphere, slowly and carefully add dry (dried over molecular sieves) ethyl acetate (10 ml) through the addition funnel while stirring the suspension. Continuously monitor the temperature *via* the internal thermometer to ensure that the ethyl acetate is not being added too fast. Leave the mixture stirring for 1 hr and then slowly add isopropyl alcohol (10 ml) *via* the addition funnel and leave stirring for a further 1 hr. Slowly add methanol (10 ml) *via* the addition funnel and leave stirring for a further 1 hr. Slowly add water (5 ml) *via* the addition funnel and leave stirring for a further 1 hr. Add the resulting mixture from the flask slowly and carefully to ice-cold water (20 ml) while stirring. In order to neutralise the mixture add dilute HCl (check pH). Separate the organic layer and dispose in waste bottle category “C” and pour the aqueous layer down a fumehood sink.

Note 1: Lithium aluminium hydride ($LiAlH_4$) reacts violently with water and has a significant heat of solvation. Therefore, do not add solvent to dry $LiAlH_4$. Instead, slowly add $LiAlH_4$ to anhydrous solvent in a nitrogen-purged flask as above; the initial small amount of $LiAlH_4$ will react with residual trace moisture.

Note 2: For the disposal of quantities more than 1 g, the above method is not appropriate and must not be used. A separate protocol must be written, approved, and implemented.

2. Recommended procedure for the disposal of Grignard reagents

(a) Solution (10 ml quantity)

The disposal must be carried out in a fume hood, free of clutter, flammable materials, and solvents. To a flask, equipped with a stirrer bar, a condenser (connected to a nitrogen inlet and a bubbler *via* a T-piece), an addition funnel, and containing a dry (supplied through the departmental SPS) low reactivity, high boiling solvent such as toluene (20 ml) or heptane (20 ml), slowly and cautiously add the solution containing the Grignard reagent (10 ml). Cool the flask in an ice bath. Maintaining a nitrogen atmosphere, slowly and carefully add isopropanol (20 ml) through the addition funnel while stirring the flask’s contents. Leave the mixture stirring for 1 hr. Slowly add methanol (10 ml) *via* the addition funnel and leave stirring for a further 1 hr. Slowly add water (5 ml) *via* the addition

funnel and leave stirring for a further 1 hr. Add the mixture slowly and carefully to ice/water with stirring. In order to neutralise the mixture add dilute HCl (check pH). Separate the organic layer and dispose in waste bottle category “C” and pour the aqueous layer down the sink.

(b) **Solid (1 g, in a Sure Seal-type bottle)**

The disposal must be carried out in a fume hood, free of clutter, flammable materials, and solvents. Extremely cautiously add a dry (supplied through the departmental SPS) low reactivity, high boiling solvent such as toluene (20 ml) or heptane (20 ml) to the bottle containing solid Grignard reagent (1 g) using a syringe (and appropriate exit needle) to make a slurry solution. To a flask, equipped with a stirrer bar, a condenser (connected to a nitrogen inlet and a bubbler *via* a T-piece), an addition funnel, and containing a dry (supplied through departmental SPS) low reactivity, high boiling solvent such as toluene (20 ml) or heptane (20 ml), slowly and cautiously add the slurry solution containing the Grignard reagent. Cool the flask in an ice bath. Maintaining a nitrogen atmosphere, slowly and carefully add isopropanol (20 ml) through the addition funnel while stirring the flask’s contents. Leave the mixture stirring for 1 hr. Slowly add methanol (10 ml) *via* the addition funnel and leave stirring for further 1 hr. Slowly add water (5 ml) *via* the addition funnel and leave stirring for a further 1 hr. Add the mixture slowly and carefully to ice/water with stirring. In order to neutralise the mixture add dilute HCl (check pH). Separate the organic layer and dispose in waste bottle category “C” and pour the aqueous layer down the sink.

Notes:

This disposal procedure for Grignard reagents can be used for the disposal of organolithium reagents (10 ml quantity).

For the disposal of quantities of either Grignard reagents or organolithium reagents of more than 10 ml, the above method is not appropriate and must not be used. A separate protocol and risk assessment must be written, approved, and implemented.

P W Dyer
7 September 2020 (Review date: 7 September 2022)

Code of Practice H: Carcinogens

1. Chemical Carcinogens and Mutagens: Rules and Usage Guidance Notes

Information regarding the potential for materials to act as carcinogens can be found in the Hazard Statements: such materials are classified as H340, H341, H350, H351, H360, H361 *etc*.

Identification of chemical carcinogens causing cancer in man has been slow because there is a time-lag; exposure of young persons must be taken particularly seriously. Extra care is needed to avoid exposure of women who are pregnant, or liable to become pregnant, because in a number of cases the foetus has been shown to be especially sensitive to harmful substances ingested or inhaled by the mother. There is now a wide measure of overlap between carcinogens and mutagens (agents that cause inherited changes in the genetic message) and, to a lesser extent, with teratogens (agents that act early in pregnancy to cause malformations of the developing foetus).

Chemicals differ very greatly in carcinogenic potency, and there is no clear dividing line between very weak carcinogens, in which it is very difficult to establish activity with certainty, and non-carcinogens. Thus, expressed as daily dose per kilogramme of body weight to induce tumours in 50% of test cases, the carcinogenic dose of aflatoxin B_1 (a fungal metabolite) is about 1 mg, the dose of 2-naphthylamine (a human occupational carcinogen) is about 10 mg and the dose of the weakest (doubtful) agents, such as saccharin, approaches 10 g. Some chemicals have a weak potency and can be handled without significant risk so long as the usual rules of laboratory hygiene are observed. Others are very potent and should only be used, if at all, with strict precautions in special accommodation.

Besides actual potency, factors affecting the degree of hazard are the volatility of the substance, whether it forms a fine dust, its ease of being absorbed through the lungs, mouth or skin, and the duration and severity of exposure.

Please note the following guidance:

(a) The use of high-risk chemical carcinogens that are not formally prohibited should be avoided wherever possible. If they must be used, the most stringent conditions must be applied to their acquisition, storage, use and disposal. They must be handled and used in such a way as to prevent entry of the carcinogens into the body of the researcher or of anyone else by any route.

(b) When using materials that are known or suspected carcinogens or mutagens a specific risk assessment **must** be made in the worker's laboratory notebook and counter signed by the supervisor. This assessment should include detailed information regarding the handling, uses and disposal procedures for the material. The following list covers many known or suspected carcinogens, but there is no definitive list. Manufacturers and suppliers have a legal duty to provide and maintain material safety data sheets (MSDS) for chemicals which they supply. *Up-to-date MSDS should be consulted to check for whether chemicals to be used have been identified as suspected carcinogens*. New materials prepared during the course of research should also be considered.

(c) The need to avoid the use of benzene and carbon tetrachloride should be noted particularly. Formaldehyde shows mutagenic activity but there is no published work showing it to be carcinogenic. However, it would be prudent to minimise inhalation of formaldehyde fumes and to avoid its interaction, even in small concentrations, with hydrogen chloride. The product bis(chloromethyl)ether is a human carcinogen with high risk potential.

(d) **Any work involving carcinogenic, mutagenic or teratogenic materials should be subject to a separate risk assessment**.

J M Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

A

A-alpha-C (2-Amino-9H-pyrido[2,3-b]indole)
Acetaldehyde
Acetamide
Acetochlor
2-Acetylaminofluorene
Acifluorfen
Acrolein
Acrylamide
Acrylonitrile
Actinomycin D
Adriamycin (Doxorubicin hydrochloride)
AF-2;[2-(2-furyl)-3-(5-nitro-2-furyl)]acrylamide
Aflatoxins
Agaritine
Alachlor
Alcidine
Aldrin
Allyl chloride
Allyl glycidyl ether
Allyl isothiocyanate
Allyl isovalerate
Aluminium products
2-Aminoanthraquinone
p-Aminoazobenzene
o-Aminoazotoluene [solvent yellow 3]
4-Aminobiphenyl (4-aminodiphenyl)
3-Amino-9-ethylcarbazole hydrochloride
1-Amino-2-methylanthraquinone
Amitrole
Ammonium dichromate
Analgesic mixtures containing phenacetin
Androgenic (anabolic) steroids
Aniline (and homologs)
ortho-Anisidine
ortho-Anisidine hydrochloride
para-anisidine
anthanthrene
Antimony oxide (antimony trioxide)
Aramite
Arsenic (inorganic arsenic compounds)
Arsine
Asbestos
Auramine
Azaserine
Azathioprine
Azacitidine
Azobenzene
Azathioprine

B

Benz[a]anthracene
Benzene
Benzidine [and its salts]
Benzidine-based dyes
Benzo[b]fluoranthene
Benzo[j]fluoranthene
Benzo[k]fluoranthene
Benzofuran
Benzo[a]pyrene
Benzotrichloride
Benzyl chloride
Benzyl violet 4B
Beryllium and beryllium compounds
Bis(2-chloroethyl)ether
N,N-Bis(2-chloroethyl)-2-naphthylamine (Chlornapazine)
Bischloroethyl nitrosourea (BCNU) (Carmustine)
Bis(chloromethyl)ether and technical-grade chloromethyl methyl ether
Bitumens, extracts of steam-refined and air refined
Bleomycins
Bracken fern
Bromodichloromethane
2-bromoethyl ether
Bromoform
1,3-Butadiene
1,4-Butanediol dimethanesulfonate (Busulfan, myleran)
Butylated hydroxyanisole (BHA)
t-butyl methyl ether
beta-Butyrolactone

C

Cadmium and cadmium compounds
Caffeic acid
Captafol
Captan
Carbazole
Carbon tetrachloride
Carbon-black extracts
Carrageenan, degraded
Ceramic fibers (airborne particles of respirable size)
Chlorambucil
Chloramphenicol
chlorbenzilat
Chlordane
Chlordecone (Kepone)
Chlordimeform
Chlorendic acid
Chlorinated camphene
Chlorinated Parrafins
alpha-Chlorinated toluenes
Chlormadinone aceate
Chlornaphazine[n,n-bis(2-chloroethyl)-2-naphthylamine]
Chlorodibromomethane
Chloroethane (ethyl chloride)
p-Chloroaniline
Chlorodiphenyl (chlorinated biphenyls)
1-(2-Chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU) (Lomustine)
1-(2-Chloroethyl)-3-(4-methylcyclohexyl)-1-nitrosourea (Methyl-CCNU)
Chloroform
bis(Chloromethyl) ether
Chloromethyl methyl ether
3-Chloro-2-methylpropene
4-Chloro-ortho-phenylenediamine
p-Chloro-o-toluidine
Chlorophenols
Chlorophenoxy herbicides
Chloroprene
Chlorothalonil
Chlorozotocin
Chromium
Chromium (hexavalent compounds)
Chrysene
C.I. Acid Red 114
C.I. Basic Red 9 monohydrochloride
Ciclosporin (Cyclosporin A; Cyclosporine)
Cinnamyl anthranilate
Cisplatin
Citrus Red No. 2
Clofibrate
Coal gasification products
Coal-tars and pitches
Cobalt metal powder
Cobalt [II] oxide
Conjugated estrogens
Copper acetoarsenite
Creosotes
Crystal violet
para-Cresidine
Cupferron
Cycasin
Cyclamates
1,4-cyclohexadiene
Cyclophosphamide (anhydrous)
Cyclophosphamide (hydrated)

D

D&C Orange No. 17
D&C Red No. 8
D&C Red No. 9
D&C Red No. 19
Dacarbazine
Daminozide
Dantron (Chrysazin; 1,8-Dihydroxyanthraquinone)
dapsone
Daunomycin
DCM
DDD (Dichlorodiphenyldichloroethane)

DDE (Dichlorodiphenyldichloroethylene)
DDT (Dichlorodiphenyltrichloroethane)
DDVP (Dichlorvos)
Decabromodiphenyl ether
N,N'-Diacetylbenzidine
2,4-Diaminoanisole
2,4-Diaminoanisole sulfate
4,4'-Diaminodiphenyl ether (4,4'-Oxydianiline)
2,4-Diaminotoluene
Diaminotoluene (mixed)
o-Dianisidine-based dyes
Dibenz[a,h]acridine
Dibenz[a,j]acridine
Dibenz[a,h]anthracene
7H-Dibenzo[c,g]carbazole
Dibenzo[a,e]pyrene
Dibenzo[a,h]pyrene
Dibenzo[a,i]pyrene
Dibenzo[a,l]pyrene
1,2-Dibromo-3-chloropropane (DBCP)
1,2-Dibromoethane
2,3-Dibromo-1-propanol
Dichloroacetylene
p-Dichlorobenzene
3,3'-Dichlorobenzidine
3,3'-Dichlorobenzidine dihydrochloride
1,4-Dichloro-2-butene
3,3'-Dichloro-4,4'-diaminodiphenyl ether
1,1-Dichloroethane
1,2-Dichloroethane
Dichloroethyl ether
Dichloromethane (Methylene chloride)
1,2-Dichloropropane
1,3-Dichloropropene
Dieldrin
Dienestrol
Diepoxybutane
Di(2-ethylhexyl)phthalate
1,2-Diethylhydrazine
Diethyl sulfate
DES, Diethylstilbestrol
Diglycidyl resorcinol ether (DGRE)
Dihydrosafrole
Diisopropyl sulfate
3,3'-Dimethoxybenzidine (ortho-Dianisidine)
3,3'-Dimethoxybenzidine dihydrochloride (ortho-dianisidine dihydrochloride)
para-Dimethylaminoazobenzene
4-Dimethylaminoazobenzene
trans-2-[(Dimethylamino)methylimino]-5-[2-(5-nitro-2-furyl)vinyl]-1,3,4-oxadiazole
7,12-Dimethylbenz(a)anthracene
3,3'-Dimethylbenzidine (ortho-Tolidine)
3,3'-Dimethylbenzidine dihydrochloride
Dimethylcarbamoyl chloride
1,1-Dimethylhydrazine (UDMH)
1,2-Dimethylhydrazine
Dimethyl sulfate
Dimethylvinyl Chloride
2,4-dinitrofluorobenzene
1,6-Dinitropyrene
1,8-Dinitropyrene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
1,4-Dioxane
1,2-diphenylhydrazine (hydrazobenzene)
Diphenylhydantoin (Phenytoin)
Diphenylhydantoin (Phenytoin), sodium salt
Direct Black 38
Direct Blue 6
Direct Brown 95
Disperse Blue 1

