CHEMICAL SAFETY

1. Before the work commences anyone working with chemicals of any sort must ensure that they:

- Understand the hazards associated with the chemicals.
- Know what precautions should be taken.

2. Main Hazard of Chemicals

The main Hazards of chemicals:

- The toxic effects of chemicals if they enter the body.
- The corrosive effects of some chemicals if they come into contact with human tissue.
- The flammable nature of some chemicals.
- The reactive nature of some chemicals - often when incompatible chemicals come together.

These Hazards need to be considered during:

- Storage of chemicals.
- Use of chemicals.
- Disposal of chemical waste.

Consider also what will be done if there is a chemical spillage (or other uncontrolled release).

3. Safety Data Sheets (SDS)

It is a legal requirement that the supplier of a chemical must provide a Safety Data Sheet (SDS) to the purchaser of the chemical. If you have purchased a chemical and do not have the SDS and cannot find it on the supplier's website, contact the supplier and request one.

Unless the chemical is one whose properties are well known to the user, it is essential to consult a Safety Data Sheet. Line managers and supervisors should get staff and students into the habit of consulting Safety Data Sheets as part of