E

Epichlorohydrin
Erionite
Estradiol 17B
Estrogens (not conjugated)
Estradiol-17
Estrone
Ethinylestradiol
Mestranol
Estrone
Ethinylestradiol
Ethyl acrylate
Ethyl methanesulfonate
Ethyl-4,4'-dichlorobenzilate
Ethylene dibromide
Ethylene dichloride (1,2-Dichloroethane)
N-Ethyl-N-nitrosourea
Ethylene imine
Ethylene oxide
Ethylene thiourea
Ethyleneimine

F

Folpet
Formaldehyde (gas or aqueous solution)
2-(2-Formylhydrazino)-4-(5-nitro-2-furyl) thiazole
Furan
Furazolidone
Furmecyclox
Fusarin C

G

Gallium arsenide
Gasoline (petrol)
Glasswool fibers (airborne particles of respirable size)
Glu-P-1 (2-Amino-6-methyldipyrido[1,2- a:3', 2'-d]imidazole)
Glu-P-2 (2-Aminodipyrido[1,2-a:3',2'-d]imidazole)
Glycidaldehyde
Glycidol
Griseofulvin
Gyromitrin (Acetaldehyde methylformylhydrazone)

H

HC Blue 1
Heptachlor
Heptachlor epoxide
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclohexanes
Hexachlorodibenzodioxin
Hexachloroethane
Hexamethylphosphoramide (HMPA)
Hydrazine
Hydrazine dihydrobromide
Hydrazine sulfate
Hydroquinone
Hydroxybutyric acid lactone

I

Indeno [1,2,3-cd]pyrene
Indium trichloride
IQ (2-Amino-3-methylimidazo[4,5-f]quinoline)
Iron dextran complex
Isosafrole

K

Kepone (Chlordecone)

L

Lactofen
Lasiocarpine
Lead
Lead acetate
Lead phosphate
Lindane and other hexachlorocyclohexane isomers

M

Malonaldehyde
Mancozeb
Maneb
Me-A-alpha-C (2-Amino-3-methyl-9H-pyrido[2, 3-b]indole)
Medroxyprogesterone acetate

MeIQ(2-Amino-3,4-dimethylimidazo[4,5-f]quinoline)
MeIQx(2-Amino-3,8-dimethylimidazo[4,5-f]quinoxaline)
Melphalan
Merphalan
Mestranol
Methoxychlor
2-Methylaziridine (Propyleneimine)
Methylazoxymethanol
Methylazoxymethanol acetate
Methyl bromide
3-Methylcholanthrene
5-Methylchrysene
4,4'-Methylene bis(2-chloroaniline) (MOCA, MBOCA)
4,4'-Methylene bis(N,N-dimethyl)benzenamine
Methylene chloride
4,4'-Methylene bis(2-methylaniline)
4,4'-Methylenedianiline (MDA)
4,4'-Methylenedianiline dihydrochloride
Methylhydrazine and its salts
Methyl chloromethyl ether
Methyl-CCNU
Methyl iodide
Methyl methanesulfonate
2-Methyl-1-nitroanthraquinone
N-Methyl-N'-nitro-N-nitrosoguanidine (MNNG)
N-Methyl-N-nitrosourea
N-Methylolacrylamide
Methylthiouracil
Metiram
Metronidazole
Michler's ketone
Mineral Oils, untreated and mildly treated
Mirex
Mitomycin C
MOPP
Monocrotaline
5-(Morpholinomethyl)-3-[(5-nitro-fufurylidene)-amino]-2-oxazolidinone
Mustard gas

N

Nafenopin
1-Naphthylamine
2-Naphthylamine
3-Naphthylamine
Nickel and certain nickel compounds
Nickel carbonyl
Nickel subsulfide
Niridazole
Nitrilotriacetic acid
Nitrilotriacetic acid, trisodium salt monohydrate
5-Nitroacenaphthene
5-Nitro-o-anisidine
o-Nitroanisole
4-Nitrobiphenyl
p-Nitrochlorobenzene
6-Nitrochrysene
Nitrofen
2-Nitrofluorene
Nitrofurazone
1-[(5-Nitrofurfurylidene)amino]-2-imidazollidinone
1-[(5-Nitrofurfurylidene)-N-[4-(5-Nitro-2-furyl)-2 thiazolyl]acetamide
Nitrogen mustard (Mechlorethamine)
Nitrogen mustard hydrochloride (Mechlorethamine hydrochloride)
Nitrogen mustard N-oxide
Nitrogen mustard N-oxide hydrochloride
2-Nitronaphthalene
2-Nitropropane
4-Nitropyrene
N-Nitrosodi-n-butylamine
N-Nitrosodiethanolamine
N-Nitrosodiethylamine
N-Nitrosodimethylamine
p-Nitrosodiphenylamine
N-Nitrosodiphenylamine
N-Nitrosodi-n-propylamine
N-Nitroso-N-ethylurea
3-(N-Nitrosomethylamino)propionitrile
4-(N-Nitrosomethylamino)-1-(3-pyridyl)-1-butanone (NNK)
N-Nitrosomethylethylamine
N-Nitroso-N-methylurea
N-Nitroso-N-methylurethane
N-Nitrosomethylvinylamine
N-Nitrosomorpholine
N-Nitrosonornicotine
N-Nitrosopiperidine
N-Nitrosopyrrolidine
N-Nitrososarcosine
Norethisterone (Norethindrone)

O

Ochratoxin A
Oestrogen, nonstreoidal
Oestrogen, steroidal
Oil Orange SS
4,4'-Oxydianiline
Oxadiazon
Oxymetholone
Oxazepam

P

Panfuran S
Pentachloroethane
Pentachlorophenol
Perylene
Phenacetin
Phenazopyridine hydrochloride
Phenesterin
Phenobarbital
Phenolphthalein
Phenoxybenzamine
Phenoxybenzamine hydrochloride
N-Phenyl-*b*-naphthylamine
Phenyl glycidyl ether
Phenylhydrazine and its salts
o-Phenylphenate, sodium
2-Phenylphenol
Phenytoin
PhiP(2-Amino-1-methyl-6-phenylimidazol[4,5-b]pyridine)
Polybrominated biphenyls
Polychlorinated biphenyls
Polychlorinated dibenzo-p-dioxins
Polychlorinated dibenzofurans
Polycyclic aromatic hydrocarbons
Polygeenan
Ponceau MX
Ponceau 3R
Potassium bromate
Potassium dichromate
Procarbazine
Procarbazine hydrochloride
Procymidone
Progesterone
Progestins
1,3-Propane sultone
Progargite
beta-Propiolactone
Propylene dichloride
Propylene imine
Propylene oxide
Propylthiouracil
Pyridinium chlorochromate

R

Radionuclides
Radon
Reserpine
Residual (heavy) fuel oils
Rhodamine 101
Rosin core solder

S

Saccharin
Saccharin, sodium
Safrole
Selenium sulfide
Shale-oils
Silica, crystalline (airborne particles of respirable size)
Sodium chromate tetrahydrate
Sodium dichromate

Sodium hexafluoroarsenate(V)
Sodium ortho-phenylphenate
Sterigmatocystin
Streptozotocin
Strontium chromate
Styrene
Styrene oxide
Sulfallate
Sulfur trioxide
Sulphur trioxide N,N-dimethylformamide complex

T

Talc containing asbestiform fibers
Terrazole
Testosterone and its esters
2,3,7,8-Tetrachlorodibenzo-para-dioxin (TCDD, dioxin)
1,1,2,2-Tetrachloroethane
Tetrachloroethylene (Perchloroethylene)
p-a,a,a-Tetrachlorotoluene
3,3',5,5'-tetramethylbenzidine
Tetranitromethane
Thioacetamide
4,4'-Thiodianiline
Thiourea
Thorium dioxide
Titanium dioxide
Tobacco, oral use of smokeless products
Tobacco smoke
Toluene diisocyanate
p-toluenesulphonic acid
ortho-Toluidine
ortho-Toluidine-based dyes
ortho-Toluidine hydrochloride
para-Toluidine
Toxaphene
Tremolite silicates
Treosulfan (Tresoluphan)
Trichlormethine (Trimustine hydrochloride)
1,1,2-Trichloroethane
Trichloroethylene
2,4,6-Trichlorophenol
1,2,3-Trichloropropane
Triphenyltin hydroxide
Tris(aziridinyl)-para-benzoquinone (Triaziquone)
Tris(1-aziridinyl)phosphine sulfide (Thiotepa)
Tris(2-chloroethyl) phosphate
Tris(2,3-dibromopropyl)phosphate
TRIZMA base
Trp-P-1 (Tryptophan-P-1) (3-Amino-1,4-dimethyl-5H-pyrido[4,3-b]indole)
Trp-P-2 (Tryptophan-P-2) (3-Amino-1-methyl-5H-pyrido[4,3-b]indole)
Trypan blue

U

Uracil mustard
Uranium compounds
Urethane (Ethyl carbamate)

V

Vinyl bromide
Vinyl chloride
4-Vinyl-1-cyclohexene diepoxide (Vinyl cyclohexene dioxide)
Vinylidene chloride (1,1-dichloroethylene)
n-vinyl pyrollidone
Vinyl pivalate
Vinyl trichloride (1,1,2-Trichloroethane)

X

2,6-Xylidine (2,6-Dimethylaniline)

Z

Zinc chromate
Zineb

Source: NIOSH (27/6/2017) and University of Oxford Department of Chemistry MSDS web resource (pre-2011).

Code of Practice I: Guidance Notes for the Use of Mercury and its Compounds

1. Accountability

(a) Strict care must be exercised in the storage, usage and disposal of mercury and its compounds, because of their known harmful effects. Mercury vapour has an occupational exposure level of 0.05 mg m^{-3}, above which such effects as nervous disturbance, insomnia and loosening of teeth may occur. Skin contact should be avoided as it has been known to lead to dermatitis and kidney damage. Water-soluble compounds are invariably toxic.

(b) Do not use organomercury compounds without first consulting the Departmental Safety Coordinator.

2. Handling Elemental Mercury

(a) Never leave a mercury surface open to the atmosphere: mercury has an appreciable vapour pressure at room temperature. Take advice from your supervisor or from the Departmental Safety Coordinator when setting up an apparatus in which mercury is required to move: an alternative fluid may be suitable.

(b) Cover dirty mercury with aqueous H_2SO_4 (0.1 mol dm^{-3}) and return it immediately to Mr Hofmann in CG127C.

(c) Recover spilled mercury immediately wearing rubber gloves as you work. If you spill mercury, you must clear the spillage. The usual method of recovery is to use suction through a glass capillary tube connected by pressure tubing to an aspirator (*e.g.* a Buchner flask) and a vacuum pump. If this method fails (for example if mercury falls into a crack in the floor) spread sparingly over the area of spillage either a paste of water, sulphur and calcium hydroxide or, preferably, zinc powder, which quickly forms an amalgam. Gather up all material used to deal with the spillage. A spillage kit is available from Mr Hofmann in CG127C.

Separate solid matter (*e.g.* glass, dust) from the mercury you recover by putting recovered mixture into a folded filter paper that you have pierced with a pin, and squeezing the mercury out through the pinhole. Put the paper into a disposal bag and treat it as solid heavy-metal waste.

You MUST ensure that no mercury enters the water-waste system.

(d) Give your recovered dirty mercury to Mr Hofmann in CG127C.

(e) There are no special recommendations for treatment to counter accidental exposure to mercury. Standard methods apply.

(i) For skin contact, wash the affected area thoroughly with cold water and remove contaminated clothing. This should be placed in a

polythene bag, sealed and labelled. Alternative clothing is available from the stores.

(ii) For inhalation, leave the area where the exposure occurred (administer oxygen if breathing is laboured) and apply artificial respiration to a casualty who is unconscious.*

(iii) For swallowing, administer large quantities of water or milk but do not induce vomiting.*

(iv) For effects of exposure that do not lessen within a few minutes, take the casualty to a hospital and explain there that exposure to mercury is responsible.

(v) Make a report in the Department's accident book if first aid was required, or if personal discomfort was experienced, or if defective practice or technique released mercury vapour.

[*Seek medical care as soon as possible in these cases.]

3. Departmental Mercury Service

Mr Hofmann provides the following service to users of mercury in the Department:

(a) receiving used mercury properly treated (Part 2(b)), and storing it pending disposal in the waste store

(b) providing chemicals and equipment to collect spilled mercury or to convert it to a harmless compound or mixture (Part 2(c)).

J M Sanderson
14 September 2020 (Review date: 14 September 2021)

Code of Practice J: Use of the Cold Room (CG211)

1. Before using the cold room, researchers should ensure familiarity with the procedures for operation of the room, particularly operation of the door, the location of the emergency button, and the appearance of the luminescent exit markings when the light is off.

2. Hazards and Risks

(a) Hazards

The main hazards result from the room being a confined space, without windows, that is maintained at a low temperature (4 °C). Additional hazards arise from the noise generated by the cooling fans in the room.

(b) Description of Risks

The principal risk from low temperatures is death or serious injury in the event of an accident should a worker be unable to exit the room. This risk is significantly amplified by the lack of windows and low ventilation. The confined space and low ventilation present a risk of asphyxiation from the accumulation of carbon dioxide or other gases that displace air. Volatile chemical hazards could accumulate to dangerous levels. Mould formation presents an inhalation risk from the resultant spores. Noise from cooling fans presents the risk that an activated fire alarm in the building may be inaudible.

3. Operating Protocols

(a) General rules:

(i) Do not **under any circumstances** take cryogens (carbon dioxide, nitrogen) into the cold room. This includes cryogens that may have been used for packaging commercial materials. Do not put samples received from external sources into the cold room without checking the packaging materials first.

(ii) The floor must be kept **free from obstruction**.

(iii) Materials left in the room must be in plastic, glass or metal containers and labelled with the date and name of the principal investigator. Do not use paper labels.

(iv) Do not use compressed gases in the cold room.

(v) Do not take flammable solvents or pyrophoric materials into the cold room.

(vi) Do not take volatile materials classed as hazardous by inhalation into the cold room.

(vii) Clean up spillages promptly.

(viii) Do not leave exposed paper, cardboard, or any other materials with a high cellulose content in the cold room – put these in a sealed plastic bag as soon as possible. Take your waste with you when you leave.

(ix) Do not take food or drink into the cold room (or leave them there).

(x) Maximum occupancy is 2 person hours per 24 hours (*e.g.* 2 people for 1 hour, 1 person for 2 hours *etc*).

(xi) Take portable lighting into the room if possible to assist with egress in the event of a power failure.

(b) **For Short Duration Work** (< 5 min), *e.g.* depositing material for use later, the door should be left open whilst the work is conducted.

(c) **For Long Duration Work** (> 5 min), *e.g.* to perform chromatography, users should discuss their plans with their supervisor and:

(i) ensure that there is sufficient time available for the work, within the 2 h per 24 h limit;

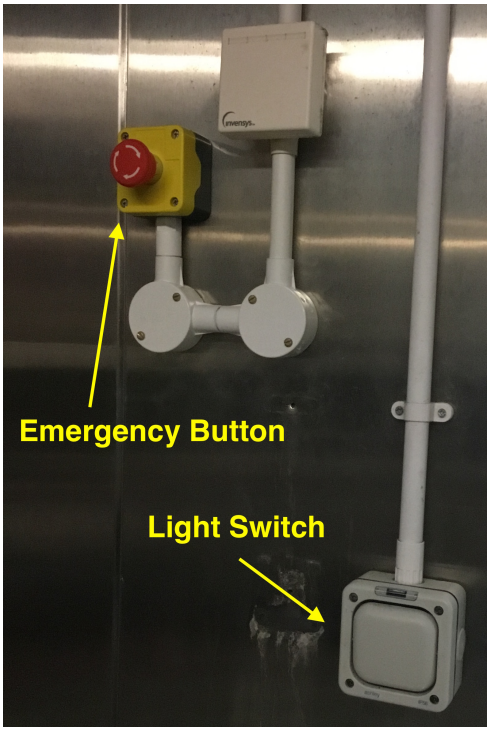
(ii) use appropriate personal protective equipment (PPE). This includes warm clothing (hat/jumper/gloves) in addition to (underneath) the PPE needed according to the risk and COSHH assessments and good laboratory practice (GLP);

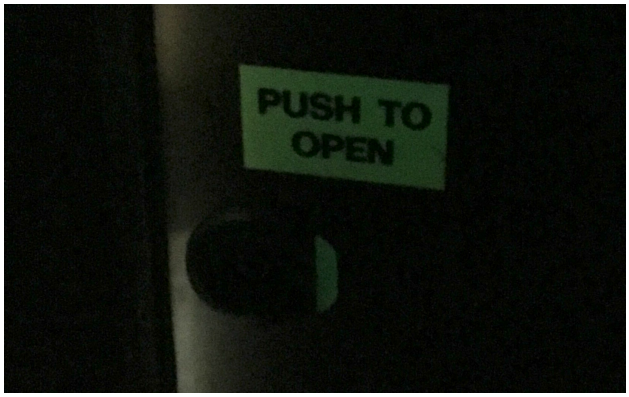
(iii) establish protocols for monitoring, usually involving a colleague who can monitor the time spent in the room and periodically check on the wellbeing of the occupant of the room. These protocols need to be agreed with the supervisor of the work and documented;

(iv) on completion of the work, ensure that other users are aware of the safe operating time that is remaining.

4. Emergency Measures

The cold room has a red emergency button to signal that help is needed. On pressing the button an alarm sounds in the corridor outside the room. The functioning of the button is checked during routine annual safety inspections. Researchers planning long duration work in the room should check its function immediately before starting their work.





In the event of a power failure, the button to open the door is marked by a luminescent tab, with a luminescent “Push to Open” sign located above it.

J M Sanderson
Chemistry Safety Committee Chair
14 September 2020 (Review date: 14 September 2021)

SECTION L: SPECIAL CODES OF PRACTICE FOR LABORATORY WORK

These codes of practice are updated annually (usually in October) by designated members of staff with experience of the relevant protocols. **Specific training in these codes of practice is a requirement** and must be completed annually. The designated staff member is responsible for organising the training and maintaining signed records of that training. Signatories to the code of practice agree that the code has been understood and will be followed. The performing of work in these codes by untrained individuals is unauthorised.

1. Special Experimental Procedures. Special codes of practice (**S-COP**) or standard operating procedures (SOPs) to be followed are listed below and are updated by the person stated, in consultation with the Departmental Safety Coordinator. The date of the last revision is shown. Please check the Chemistry Safety web pages for revisions made since this policy document was generated.

Notes of guidance for the use of cyanides (10/09/2019)	(**S-COP A**	- Dr Connor Sibbald)
High-pressure laboratory (15/09/2017)	(**S-COP B**	- suspended)
Reactions in Carius tubes (15/09/2017)	(**S-COP C**	- suspended)
Perchloric acid (13/09/2019)	(**S-COP D**	- Dr John Sanderson)
Elemental fluorine and anhydrous hydrogen fluoride (15/09/2017)	(**S-COP E**	**-** Prof Graham Sandford)
X-ray diffractometry (15/09/2017)	(**S-COP F**	- Dr Ehmke Pohl)
Live electrical work (13/09/2019)	(**S-COP G**	- Dr Bryan Denton)
Safe use of carbon monoxide gas at low pressures in synthetic laboratories (15/09/2017)	(**S-COP H**	- suspended)
Use of unsealed sources of radioactive materials (13/09/2019)	(**S-COP I**	- Dr Gary Sharples)
Laser safety policy (13/09/2019)	(**S-COP J**	- Dr Eckart Wrede)
Biological materials safety policy (13/09/2019)	(**S-COP K**	- Dr Gary Sharples)
Piranha (hydrogen peroxide/sulfuric acid) (14/09/2019)	(**S-COP L**	- Prof Andrew Beeby)
Hazardous material release involving the use of SC-B/A (10/09/2018)	(**S-COP M**	- Dr John Sanderson)

2. The rules below apply to the use of cyanides and Schedule 1 substances.

(a) Persons intending to use cyanides (CN^- compounds and HCN) must:
- read and complete **Special Code of Practice A**;
- comply with legal requirements for the storage of scheduled poisons;
- familiarise themselves with the location of medical oxygen (outside and inside CG004);
- inform a specialist first aider (see **Special Code of Practice A**) when work with cyanides is being carried out;
- conduct all manipulations inside CG004.

(b) All Schedule 1 substances must be stored in a suitable secure place and an inventory kept of their usage.

SECTION M: APPENDICES

APPENDIX A

SAFETY COMMITTEE: MEMBERSHIP 2020
(AUGUST 1) TO 2021 (JULY 31)

This Committee meets once each term. The Safety Administrator minutes its meetings.

Chair of Safety Committee and Chair's delegate, Waste Disposal:	Dr John Sanderson
Departmental Safety Coordinator, (DSC) and Safety and Research Technician:	Dr Connor Sibbald
Chemistry safety administrator and secretaries' representative:	Ms Lizzie Amies
Representative of technical and laboratory staff:	Ms Emma Smart
Buildings Manager	Mr Paul Hofmann
Deputy Health and Safety Coordinator:	Ms Emma Smart, Dr Connor Sibbald
Departmental Radiation Protection Coordinator:	Dr Dmitry Yufit
Biological Health & Safety Coordinator:	Dr Gary Sharples
Inorganic Chemistry laboratories:	Dr Philip Dyer
Departmental Laser Safety Coordinator: / Physical Chemistry laboratories:	Dr Eckart Wrede
Organic Chemistry laboratories:	Dr John Sanderson
Postdoctoral representative, appointed annually:	To be confirmed
Postgraduate representative, appointed annually:	To be confirmed
Health & Safety Business Partner (Science and Social Sciences & Health):	Nicola Irving
H&S Business Partner (Biological, Chemical and Radiation):	Gretta Roberts

Copies of the agenda and minutes are sent to the Health and Safety Service for information.

The minutes are received by the Board of Studies in Chemistry.

[a] Reports to the Chair of the Board on the first working day of each month; more frequently as necessary.

K. Coleman, Head of Department (Reviewed: September 2020)

APPENDIX B

DUTIES CARRIED OUT BY THE CHEMISTRY SAFETY AUDITOR

Make a verbal report as required to a representative of the Safety Committee about the annual audit in November of the following items. [*NB*. The list excludes items audited for electrical safety or as sources of radiation.].

1. Fire alarms: Check the written records held in the Science Caretakers' office of the weekly testing scheduled by Estates and Facilities' Electricians. Report significant irregularities to the Chemistry Health & Safety Coordinator.

2. Fire blankets: Make a visual check only, without removal, report on the Estates and Buildings K2 System of any defects, or absence of evidence of a recent service by the contractor.

3. Fire doors: Check that those not closed automatically during an alert are labelled as fire doors and are self-closing. Notify E & F *via* the K2 System, if any faults are found.

4. Fire exits: Check they are all clear with easy access and that they are not sticking. Request any repairs by E & F *via* the K2 System.

5. Fire extinguishers: Check that they are of the correct type, are supported properly, easily detached from the bracket, have unbroken seals and are in the correct location. Liaise with the Estates and Facilities representative and notify any defects, or absence of evidence of a recent service by the contractor.

6. Registered Step Ladders: Check on location, fitness for purpose and tag number.

7. First Aid Stations: Request a report from Miss Kerry Strong, who checks that the stations have more than the minimum quantities of the prescribed contents.

8. Fume cupboards: Report cupboards that are unduly untidy and dirty. At a user's request, report on the K2 System of any attention required.

9. Piped lab gases: Make an annual snapshot inspection of the external gas cylinder systems used by research groups (visible only). Report defects to the appropriate research-group leader, or the Safety and Research Technician.

10. Hazardous-equipment register: Record location, identity marks and professional inspections of registered lifting equipment and pressurised liquid nitrogen vessels. Report shortcomings to the Safety and Research Technician.

11. Personal Protection Equipment: Include a report about the location, testing and replacement of respiratory protection equipment.

12. Showers and eyewash stations: Check on water supply, wash out the hose and spray head, check for leaks. Report deficiencies to E & F *via* the K2 System.

13. Signs and Labels: Order and affix new signs to ensure compliance. Ensure that each room controlled by the Board has an approved notice bearing clear instructions for action to be taken when fire occurs.

14. Solvent bins and cupboards: Check on location, fitness for purpose, appropriateness of use and labelling. Report deficiencies to the Safety and Research Technician.

P A Hofmann
11 September 2020 (Review date: 11 September 2021)

General Assessment of Hazards for Work in the Chemistry Department

This hazard assessment should be read by those performing and supervising work in conjunction with all relevant documentation, including the departmental policy, codes of practice and safe systems of work. This is not a risk assessment: the contribution of 'likelihood' to the level or risk will depend on the details of specific projects and the environment in which they are conducted.

Location(s):				All areas of the Chemistry (CG) and Materials Chemistry (MC) buildings			
Description of task or activity	**Hazards** *(things with the potential to cause harm)*	**Those at risk** *(people who could be harmed)*	**How could they be harmed?** *(nature of injuries, damage that could result)*	**Uncontrolled hazard level** *(level of risk without control)*	**Required controls** *(how the risk can be removed or reduced by for example engineered methods, safe systems of work, training and/ or personal protective equipment)*	**Controlled hazard level** *(level of risk when controls are in place)*	**Relevant sections of policy**
Overnight experiments and permanently running equipment	Fire, flood, failure of services	All personnel working out of hours	Burns, electric shock, slip, chemical exposure	**Serious**	Supervisor approval required for overnight experiments; condenser tubing checked for leaks and secured with cable tie; experiment stable for at least one hour before departure; temperature controllers on heating equipment; contact information in the event of service failure; record of running experiments and equipment.	**Minor**	Section E
Use of chemicals and synthetic chemistry	Chemical exposure	All personnel in laboratories, general circulation areas, Chemistry stores	Effects of chemical exposure	**Moderate to Major**	Wearing of suitable lab coats, safety spectacles (EN 166-F); hazardous chemicals (identified by prior COSHH assessment) manipulated in appropriate fume cupboards using appropriate PPE, including gloves (EN 374-3); good laboratory practice; codes of practice for transporting materials in the department; codes of practice for conduct in public areas, with appropriate signage; code of practice in the event of a power failure; codes of practice for highly hazardous materials with an uncontrolled risk level of 'Major'; code of practice for handling deliveries to stores; code of practice for external contractors.	**Minor**	Section B Section D Section I Section K Section L
	Chemical incompatibility	All personnel in laboratory and surroundings	Explosion, toxic or harmful byproducts	**Moderate to Major**	Check for chemical incompatibilities during COSHH assessment prior to work; identify appropriate waste disposal procedures.	**Minor**	Section K
	Chemical spillage	All personnel in laboratories, circulation areas, Chem. stores	Effects of chemical exposure	**Moderate to Major**	Consideration of spillage during COSHH assessment prior to work; availability of spill kits; emergency response protocol for hazardous material spillage, including use of breathing apparatus; good laboratory practice; codes of practice for transporting materials in the department; codes of practice for conduct in public areas, with appropriate signage.	**Minor**	Section B Section D
	Fire	All laboratory personnel	Burns, explosion and debris	**Moderate to Major**	Fire extinguisher training for all staff and postgraduate students, plus undergraduates conducting lab projects; emergency evacuation plan; practice evacuations.	**Minor**	Section B
	Use of glassware	All laboratory personnel	Cuts, chemical contamination if wounded	**Moderate**	Good laboratory practice; policy for the disposal of waste glassware, including dedicated waste disposal bins; availability of trained first aiders.	**Minor**	Section K
	Use of sharps	All laboratory personnel	Needlestick injuries	**Moderate**	Good laboratory practice; no re-sheathing of sharps; code of practice for disposal in sharps containers; availability of trained first aiders.	**Minor**	Section K
	Use of hotplates and heating equipment	All laboratory personnel	Burns, fire	**Moderate**	Good laboratory practice; flammable substances kept away from sources of ignition; condenser tubing checked for leaks and fit; use of temperature controls; availability of trained first aiders.	**Minor**	Section K
	Use of cryogens	All laboratory personnel	Asphyxiation, burns, explosion	**Moderate to Major**	Use in well ventilated areas; no use in confined areas; use of appropriate PPE; no use of liquid nitrogen mixed with flammable solvents; no systems cooled by liquid nitrogen left open to the air; gradual addition of solid carbon dioxide to cold fingers.	**Minor**	Section K

	Use of vacuum equipment and Schlenk lines	All laboratory personnel	Implosion, chemical exposure, others as for cryogen use	**Moderate or Serious**	Use of appropriate PPE and local ventilation; inspection of vacuum lines before use; no use of damaged, scratched or cracked glassware; use of covered glassware to minimise the likelihood of generating high velocity glass fragments; COSHH assessments for materials under vacuum.	**Minor**	Section K
	Use of rotary evaporators	All laboratory personnel	Use of vacuum equipment and cryogens (see above); rotating equipment, explosion	**Moderate or Serious**	As for 'Use of vacuum equipment' and 'Use of cryogens'; no manipulation of rotating glassware; peroxide testing of ether-based solvents.	**Minor**	Section K
	Use of UV lamps	All laboratory personnel	Eye or genetic damage	**Moderate**	Use in conjunction with a cabinet fitted with a suitable UV-filter	**Minor**	Section K
	Spectroscopy services (NMR, MS)	All using the facility	Chemical exposure, glass cuts	**Moderate**	COSHH assessment of chemicals; care when handling glass tubes and vials; disposal of broken tubes and used vials in glass bins after cleaning	**Minor**	Section K
Laser work	Exposure to non-ionising radiation	All laboratory personnel	Eye damage, burns	**Moderate or Serious**	Approved codes of practice; use of interlocks; use of appropriate PPE.	**Minor**	Section L
Radioisotope and X-ray work	Exposure to ionising radiation	All laboratory personnel	Genetic damage	**Moderate or Serious**	Work only conducted in approved areas; user training; exposure monitoring; safety mechanisms including beam shutters, warning lights and interlocks on x-ray equipment.	**Minor**	Section L
Biological work	Cell culture	All laboratory personnel	Disease or infection	**Moderate or Serious**	Work conducted in approved areas with appropriate level of containment; provision of training to researchers culturing microbes.	**Minor**	Section L
	Exposure to GMOs	All laboratory personnel	Disease or infection, environmental release	**Moderate or Serious**	Work conducted in approved controlled areas; provision of training to researchers manipulating GMOs.	**Minor**	Section L
	Flame sterilisation	All laboratory personnel	Burns, fire, aerosols	**Moderate**	Use in designated area of the laboratory with no flammable materials in the vicinity; turn off when not in use; fire extinguisher training.	**Minor**	Section K
	Use of cold room	All laboratory personnel	Asphyxiation, spore inhalation	**Moderate or Serious**	No cryogenic liquids or solid carbon dioxide to be taken into the cold room; no storage of paper or cardboard in the cold room.	**Minor**	Section K
	Autoclaving	All laboratory personnel	Release of stored energy	**Moderate**	Instrument failsafe mechanisms; code of practice; user training; regular inspection.	**Minor**	Section K
	Gel electrophoresis	All laboratory personnel	Effects of chemical exposure	**Moderate or Serious**	Wearing of suitable lab coats, safety spectacles (EN 166-F); hazardous chemicals (identified by prior COSHH assessment) manipulated in fume cupboards using appropriate PPE; good laboratory practice.	**Minor**	Section K
	Use of UV transilluminator	All laboratory personnel	UV exposure, genetic damage	**Moderate or Serious**	Instrument failsafe mechanisms and guards; code of practice; user training; regular inspection.	**Minor**	Section K

Assessment prepared by				**Review date**
Name:	Chemistry Department Safety Committee			14 September 2019
Signature:	(DSC, committee chair)			
Date:	14 September 2018			

Appendix D: Manual Handling Regulations

1. The Manual Handling Operations Regulations (1992) state that:

(a) if you are a supervisor/line manager or someone who asks others to move something;

OR

(b) if you move things for yourself, or for others then **you** have **responsibilities** under the Regulations. They can be found online at **UHSS Topic A-Z/Manual Handling** and are summarised in the following sections.

A. INTRODUCTION

(a) The **Regulations** came into force on 1st January 1993 with amendments in 2002 and are intended to prevent injury to *any part* of the body, not just the back. They require the University to:

- ensure the health and safety of its employees who are involved in manual operations;
- conform to the legal requirements.

Local Health and Safety Executive inspectors will monitor the University's compliance with these requirements.

(b) *Manual handling operation* means any manual transporting or supporting of a load including **lifting, putting down, pushing, pulling, carrying** or **moving by hand** or **bodily force.**

(c) A *significant operation* is one of the above operations that in the *preliminary judgement* of an *assessor* might be a hazardous operation and therefore requires a *formal assessment*.

(d) A *hazardous operation* is a handling operation that formal assessment shows to have the potential to cause injury.

(e) A *manual handling assessor* is a person trained to carry out assessments.

[Note that handling activities may lead to other hazards such as the leakage or spillage of a toxic or corrosive substance]

Manual Handling trainers in Chemistry are: Dr Connor Sibbald (CG004X), Mr Aaron Brown (CG015) and Mrs Annette Passmoor (Stores)

B. PRINCIPLES

(a) So far as is reasonably practicable, manual activities involving risk of injury should be **avoided.**

(b) All significant operations that cannot be avoided must be assessed.

(c) Assessments must involve the individuals who carry out the manual handling operations. This involvement is to assist in the identification of handling problems and the practical solutions to the problems.

(d) Assessments must be reviewed and must be changed

(i) when they are no longer valid or when there has been a significant change in the handling operations;
(ii) if a reportable injury caused by the operations has occurred.

C. ASSESSMENT PROCEDURE

Before any work is undertaken, any individual who is required to carry out a manual handling activity identified in a risk assessment should discuss the matter with their supervisor and undergo any training required. Training in manual handling is available on DUO under **My Organisations & Online Training** ("Health and Safety All Staff Training").

A supervisor/line manager must identify all operations in which any individual is required to carry out a manual task. A **preliminary judgement** should then be made to determine whether there is any risk to the person involved. This judgement requires a basic knowledge of the factors that contribute to the risk of injury, an understanding of the principles of good manual handling practice, and where possible, past experience of the particular operation.

In making a judgement, the supervisor/line manager will use the algorithm shown on the previous page and UHSS guidelines to consider:

- can the operation be eliminated?
- are significant forces used to push, pull, carry or restrain?
- is there any sideways movement, twisting or awkward posture involved?
- is the load carried extensive distances or up/down different levels?
- are there any concerns or history of accidents relating to the operation?

Examples of the tasks and the requirement for formal assessment:

Task Required	*Formal Assessment*
Moving a box containing 5 x 500 sheets of A4 paper	No
Moving a **large** item of furniture, e.g. a desk	Yes
Moving a gas cylinder other than a hand-held gas cylinder	Yes

If a risk of injury is identified, *i.e.* it is a significant operation, and if the task cannot be **avoided** or **eliminated**, the supervisor/line manager must ask a manual handling assessor to make a **formal written assessment**.

When the assessment has been carried out, **the persons involved** in the task will then **agree** the actions necessary to reduce the risk. The assessment will then be submitted to the persons' immediate supervisor/line manager for approval.

J M Sanderson
14 September 2020 (Review date: 14 September 2021)

Appendix E: Chemical Glove Performance Standards

The **EN 374:2003 (2013)** standard specifies the capability of gloves to protect the user against chemicals and/or microorganisms. The standard should be used in conjunction with EN 420 and is superseded by **EN ISO 374-1:2016**.

EN 374:2003 (2013)

1. Definitions

(a) **Length of life**: degradation is rated according to the change in the integrity of a material following chemical exposure. The rate of degradation depends on which chemical the glove has or will come in contact with.

(b) **Penetration**: is the flow of chemicals and microorganisms through the porous material, seams, small holes or other small defects in the material.

(c) **Permeation**: passage through the glove material at a molecular level. Absorption is the flow of molecules in contact with the outer surface of the glove. Diffusion is the movement of molecules through the material. Desorption is the outward flow of molecules from inside the glove.

(d) **Breakthrough time**: the time taken for a chemical or hazardous substance to pass through a glove and be detected on the inside surface of the material.

2. Requirements

(a) The size of the minimum liquid proof section of the glove must equal the minimum length of the gloves specified in EN 420. In essence, this is to ensure, for example, that a glove designed to cover the wrist provides the same protection to the wrist as the main part of the glove.

(b) **Penetration**: glove performance during an air and/or water leak test, tested and inspected in compliance with the Acceptable Quality Level (AQL). AQL refers to an internationally used quality standard for measuring the percentage of pinhole defects in disposable gloves (*i.e.* lower = fewer defects). Gloves assigned a protection rating of 1 are waterproof while gloves with ratings of 2 and 3 provide protection against microorganisms

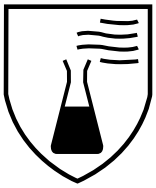
Performance level	Acceptable quality level unit	Inspection levels
Level 3	≤ 0.65	G1
Level 2	≤ 1.5	G1
Level 1	≤ 4.0	S4

(c) **Permeation**: Each chemical tested is classified in terms of breakthrough time (reported as Class or Level 1 to 6).

Measured breakthrough time	Protection Index	Measured breakthrough time	Protection Index
> 10 min	**class 1**	> 120 min	**class 4**
> 30 min	**class 2**	> 240 min	**class 5**
> 60 min	**class 3**	> 480 min	**class 6**

(d) Gloves that provide performance level 2 protection against water penetration and microorganisms and attain a level 2 protection score (breakthrough time of at least 30 minutes) against any 3 of the 12 standard defined chemicals in the table below meet the EN 374-3 standard for chemical resistance. Gloves meeting this standard have the 'Chemical Resistant' glove pictogram, which must be accompanied by a 3-digit code that refers to the code letters of the 3 chemicals for which the breakthrough time ≥ 30 min was obtained:

EN 374-3



ABC

CODE Letter	Chemical	CAS NUMBER	CLASS
A	Methanol	67-56-1	Primary alcohol
B	Acetone	67-64-1	Ketone
C	Acetonitrile	75-05-8	Nitrile compound
D	Dichloromethane	75-09-2	Chlorinated paraffin
E	Carbon disulphide	75-15-0	Sulphur-containing organic compound
F	Toluene	108-88-3	Aromatic hydrocarbon
G	Diethylamine	109-89-7	Amine
H	Tetrahydrofuran	109-99-9	Heterocyclic and ether compound
I	Ethyl acetate	141-78-6	Ester
J	n-Heptane	142-85-5	Saturated hydrocarbon
K	Sodium hydroxide 40%	1310-73-2	Inorganic base
L	Sulfuric acid 96%	7664-93-9	Inorganic mineral acid

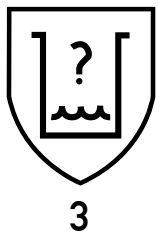
(e) EN 374-2: the 'Microorganism' pictogram is used when the glove conforms to at least performance level 2 for water penetration and protection against microorganisms.

EN 374-2

3

.

(f) EN 374-1: the 'Low Chemical Resistant' or 'Waterproof' glove pictogram is used for gloves that do not achieve a breakthrough time of at least 30 minutes against at least three chemicals from the defined list, but which comply with EN 374-2. The following example is for a glove that has passed performance level 3 for water penetration and protection against microorganisms



EN ISO 374-1:2016

3. This is a revised version of EN 374:2003 (2013), with new tests for penetration, permeation and degradation. Key points:

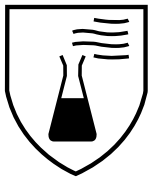
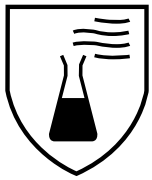
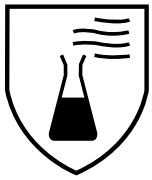
(a) New test chemicals. There are now 18 listed chemicals in total, as opposed to 12. The 6 additional chemicals are as follows:

CODE Letter	Chemical	CAS NUMBER	CLASS
M	65% Nitric Acid	7697-37-2	Inorganic mineral acid, oxidising
N	99% Acetic acid	64-19-7	Organic acid
O	25% Ammonium hydroxide	1336-21-6	Organic base
P	30% Hydrogen peroxide	7722-84-1	Peroxide
S	40% Hydrofluoric acid	7664-39-3	Inorganic mineral acid, contact poison
T	37% Formaldehyde	50-00-0	Aldehyde

(b) Degradation. A new degradation test has been introduced which measures the change in physical properties of the glove after exposure to a chemical for a period of time. Degradation may appear as swelling, disintegration, flaking, colour change, embrittlement, hardening, softening or dimensional change. To claim protection against a chemical on the defined list, permeation and also degradation tests must be carried out. The results of the degradation test should be outlined in the information leaflet.

(c) Biological hazards. If the glove is intended to protect wearers against biological hazards, the manufacturer will need to decide whether they are going to claim protection against viruses, fungi and bacteria. If this is the case, the glove will require further testing to ISO 16604: 'Clothing for protection against contact with blood and body fluids'.

(d) Specifications

Type of Glove	Requirement	Marking
Type A	Penetration resistance (EN 374-2). Breakthrough time ≥ 30 min for at least 6 chemicals in the new list.	EN ISO 374-1 / Type A  A J K L P R
Type B	Penetration resistance (EN 374-2). Breakthrough time ≥ 30 min for at least 3 chemicals in the new list.	EN ISO 374-1 / Type B  J K L
Type C	Penetration resistance (EN 374-2). Breakthrough time ≥ 30 min for at least 1 chemical in the new list.	EN ISO 374-1 / Type C 

4. Selection of Materials

The chart below is **for guidance only** to assist with the choice of an appropriate glove material. Before any given material is used, the specifications provided by the manufacturer should be checked against the intended use.

Chemical group	Nitrile	Butyl rubber	Neoprene	Viton	PVC	PVA	Latex
Halogenated solvents	×	×	×	Y	×	Y	×
Ketones	×	Y	×	×	×	(Y)	×
Aldehydes	×	Y	×	(Y)	×	×	×
Alcohols	Y	Y	(Y)	Y	×	×	×
Esters	×	Y	×	×	×	(Y)	×
Ethers	(Y)	(Y)	(Y)	×	×	(Y)	×
Amines	(Y)	Y	(Y)	(Y)	×	×	×
Aliphatic hydrocarbons	Y	×	×	Y	Y	Y	×
Aromatic hydrocarbons	×	×	×	Y	×	Y	×
Organic acids	(Y)	Y	Y	Y	Y	×	(Y)
Inorganic acids	(Y)	Y	(Y)	Y	Y	×	Y
Alkalis	(Y)	Y	Y	Y	Y	×	Y

Key: x, not suitable for immersion use (breakthrough times generally < 1 h); Y, suitable (breakthrough times generally > 4 h); (Y), suitable in some cases.

J M Sanderson, 14 September 2020. (Review date: 14 September 2021)

Appendix F: Absorbent Materials in Spill Kits

1. Ecospill Elite Chemical Spill Kit (15 l)

These are basic kits and are packed in distinctive yellow holdalls (**A**):

Each kit contains:

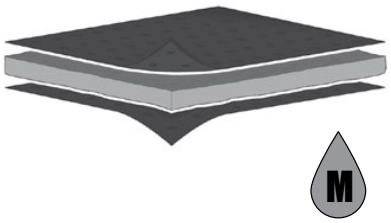
- 1 Absorbent boom (**B**) for use to contain a spill.
- 8 Absorbent pads (**C**) for use directly on a spill for absorption.
- 2 Hazardous waste bags & Ties (**D**) for disposal of contaminated booms and pads.
- 1 Instruction Leaflet.

The pads and absorbent boom are of the yellow 'Chemical' or 'C' type for spills involving water, oils, and aggressive liquids (*i.e.* acids and bases). These kits do not contain chemically-resistant gloves, acid/base neutralising agents and other equipment such as a dustpan and brush or pH paper.

2. Types of Absorbent Material

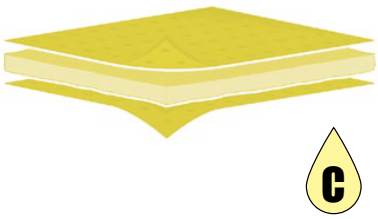
These guidelines apply to <u>any</u> chemical spill kit used in the department.

Industry colour coding for absorbents



Maintenance Grey/Black
For use inside on spills of non aggressive water and oil based fluids and mild chemicals.

Oil Only White
For the preferental absorption of oil based liquids on land or water, including vegetable oil, mineral oil and most hydrocarbon derivatives.



Chemical Yellow
For use on spills of aggressive liquids *i.e.* acids and alkalis. Can be safely used on water and oil based spills. For use on land only.

*Ecospill absorbents are tested to BS7959 and meet the BS standards for the colour coding of absorbents.

3. Absorbent Material Compatibility

Absorbent Compatibility Guide.

This information is provided as a guide only. It is assumed that Chemicals are at an ambient temperature and pressure and are used in their basic state not mixed or in combination. We strongly recommend that for specific applications you contact Cromwell. Small test sampling by the user is always recommended to ensure safe application. No claims or warranties are expressed or implied as to the absolute accuracy of the data supplied.

Maintenance - Grey/Black. For use inside on spills of non aggressive Water and Oil based fluids and mild Chemicals.

Oil Selective- White. For the preferential absorption of Oil based liquids on land or water. Including Vegetable oil, Mineral oil and most Hydrocarbon derivatives.

Chemical- Yellow. For use on spills of aggressive liquids i.e. Acids and Alkalis. Can be safely used on Water and Oil based spills. For use on land only.

Liquid	Maintenance	Oil Selective	Chemical	Liquid	Maintenance	Oil Selective	Chemical
Acetaldehyde	✓		✓	Carbon Disulphide	✓		✓
Acetic Acid			✓	Carbon Tetrachloride	✓	✓	✓
Acetic Acid Amyl Ester	✓	✓	✓	Castor Oil	✓	✓	✓
Acetic Anhydride	✓		✓	Chloracetic Acid			✓
Acetone	✓	✓	✓	Chlorbenzine	✓		✓
Acetyl Chloride	✓	✓	✓	Chlorine	✓		✓
Acrolein		✓	✓	Chlorine Soda			✓
Acrylic Acid			✓	Chloroform	✓	✓	✓
Acrylic Emulsions	✓		✓	Chlorosulphuric Acid			✓
Acrylonitrile	✓		✓	Chlorox (Full Bleach)			✓
Allyl Alcohol	✓		✓	Chromic Acid (50%)			✓
Aminobenzoic Acid			✓	Citric Acid			✓
Ammonia Anhydrous	✓	✓	✓	Corn Oil	✓	✓	✓
Ammonium Hydroxide	✓	✓	✓	Cotton Seed Oil	✓	✓	✓
Amyl Acetate		✓	✓	Cresol	✓	✓	✓
Amyl Alcohol	✓		✓	Cyclohexane	✓	✓	✓
Aniline	✓		✓	Detergents	✓		✓
Aqua Regia	✓		✓	Dichlorbenzol	✓	✓	✓
Aviation Fuel	✓	✓	✓	Diethyl Amine	✓	✓	✓
Benzene*	✓	✓	✓	Diethyl Ether	✓	✓	✓
Benzoic Ether	✓	✓	✓	Di-Nitrobenzene	✓	✓	✓
Benzonitrile	✓		✓	Dioxan	✓		✓
Benzyl Alcohol	✓		✓	Discooctyl Phthalate	✓	✓	✓
Benzyl Chloride	✓		✓	Ether	✓	✓	✓
Boric Acid			✓	Ethyl Acetate	✓	✓	✓
Brake Fluid	✓	✓	✓	Ethyl Alcohol	✓	✓	✓
Bromine (inorganic)*	✓		✓	Ethyl Chloride*	✓	✓	✓
Butyl Acetate	✓	✓	✓	Ethyl Ether	✓	✓	✓
Butyl Alcohol	✓	✓	✓	Ethylene Glycol	✓		✓
Butylamine	✓		✓	Ethyl Proianate	✓	✓	✓
Butyric Acid			✓	Formaldehyde	✓		✓
Calcium Hydroxide	✓		✓	Formic Acid			✓
Carbolic Acid			✓	Fuel Oil	✓	✓	✓

continued…

Absorbent Compatibility Guide.

Liquid	Maintenance	Oil Selective	Chemical	Liquid	Maintenance	Oil Selective	Chemical
Galvanic Liquids	✓		✓	Phenyl Formic Acid			✓
Gearbox Oil	✓	✓	✓	Phosphoric Acid			✓
Glacial Acetic Acid	✓		✓	Potassium Hydroxide	✓		✓
Glycerol	✓		✓	Propanol	✓		✓
Heptane	✓	✓	✓	Propionic Acid			✓
Hexane	✓	✓	✓	Propyl Alcohol	✓	✓	✓
Hydrazene	✓		✓	Propylene Glycol	✓	✓	✓
Hydrochloric Acid			✓	Quinoline	✓		✓
Hydrofloric Acid			✓	Resorcinol	✓		✓
Hydrogen Cyanide	✓	✓	✓	Saccharose	✓		✓
Hydrogen Peroxide	✓		✓	Salt Solution (Metallic)	✓		✓
Isobutyl Alcohol	✓	✓	✓	Silicone Oil	✓	✓	✓
Isobutyric Acid	✓	✓	✓	Silver Nitrate	✓		✓
Isopropyl Acetate	✓	✓	✓	Soap Solutions	✓		✓
Isopropyl Alcohol	✓	✓	✓	Sodium Bicarbonate	✓		✓
Kerosene	✓	✓	✓	Sodium Chloride	✓		✓
Keytone	✓	✓	✓	Sodium Hydroxide	✓		✓
Linseed Oil	✓	✓	✓	Sodium Nitrate	✓		✓
Lubricating Oil	✓	✓	✓	Stannic Chloride	✓		✓
Magnesium Oxide Hydrate	✓		✓	Starch	✓		✓
Methyl Alcohol	✓	✓	✓	Styrene	✓	✓	✓
Methyl Chloride	✓	✓	✓	Sucrose	✓		✓
Methyl Ether	✓	✓	✓	Sulphuric Acid*			✓
Methyl Ethyl Ketone	✓	✓	✓	Synthetic Motor Oil	✓	✓	✓
Methyl Methacrylate	✓	✓	✓	Tannic Acid			✓
Methyl Propianate	✓	✓	✓	Tin Chloride	✓		✓
Milk	✓		✓	Toluene*	✓	✓	✓
Mineral Oil	✓	✓	✓	Transformer Oil	✓	✓	✓
Mineral Spirits	✓	✓	✓	Trichlorethylene*	✓	✓	✓
Motor Oil	✓	✓	✓	Triethylene Glycol	✓	✓	✓
Naphtalene			✓	Turpentine*	✓	✓	✓
Nitric Acid*			✓	Urine	✓		✓
Nitrobenzene Acid			✓	Vinegar	✓		✓
Nitrobenzol	✓		✓	Vinyl Acetate	✓		✓
Nitrotoluen	✓	✓	✓	Water	✓		✓
Octane	✓	✓	✓	Xylene*	✓	✓	✓
Oleic Acid	✓	✓	✓	**Notes:**			
Olive Oil	✓	✓	✓				
Parraffin	✓	✓	✓				
Perchlorethylene*	✓	✓	✓				
Petroleum Ether	✓	✓	✓				
Phenol	✓		✓				

***These fluids will react with Polypropylene causing it to degrade.**

J M Sanderson, 14 September 2020. (Review date: 14 September 2021)

Appendix G: Red List Substances

These substances must never be disposed of down the drain:

1,2-Dichloroethane
Aldrin
Atrazine
Azinphos-methyl
Cadmium salts
Dichlorvos
Dieldrin
Endosulphan
Endrin
Fenitrothion
Hexachlorobenxene
Hexachlorobutadiene
Hexachlorocyclohexane
Malathion
Mercury
Polychlorinated biphenyls
Pentachlorophenol
Simazine
DDT
Tributyl tin
Trichlorobenzene
Trifluralin
Triphenyltin

J M Sanderson, 14 September 2020. (Review date: 14 September 2021)

Appendix H: Diphoterine® MICRO DAP Instructions for Use

MICRO DAP / Diphoterine® Solution:
Emergency rinsing solution for washing chemical splashes on the skin.

What is a MICRO DAP?

A MICRO DAP is an aerosol spray containing 100ml of Diphoterine® solution. It is intended for washing chemical splashes within the first 60 seconds, either on a hand or a small body surface of equivalent size.

Installation and use of the MICRO DAP:

Thanks to the 100ml of Diphoterine® solution, the MICRO DAP allows an effective washing within the first 60 seconds following the accident.

The MICRO DAP must be either available near the zones at risk or be worn directly by employees on their belt. Its use is especially recommended in laboratories or in zones which are at risk for chemical splashes on small cutaneous surfaces.

Recommended protocol for maximum efficacy:

The MICRO DAP is intended to be used for the first emergency washing. Its contents are recommended for cutaneous splashes, particularly for a hand or equivalent body surface. If the splashed body surface is more important, it is recommended to use a DAP autonomous portable shower of 5 liters.
The efficacy of the MICRO DAP comes from the active properties of Diphoterine® solution.

It is recommended, during an accident, to use all the contents of the MICRO DAP.

- **General recommendations**

The MICRO DAP must be used as the first solution and as the first response. A preliminary washing with water leads to a delay in the application, and because of this loss of time, the efficacy of Diphoterine® solution is reduced. If Diphoterine® solution is not available on the place of the splash, never delay the washing. Failing that, use water.
Do not exceed the expiry date indicated on the packaging.
The MICRO DAP must be used continuously while washing. Partial or non-continuous spraying may lead to a decrease in pain but will not prevent the injury from developing.

- **Scope of effectiveness and known limitations of Diphoterine® solution**

Diphoterine® solution makes it possible to stop the penetration of the chemical and the development of all chemical injuries, except for splashes of hydrofluoric acid and its derivatives on which it has a reduced effect. In this case it is especially recommended to use Hexafluorine® solution, a washing solution for splashes of both hydrofluoric acid and of fluorides in an acidic medium

- **What to do if the injury has already developed, or if I intervene after 60 seconds?**

After 60 seconds, and according to the type of chemical, the injury may have already developed. Washing, including on an injury that has already developed, will improve the implementation of secondary care.
Diphoterine® solution also appears of interest in cases of delayed washing (after 60 seconds). In this case, we recommend continuing the initial washing performed with a MICRO DAP of Diphoterine® solution by a second washing of an ideal duration equal to 3 to 5 times the contact time.

- **Upkeep and Maintenance**

The MICRO DAP must be stored in a place which is neither exposed to high temperatures nor sunlight. It is however advised not to expose the product to freezing temperatures, because the aqueous solution can freeze and thus may not be immediately usable. There is, however, no loss of effectiveness when Diphoterine® solution has thawed out. The ideal temperature at which it should be used lies between 15 and 35°C.
The MICRO DAP must be replaced on or before the expiry date indicated on the label

- **Toxicology**

Diphoterine® solution is a non-irritating, non-allergenic and non-toxic solution.

CE 0459

For more information, visit http://community.dur.ac.uk/chem.safety/local/diphoterine.html

J M Sanderson, 14 September 2020. (Review date: 14 September 2021)

Appendix I: Arrangments in Response to Covid-19

Phase 3 risk assessment (Chemistry and Materials Chemistry)

Location(s): *(where will the activity or task take place?)*				**Chemistry Building, Materials Chemistry Building and Waste Store**	**Reference**	**COVID19_RA_Phase3**
Description of task or Activity *(enough information to establish the foreseeable hazards)*	**Hazards** *(things with the potential to cause harm)*	**Those at risk** *(people who could be harmed)*	**How could they be harmed?** *(nature of injuries, damage that could result)*	**Uncontrolled risk level** *(level of risk without control)*	**Required controls** *(how the risk can be removed or reduced by for example engineered methods, safe systems of work, training and/ or personal protective equipment)*	**Controlled risk level** *(level of risk remaining when controls are in place)*
The following is the phase 3 risk assessment for users of the chemistry and materials chemistry building as well as the associated hazardous waste and solvent storage building. Biosciences staff based in the building are expected to follow these controls and it also includes access to the faculty office and catering spaces but these areas should have their own risk assessments for their own activities/rooms. Phase 3 is to follow on from the initial reoccupation under phase 2 after the demonstration during phase 2 that the controls were effective and were followed within the department. In the event of the COVID-19 situation worsening, or the phase 3 measures not working, the department initially propose a regression back to the phase 2 controls and way of working. The department understand that the restricted working practises have caused stress and anxiety for our staff and students and have therefore made extensive efforts to re-open as much as is safe to do so, so people can operate as close to the pre-pandemic working arrangements as possible. It must be noted that all other risk assessments for the building are still in force and the following measures are additional to protect against the biological viral hazard covid-19. The department remains committed to their equality, diversity and inclusion policy and will ensure any pre-existing reasonable adjustments are respected by any changes in work plans, this might mean patterns of hours, access to bespoke computing resource or physical access issues. If anyone feels that the change in work plans disadvantages them on grounds of disability that have or haven't been disclosed, or that they have concerns that stem from belonging to a higher risk group for covid-19, the department encourages that person to bring this concern forward to their line manager who will engage with the relevant parties (e.g. HR, safety representatives) and individual risk assessments can be conducted. Occupancy of the buildings have been based on ~300 people at any one time. This comprises of about 150 staff and post-doctoral/postgraduate researchers and about 150 undergraduate students in 3 teaching laboratories and 9 centrally bookable teaching spaces.						
General considerations and access to the building and to circulation spaces	Biological viral hazard – covid-19	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The	**Severity – 4** **Likelihood – 4**	Staff who identify as Clinically Extremely Vulnerable, High Risk Clinically Vulnerable or Clinically Vulnerable should have individual risk assessments completed in line with the Return to campus guidance for staff at higher risk of severe covid-19 infection process and additional mitigation measures put in place if required, in certain cases this may include no face to face	**Severity – 4** **Likelihood - 2**

			effects of covid-19 infection range from minor respiratory symptoms to death.		teaching. **Everyone should self-isolate if required. This helps to protect others:** The latest government guidance should always be followed, available at: https://www.gov.uk/government/publications/covid-19-stay-at-home-guidance. Extract at time of writing: "The most important symptoms of coronavirus (COVID-19) are recent onset of any of the following: •a new continuous cough •a high temperature •a loss of, or change in, your normal sense of taste or smell (anosmia) For most people, COVID-19 will be a mild illness. However, if you have any of the symptoms above you must stay at home and arrange to have a test to see if you have COVID-19. Tests can be requested using: https://www.nhs.uk/conditions/coronavirus-covid-19/testing-and-tracing/ask-for-a-test-to-check-if-you-have-coronavirus/. If you have symptoms of COVID-19 however mild, you must self-isolate for at least 10 days from when your symptoms started. You should arrange to have a test to see if you have COVID-19. If you are not experiencing symptoms but have tested positive for COVID-19 you also must self-isolate for at least 10 days, starting from the day the test was taken. If you develop symptoms during this isolation period, you must restart your 10-day isolation from the day you develop symptoms. After 10 days, if you still have a temperature you should continue to self-isolate and seek medical advice. You do not need to self-isolate after 10	

					days if you only have a cough or loss of sense of smell or taste, as these symptoms can last for several weeks after the infection has gone. If you live with others, all other household members must stay at home and not leave the house for 14 days. The 14-day period starts from the day when the first person in the household became ill or if they do not have symptoms, from the day their test was taken. If anyone else in the household starts displaying symptoms, they must stay at home for at least 10 days from when their symptoms appear, regardless of what day they are on in their original 14-day isolation period." If you are contacted by the NHS test and trace service (https://www.gov.uk/guidance/nhs-test-and-trace-how-it-works) you must follow any request to self-isolate as required by the service. Anyone self-isolating must inform their line manager, the department manager (chemistry.departmentmanager@durham.ac.uk), head of department (chemistry.hod@durham.ac.uk) and chemistry departmental safety coordinator (chem.safety@durham.ac.uk) with details about why they are self-isolating, when their self-isolation started, what they had been doing *within the department* for the 48 hours prior to self-isolation and who they had likely been within <2m contact with for 15 minutes or more in this period. This information must also be reported to hr.absence@durham.ac.uk as required by university procedures. **Precautions in the department:** The department will aim to minimise building occupancy by advising staff to work from home if it is possible, and only occupy the building for necessary, planned work; using designated work patterns approved in advance. Hand sanitiser is provided at entry points and	

CRA1, version 1.4.1, 17 October 2018

					throughout the department. Those who do not want to use an alcohol-based sanitiser (e.g. for religious reasons) should employ frequent hand washing. Each room has a maximum occupancy number stated clearly on (or next to) the door, which must be adhered to. This applies to all users of an area. Covid-19 safe-working posters are displayed around the Department to reinforce key messages. Corridors, stairwells and doorways are 2-way and a 'keep left' policy is in operation. All other doors should only be used one person at a time. Where indicated, follow individual doors as entry or egress only. Building circulation areas will be cleaned between 06:00 and 12:00 each day by E&F, following SOP CVD 05. Chemistry lab attendants will then clean circulation areas for a second time in the early afternoon, following the same SOP. Additional touchpoint will be completed by E&F during term time. Windows, including those set into office and lab doors, must not be covered so that occupancy of rooms can be clearly seen from corridors, and movement in corridors can be clearly seen from inside rooms, to prevent unexpected close contact. Any existing coverings on windows must therefore be removed. Guidance information has been given to all staff and visitors, including a formal Return to Work induction. A general induction is available on the university health and safety pages (https://www.dur.ac.uk/coronavirus/password/staff/hs/). Department level inductions have been completed for phase 2 and phase 3 and were recorded for those who could not attend. **Behavioural controls expected from all building occupants:**	

					Social distancing should be maintained at all times with a 2 m distance being maintained. Employ good hand hygiene with regular and thorough handwashing. When coughing or sneezing, personnel should cover their mouth and nose with a tissue or with their elbow. Avoid physical contact with others. Face coverings should be worn when moving about within buildings, during queuing, and collection at catering outlets, in corridors and other communal areas in colleges, academic and other buildings including when using multiple occupancy restrooms. More information is available in the University policy on face coverings available at https://www.dur.ac.uk/resources/coronavirus/password/Facecoveringpolicy.pdf. It must be noted that while the use of face coverings is required, not everyone can wear face coverings for a variety of reasons. People therefore need to be careful when challenging others about using (or not using) face coverings – for EDI reasons people cannot expect others to disclose why they are not wearing a face covering. Laboratory PIs are responsible for managing access to their areas and ensuring the stated area occupancies are not exceeded. Compliance with social distancing measures will be monitored actively by the Chemistry Safety Committee and inspections may be made by UHSS. Concerns from individuals can be flagged to any member of the Chemistry Safety Committee directly, or, if preferred, the Chemistry Department Near Miss reporting tool can be used (http://community.dur.ac.uk/chem.safety/local/near_miss.html). Posters are displayed in the department with information of how to report	

CRA1, version 1.4.1, 17 October 2018

					concerns at the University level if people feel more comfortable reporting concerns outside the Department. Individuals reporting symptoms whilst in the department should isolate themselves in the faculty meeting room on the third floor, with the windows open, and seek further advice, until returning home wearing a face covering. If an individual is unsure whether they are suffering from a fever a non-contact thermometer is available within the faculty meeting room for them to be checked. They should identify themselves and symptoms to a first aider who will be able to help using the thermometer and appropriate PPE. Use of the Department as a thoroughfare for non-Chemistry staff or students should be prevented. To achieve this, signs will be displayed on entrance to the department that access is for chemistry users only and that there is no thoroughfare permitted. General health and safety information from the university can be found at https://www.dur.ac.uk/coronavirus/password/staff/hs/ **Department actions in the event of a positive test** In the event of a being notified that a member of the department has tested positive, the department will make efforts to contact those within the department who have been in close contact with that individual where they were not socially distanced (either 2 meters or 1 meter plus extra mitigation such as a face covering) for 15 minutes or more and advise them to not attend site and that they should submit themselves for a test. The name of the person who has tested positive will not be divulged without their consent. In the event of a confirmed case of C-19, of a University member who has been on University premises, a deep clean of areas they frequented, in the previous five days, will be completed, as far	

					as is practicable, in terms of confirmation of locations, by an external, competent contractor.	
Use of communal facilities (toilets, kitchens, vending machines, mail racks, photocopiers, showers, lifts, Chemistry Café)	Biological viral hazard – covid-19 Transmission through use of communal facilities	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	**Toilets** Users should use their nearest toilet facility to minimise movement around the building. Social distancing should be respected in toilet facilities. In order to help facilitate this, toilets have been marked out with some urinals and sinks marked as out of use. Cubicles provide a physical barrier so all cubicles can be used. If all cubicles and urinals are in use, people should queue outside of the toilet facility until there is space. Toilet seats should be lowered before flushing to prevent droplets from being dispersed. This message is reinforced with signage. Hands must be washed before leaving toilets. Signage is displayed in the toilet facilities to reinforce the need for good hand hygiene and hand washing technique. **Kitchens** Kitchen areas in the chemistry department are located in CG141, CG300D, MC005, MC109. Social distancing should be respected in kitchen areas, a queue will be demarked where heavy use of a kitchen area is anticipated. Touch points such as handles must be wiped before and after each usage. This should be done using Sani 4 in 1 following SOP CVD 05. Good personal hygiene with frequent hand washing and sanitising should be employed. Vending machines are available in the red atrium and in the Musgrave Room (CG141). They should be cleaned before and after use by the user using sanitising wipes. The Chem Café will be reopening as a click and collect service only from October 5th. **Rest facilities**	**Severity – 4** **Likelihood - 2**

CRA1, version 1.4.1, 17 October 2018

					The seating capacity in the Musgrave Room (CG141) has been reduced so that social distancing can be maintained. Some seats have been marked out of use and floor markings will be used to indicate where the other seats should be. In communal seating areas, wipeable chair coverings are used. These are plastic laundry bags covered over fabric chairs. These will be wiped clean after each use and the bags will be replaced weekly. If weather permits, the external spaces are also available for rest/lunch breaks. **Washing facilities** The non-emergency shower may be used but it must be sanitised before and after use using SANI4 in 1 following SOP CVD 05 by the user. All personal items should be removed from the washing facility after use. **Lifts** Lifts should only be used if essential (for example health and mobility issues or transport of articles – note that transport with cryogens and other hazardous substances is not permitted due to hazards around creating a confined space). Occupancy should be reduced to one, with the exception of where a disabled user is required to be accompanied by a mobility advisor. Hand sanitiser should be used before and after use of the lift – a hand sanitising station is available next to each lift. Buttons will be cleaned during the touchpoint cleaning of the building. **Personal storage** Storage spaces should be individual and not shared. E.g. one locker per person, no sharing. **Departmental facilities** The open pigeon holes are not in use and have been taped up. Use of the communal photocopiers (MFPs) should be avoided where possible. Where this is not	

					possible they should be used as infrequently as is possible by grouping any jobs and completing them all in one visit. When using the MFPs, they should be wiped clean before and after use with the sanitiser provided.	
All departmental work	Welfare/Mental health	All	Adverse effects on mental health due to worry/stress and/or reduced social contact	**Severity – 3** **Likelihood -3**	All personnel have been provided with a social contact to whom they can talk informally by any appropriate means. New PGRs/PDRAs and staff will be assigned a social contact as part of their induction to the department. The department have an appointed mental health first aid contact and advice and resources are available from the occupational health website: https://www.dur.ac.uk/hr/occupationalhealth/mentalhealth/ Staff and researchers should be encouraged to access resources that are available: • Report and Support tool for staff who are concerned for their safety or experiencing unwanted behaviours, including online harassment: https://reportandsupport.durham.ac.uk . • Guidance on working remotely and advice on how to improve mental wellbeing: https://www.dur.ac.uk/od/remotesupport/ • The Five Ways to Wellbeing, a set of evidence-based public mental health messages, to improve mental health and wellbeing. https://www.dur.ac.uk/od/wellbeingandworkdiff/fiveways/ • Modules are available on Duo for staff to build resilience and develop Wellness Action Plans. https://www.dur.ac.uk/hr/occupationalhealth/mentalhealth/counselling/. • Access to the full suite of SilverCloud	**Severity – 3** **Likelihood - 2**

					psychoeducation modules is available via mobile phone, tablet or computer, after registration. https://www.dur.ac.uk/wellbeing/silvercloud/ . • Employee Assistance Programme – an EAP is a confidential employee benefit designed to help you deal with personal and professional problems that could be affecting your home life or work life, health and general wellbeing. https://www.dur.ac.uk/hr/password/occupationalhealth/employeeassist/	
	Out of hours working (outside of working hours 07:00 until 19:00)	All	Lower response time to emergency situations from out of hours working. Increased risk of lone working due to lower occupancy of department.	**Severity – 4** **Likelihood – 4**	Research workers must not undertake experimental procedures outside normal working hours unless their supervisor or the Chair of the Board of Studies authorises the work. Once the work has been authorised, the supervisor must send an email to chemistry.reception@durham.ac.uk giving details of: • Who will be working out of hours • Where they will be working • How long they anticipate they will be on site. This information must be sent by 12:00 noon on the day of the out of hours working request. For weekend/bank holiday working, this must be sent by 12:00 noon on the final normal working day before the weekend/bank holiday. If work is permitted out of hours, workers must be working with a buddy competent to provide emergency help if needed. This means they have the required knowledge, training, skills and experience in the activities being completed to respond appropriately to any foreseeable emergency situation (e.g. shutting equipment down as required, cleaning up spills, summoning help). Hazardous work must not be undertaken out of hours.	**Severity – 4** **Likelihood - 2**

					Students should normally leave the science site by 22.00. Any work between 22.00 and 07.00 needs specific permission from the supervisor and the Chair of the Board of Studies, as well as a separate risk assessment. Students and staff members must use the entrance next to the Security Office (red atrium) out of normal working hours. They must record their presence on the MS Teams shifts app regardless of the time or day that they are attending site. A person who is already in the Department at 19.00 on a normal working day and plans to stay in the Department beyond that time, must leave themselves clocked into the building on the MS Teams app. Out-of-hours, the only fire muster point for the building in the event of a fire alarm activation is opposite the red atrium at the front of the building. All building occupants must report here due to building fire wardens not necessarily being on site. First aid provision is through security (43333) as there is reduced first aider presence on site from the department.	
Use of shared desk rooms	Biological viral hazard – covid-19 Transmission through use of desks, chairs, keyboards, lockers and other facilities	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Building occupancy is being minimised by advising staff to work from home if it is possible, and only occupy the building for necessary, planned work; using designated work patterns approved in advance. Shared desk rooms may be used by users who are assigned occupancy in a lab space on the basis of the following conditions being met. Social distancing in desk rooms must be maintained at all times. To achieve this: • Rotas should be considered. • Desks could be marked up with colours or days of the week in use to give a visual indication at the point of use about	**Severity – 4** **Likelihood - 2**

					the plan. • If services allow (network and power points), moving the desks can be considered to help facilitate social distancing. • This will be coordinated locally by users and overseen by line managers. • Compliance will be monitored by the safety committee. Maximum occupancies for desk rooms must be followed. This includes anyone using the desk room as a thoroughfare. For hygiene reasons there should be one desk, chair and workstation per worker (no hot-desking). Desks must be wiped after each shift using an appropriate disinfectant for example SANI 4 in 1 following SOP CVD 05. Personal storage spaces must not be shared, e.g. one locker per worker. Any common touchpoints in shared desk rooms, should be cleaned before and after use with an appropriate disinfectant, e.g. Sani 4 in 1 following SOP CVD 05. Good personal hygiene must be maintained through increased use of handwashing facilities and hand sanitiser. Any recirculating air ventilation unit in a desk room must preferably be switched off. If the unit cannot be switched off, the room should be limited to a single named user. If it is not possible to limit the room to a single named user, then the room should be limited to a small number of named users and efforts made to increase fresh air ventilation by opening windows. See also Chemistry Building – Ventilation Assessment.	
	Incorrect use of desk spaces	Workspace users	DSE related injuries, e.g. musculoskeletal	**Severity – 3** **Likelihood – 3**	Given the long absence from the department each worker must complete a DSE assessment of their workstation before starting work at their	**Severity – 3** **Likelihood – 2**

			disorders, back pain, eye strain, headaches.		workstation. This must be repeated for any additional workstations to be used. DSE assessments are completed via DUO under the 'Health and Safety All Staff Training' heading. Completion will be monitored by the safety committee.	
Meetings	Biological viral hazard – covid-19	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Meetings should be conducted using video conferencing software (Teams is preferred due to close caption) to do the meeting remotely. Where this is not possible, a centrally bookable meeting space should be booked if available adhering to the maximum occupancy and any social distancing/local arrangements. The area must be cleaned down after use and face coverings worn. Furniture must not be rearranged in centrally bookable spaces. Where neither of these are possible, a 1:1 meeting in a large enough departmental space is permitted provided there are additional control measures in place. For example, social distancing is observed, face coverings are worn, windows and doors are opened to increase ventilation and good hygiene measures are followed including cleaning down surfaces. See also university guidance on meetings in staff offices.	**Severity – 4** **Likelihood - 2**
Emergency Cover	Various hazards relating to a reduction of people on site meaning an emergency response might be slower.	Fire	Insufficient fire warden presence.	**Severity – 5** **Likelihood – 5**	The Chemistry dynamic fire warden system will help with this. If the fire alarm sounds, all staff should leave by the nearest exit and proceed outside of the building to the security office for fire warden duties. Staffing levels in the building, during normal working hours on weekdays, should be maintained above the minimum number required to support this function. Building occupants should evacuate as normal, maintaining social distancing where possible. Any one-way systems should be ignored and occupants should leave by their nearest exit. Social distancing should be maintained once outside of the building. Re-entry to the building will be staggered to avoid overcrowding – this will be managed by the acting chief fire warden.	**Severity – 5** **Likelihood - 1**

CRA1, version 1.4.1, 17 October 2018

		First aid	Insufficient First Aider presence.	**Severity – 4** **Likelihood – 3**	If first aid is required, security should be contacted on 43333, giving details of the incident and its location. Security will then contact the first aid channel (channel 1) on the hand-held radios and a first aider will attend. First aiders will arrive in PPE consisting of a face-shield, face covering and single-use nitrile gloves.	**Severity – 4** **Likelihood - 1**
		Chemical spill	Insufficient breathing apparatus staff to cover a spillage.	**Severity – 4** **Likelihood – 3**	Chemical Emergency Response Team service is temporarily suspended. All experiments should be planned on the basis that the Chemical Emergency Response Team will not be available on site – i.e. in the event of a spill that would normally require the Chemical Response team, the area would need to be evacuated and taken out of use until follow up was possible with sufficient members of the Chemical Response team.	**Severity – 4** **Likelihood – 2**
Laboratory Research	Biological viral hazard – covid-19	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	**Lab management** In addition to the risk assessments normally in use, each area in operation has a risk assessment in place to cover the biological viral hazard of covid-19. Area managers have been provided with guidance and asked to prepare this for their individual areas and these risk assessments have been reviewed by the safety committee before reoccupation of that area. This has been reviewed for phase 3. Procedures and experiments for which existing risk assessments or SOPs are in place must consider the associated risks of covid-19 before any additional work is undertaken. This can be either in the form of a new assessment, or an update to the previous one. Covid-19 must be considered in any new risk assessments. Any specific activity where social distancing measures cannot be complied with should have a risk assessment and level of PPE determined – approved by the DSC (chem.safety@durham.ac.uk).	**Severity – 4** **Likelihood - 2**

					For existing procedures that have no additional training element, risk assessments can be authorised remotely by a competent authority. For any procedures requiring additional training, a detailed risk assessment and associated plan for how supervision and training will be delivered is required before undertaking the work. This could be undertaken through the use of body cams and ear pieces, or if only short duration training is required, type IIR/surgical mask and visor should be worn where practical. **Maintaining social distancing** 2m social distancing in laboratories should be maintained at all times. To achieve this: • Rotas should be considered and maximum occupancies must be adhered to. • One way systems can be used where practical, supported by floor markings. • Primary and secondary workstations could be marked out with floor markings to designate space that users will occupy. • This will be coordinated locally by users and overseen by line managers. • Compliance will be monitored by the safety committee. In general lab groups will not mix within each others spaces. Users will use their own desk rooms and lab spaces for working within their own small cohort consisting of only their co-workers in their research space. Footfall around the department has been minimised and therefore cross contamination of areas and interactions with other researchers or cohorts has also been minimised. Within the cohort researchers will maintain distancing measures. **Increased cleaning and personal hygiene** All surfaces touched by hand must be wiped down after use with an appropriate disinfectant active against enveloped viruses for the manufacturer's stated contact time. For example, using Sani 4 in	

CRA1, version 1.4.1, 17 October 2018

					1 following SOP CVD 05 or Distel at 1:100 dilution with a 30 minute contact time. Please note however that some cleaners have chemical properties and these should be consider locally to determine whether that cleaner is suitable for use in the given environment. Ethanol and/or isopropanol should not be used as a disinfectant due to the added fire risk of spraying flammable solvents onto surfaces. A clearly identifiable sanitising station should be set up in each lab consisting of the appropriate disinfectant, disposable cloth to wipe with, sanitising wipes and, where applicable, hand sanitiser. Gloves could be considered for work involving multiple contact with shared surfaces if disinfection is not practical. Laboratory coats must be stored separately for each researcher, in a drawstring cotton bag. This should be kept inside the laboratory in a defined area per person; in most cases, on labcoats hooks inside the drawstring cotton bag. Other PPE, for example safety glasses, must also be stored separately for each researcher in a non-contaminated environment. PPE should not be shared. Where possible, researchers should be allocated personal fume cupboard and bench space. Shared facilities must be cleaned before and after each use with an appropriate cleanser. Face coverings are not required when working at a laboratory workstation as these areas have been laid out to ensure social distancing. Risk assessment may also exclude the use of face coverings where their use may pose a risk to safety: • Where they could become caught or snagged in equipment	

					• Working with open flames or other heat sources, pyrophoric or flammable chemicals • Where they could risk the health of individuals, e.g. because of thermal exposure or where they could absorb or become contaminated with chemical or biological hazards used in activities • Where they may impair safety critical communication. In some circumstances, disposable face coverings may provide an acceptable alternative to re-usable face coverings. In these cases, disposable face coverings will be provided by the University. Keypad access systems should be removed or disabled where possible. Where removal is not possible, the keypad should be cleaned regularly. Where practical, arrangements should be put in place to minimise hand contact with door furnishings. This includes the use of kick panels and attachments that enable doors to be opened by arm. For fire safety reasons and COSHH safety reasons, doors to laboratories and offices should not be propped open. **Use of cold rooms** Due to the lower temperature and recirculating air, cold rooms have been highlighted as higher risk than other laboratory areas. For this reason cold rooms should be limited to an occupancy of 1 person at a time.	
	Increased risk from ***Legionella*** due to infrequent use of the water systems	All	Legionaires' disease is a type of pneumonia affecting the lungs and other organs of the body.	**Severity – 5** **Likelihood – 4**	Each laboratory should have a rota for running **all** water outlets for at least two minutes each week to minimise risks. This should be recorded and the records kept locally until a departmental process can be put in place to maintain these records. A sock is available from stores to assist with the flushing of emergency showers and can be requested through the area's bubble manager. Checks will be made during safety committee audits to ensure this is being complied with.	**Severity – 5** **Likelihood – 2**

	Lone working	All researchers	Social distancing and designated work patterns lead to single occupancy in labs Increased working from home, plus the potential for self-isolation could lead to insufficient academic staff to provide research cover	**Severity – 4** **Likelihood – 4**	Where rooms are singly occupied, a system must be in place to safeguard the lone worker. This will usually involve some form of regular checking in by the researcher. Personal mobile phones (at the risk of the user) may be used for this purpose only and must not be used for phone conversations until they have been decontaminated before leaving the laboratory. Where practical, academic staff should be grouped into teams according to competency. Any staff member in a competency grouping should be prepared to cover the supervisory role of any other. Laboratory work will be permitted if one member of the relevant competency team is in the department. Activities deemed high-risk should not be undertaken by a lone worker.	**Severity – 4** **Likelihood – 1**
Management of departmental services						
Maintenance of laboratory supplies and hazardous waste removal (i.e. solvents, waste, dry ice, and liquid nitrogen)	Biological viral hazard – covid-19 Transmission from increased footfall through the department.	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Maintenance of laboratory supplies and hazardous waste removal should be completed by one laboratory representative each working day. This should be managed locally, however it is recommended that this job is rotated around the lab users. As per university policy, face coverings should be worn when moving around within buildings. The number of trips by the daily laboratory representative should be minimised by, for example, grouping jobs together, or collecting in bulk where possible, whilst still adhering to the building DSEAR controls (minimise the amount of flammable solvent in the building and store flammable solvent in flammable cupboards). Trollies should be used where necessary to reduce the risks of manual handling related injuries. **Solvents (SPS, Solvent Store)** Laboratory solvents can be obtained from the external solvent store, which is naturally well	**Severity – 4** **Likelihood - 2**

					ventilated for fire safety reasons. This therefore reduces the transmission risk. The occupancy of the solvent store and SPS room will be limited to 1 technician with the laboratory representative collecting their order from the doorway. For chemical safety reasons, the technician present wears single-use gloves, which are changed frequently and removed before leaving the solvent store. Order records will be monitored electronically by the solvent stores technician. Orders must therefore be submitted 15 minutes prior to solvent stores opening. Opening times extended by 15 minutes to facilitate social distancing. Opening times will be 09:15-09:45 and 14:15-14:45. **Waste** Hazardous waste is stored in our external hazardous waste store, which is naturally well ventilated for fire safety reasons. This therefore reduces the transmission risk. The occupancy of the waste store will be limited to 1 technician with the laboratory representative dropping their waste off just inside the doorway. For chemical safety reasons, the technician present wears single-use gloves, which are changed frequently and removed before leaving the waste store. Opening times extended by 15 minutes to facilitate social distancing. Opening times will be 09:15-09:45 and 14:15-14:45. **Solid carbon dioxide** The solid carbon dioxide box will be moved external to the building. This will therefore reduce the risk of COVID-19 transmission as the area will be naturally well ventilated. Ideally users should	

					bring their own scoop to collect the dry ice with, but if this is not possible, the departmental scoop may be used and the handle should be cleaned before and after use. **Liquid nitrogen** Liquid nitrogen dewars are filled by a member of the technical staff and left in a cage external to the building, where they can be collected. This is a naturally well-ventilated area for cryogen safety reasons, and so the transmission risk is reduced. **Ice** Ice can be collected from the ice machines located outside CG127 and CG209 by the daily nominated laboratory representative. If possible, the laboratory representative should bring their own scoop from their lab to collect ice with. If this is not possible, hand sanitiser is positioned next to the ice machines and should be used before and after ice is collected using the department scoop. **DI water** DI water can be collected by the laboratory representative from the taps throughout the department. Hand sanitisers should be used before and after collecting DI water.	
Workshops	Lone working	Workshop staff	Social distancing and designated work patterns lead to single occupancy in workshops.	**Severity – 4** **Likelihood – 4**	Where workshops are singly occupied, a system must be in place to safeguard the lone worker. This will usually involve some form of regular checking in with a line manager by the lone worker. Personal mobile phones (at the risk of the user) may be used for this purpose only and must not be used for phone conversations until they have been decontaminated before leaving the workshop. Lone working alarms will be used in workshop areas where lone working is undertaken and a buddy system for welfare checking is not appropriate. Activities deemed high-risk should not be undertaken by a lone worker.	**Severity – 4** **Likelihood – 1**

	Biological viral hazard – covid-19 Transmission from increased footfall through the department.	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Staff should contact the workshop staff through either Teams, email or by phone to discuss any work. The workshop staff will agree a pre-arranged time for any required consultation, and for people to drop off any items necessary. The workshop staff will notify the user when the work is completed and arrange a time for them to come and collect their item(s). This will be from the designated area inside each workshop. Social distancing should be maintained whilst collecting items from the workshops. Social distancing and increased hygiene measures should be followed at all times in workshops. Floor markings have been used to help with social distancing and sanitising stations have been set up to help with increasing hygiene.	**Severity – 4** **Likelihood - 2**
Analytical Services	Biological viral hazard – covid-19 Transmission from increased footfall through the department.	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Discussion with the analytical staff should be completed remotely via teams, phone or email. Maximum lab occupancies and social distancing measures must be adhered to and increased hygiene measures must be followed. Floor markings have been used to help with social distancing where required and sanitising stations have been set up to help with increasing hygiene. Service managers have put local procedures and risk assessments in place to operate their service. Services will operate as one of two types of service: **Managed services** This is a service which is managed by analytical staff, who take a sample and complete the analysis themselves. For these services, a sample drop off point will be set up and the sample will be collected, sanitised and analysed by the analyst. The sample can then be collected from the sample collection point (typically next to the drop off point). Specific arrangements will be managed locally by the service manager and included in the room/service risk assessment.	**Severity – 4** **Likelihood - 2**

CRA1, version 1.4.1, 17 October 2018

					Walk-up services These are services which are available as open access facilities for members of the department to use themselves. Where these facilities have recirculating air conditioning units, the guidance received in the E&F ventilation assessment should be followed. This is that they should ideally be switched off. Where they cannot be switched off, ventilation should be increased by opening windows where possible, occupancies should be limited and the use of face coverings should be mandated where this is safe to do so considering other chemical, biological and thermal hazards in the area. A queue will be set up outside of the walk-up services rooms to help facilitate social distancing. Space in the queue will be limited, and if the queue is full, users should return to their lab and try again later rather than dwell in the corridors. To increase hygiene in the walk-up services rooms, fabric chairs will be covered with a chair covering, or replaced for plastic chairs. Sanitiser wipes must be positioned near to the workstations and wipe-clean keyboards or keyboard covers must be used and wiped before and after each use. Where sanitising is not practical, mandating the use of gloves may be considered. When maintenance is required in these areas, the service will be closed and area isolated whilst the maintenance activity is completed. This will help to maintain lab occupancy numbers. Specific arrangements will be managed locally by the service manager and included in the room/service risk assessment.	
Stores	Biological viral hazard – covid-19	Everyone including those on and	Inhalation of or mucocutaneous contact with	**Severity – 4** **Likelihood – 4**	Stores orders will be collected by a lab zone representative for the given day during their allocated timeslot. When the order is ready to collect, this will be advertised on the lab zone	**Severity – 4** **Likelihood -**

	Transmission from increased footfall through the department	off site	contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.		teams site and a representative should respond to say they will come to complete the collection for their zone. Timeslots will be allocated and collections for each area will only be permitted during this time. This is to manage any crowding and waiting outside of stores. Social distancing of 2 m should be maintained at all times. Face coverings in circulation spaces are required, so should be worn when collecting orders. It must be noted that while the use of face coverings is required in circulation spaces, not everyone can wear face coverings for a variety of personal reasons. People therefore need to be careful when challenging others about using (or not using) face coverings – for EDI reasons people cannot expect others to disclose why they are not wearing a face covering. A clear protective screen has been erected across the hatch area for people to stand behind when collecting orders. Floor markings are used to reinforce this message. A hand sanitiser station has been fitted to the wall outside stores and should be used as people are collecting their orders. A queue will be marked out in the corridor outside of stores. Stores staff can consult with users to come and collect urgent deliveries (e.g. large items or items delivered on ice that need to be moved into cold storage). The main door to stores should remain locked to help with social distancing and limiting room occupancies. External deliveries should be dropped at the hatch where possible. Otherwise a 1-in-1-out system will	**2**

					operate.	
Teaching						
Teaching labs	Biological viral hazard – covid-19 Transmission from increased footfall through the department	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	Teaching labs CG021, CG193 and CG127 will open for undergraduate studies. Lab classes and occupancies have been adjusted in order to facilitate social distancing: CG021 will open for 18 students CG127 will open for 10 students CG193 will open for 20 students The key controls laid out in the Undergraduate and Taught Postgraduate Laboratory Practical Classes risk assessment will be followed. These are: • Socially distancing (2 m) wherever possible, where not possible, adding additional precautions in place. • Enhanced disinfection and hand-hygiene procedures • Encouraging good respiratory hygiene (catch it, kill it, bin it) • Provision of clear information on expectations and behaviors • Encouraging those who are unwell not to attend practical classes by ensuring they are not disadvantaged by not doing so • Identifying staff and students who identify as having a higher-risk of severe Covid-infection and putting additional procedures in place where possible. • The use of face coverings must be considered in the local risk assessments. Where their use presents a risk to safety, the risk assessment may identify that they should not be worn. This is in accordance with the Undergraduate and Taught Postgraduate Laboratory Practical Classes risk assessment and University Face Covering policy.	**Severity – 4** **Likelihood - 2**

					Local risk assessments for each practical course will be adjusted to follow these principles and any points which are expanded upon in the Undergraduate and Taught Postgraduate Laboratory Practical Classes risk assessment. Toilet facilities close to the teaching spaces should be used to limit movement round the department. Central break-out spaces should be used for lunch and welfare breaks.	
Face to face teaching by Chemistry staff	Biological viral hazard – covid-19 Transmission from increased footfall through the department	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The effects of covid-19 infection range from minor respiratory symptoms to death.	**Severity – 4** **Likelihood – 4**	See face to face teaching in central-bookable rooms risk assessment for additional detail to the below. Individuals are required to wear a face covering during face-to-face teaching sessions, as well as in the wider building (accessing facilities/queueing etc.) unless they are unable to do so due to a medical condition or disability. Additional COVID-19 controls must be considered when preparing face-to-face teaching in accordance with the face to face teaching in central bookable rooms risk assessment. For example, session leaders should bring their own whiteboard/flip chart pens and slide changer/laser pointer. Measures have been put in place in the face to face teaching in central bookable rooms risk assessment for social distancing to be maintained prior to the sessions, on entry, during the sessions and at the end of the sessions. These measures must be followed. Increased hygiene measures through frequent hand washing and sanitising.	**Severity – 4** **Likelihood - 2**
Use of teaching spaces within Chemistry	Biological viral hazard – covid-19 Transmission from increased footfall through	Everyone including those on and off site	Inhalation of or mucocutaneous contact with contaminated droplets leading to infection with covid-19. The	**Severity – 4** **Likelihood – 4**	The Departmental buildings contains 9 centrally bookable teaching spaces, the capacity for each has been determined to allow for 2m social distancing and this information displayed on the door of the room as well as timetabling and student allocation. Only students associated with the department have	**Severity – 4** **Likelihood - 2**

	the department		effects of covid-19 infection range from minor respiratory symptoms to death.		been timetabled to use these rooms. Occupancy numbers are as follows: • CG218, capacity of 7 • CG60, capacity of 9 • CG65, capacity of 12 • CG66, capacity of 11 • CG68, capacity of 6 • CG83, capacity of 14 • CG85, capacity of 17 • CG91, capacity of 12 • CG93, capacity of 27 Additional seating has been removed. Windows must be open when room is in use to ensure adequate supply of fresh air, if this is required for that space. Information is displayed on room layout within the room, together with key instructions. Hand-sanitiser stations have been placed on the outside (or near to) of entrance/exit for students and staff to use. Students are asked not to attend the building until just before the face-to-face teaching session (information included in student induction/timetabling) to minimise numbers inside the building during change-over times. Immediately prior to entering the teaching rooms, students are asked to queue outside the entrance door(s) to each room, keeping single file, wearing face coverings and keeping socially distanced. This message is reinforced with local signage. Information on layout of each room and procedures will be displayed within the room (via overhead projector). Where possible this information will be shared in advance. Each teaching room will have provision for clean as you go (wipes) and foot operated lidded bins available for disposal of wipes at exits.	

					Movable screens have been made available for staff to use as a physical barrier between students. For more information on face-to-face teaching. Teaching rooms will be cleaned daily by housekeeping services using an anti-viral disinfectant in line with the Housekeeping service level agreement. When not used for teaching, it is possible that teaching rooms in chemistry may be used for activities to improve the wider student experience. Maximum occupancy numbers and cleaning regimes will need to be followed for this to take place.	

Assessment prepared by:		**Assessment reviewed by:**		**Review date**
Name:	Karl Coleman Connor Sibbald John Sanderson Paul Hofmann Emma Knighton	Name:	Nikki Irving (HSS) Gretta Roberts (HSS)	To be reviewed monthly
Signature:		Signature:		
Date:	17/09/20	Date:		
Competency Level:	1	Competency Level:	Must be Competency Level 1 to authorise	
Assessment read and understood by				

Health and Safety Risk Matrix

			Probability/ likelihood of risk realisation				
			Almost Impossible (1)	Not Likely to occur (2)	Could occur (3)	Known to occur (4)	Common occurrence (5)
		Health and Safety	A freak combination of factors would be required for risk to be realised	A rare combination of factors would be required for risk to be realised	Could happen when additional factors are present otherwise unlikely to occur	Not certain to happen but an additional factor may result in risk being realised	Almost inevitable that risk will be realised
Potential Consequences	Severe (5)	One or more fatalities. Irreversible health problems	5	10	15	20	25
	Major (4)	Partial or medium-term, disabilities or major health problems	4	8	12	16	20
	Moderate (3)	Lost-time injuries or potential medium-term health problems	3	6	9	12	15
	Minor (2)	Minor, very short-term health concerns on recordable injury cases.	2	4	6	8	10
	Insignificant (1)	Inherently safe, unlikely to cause health problems or injuries	1	2	3	4	5

Extreme risk	High risk	Medium risk	Low risk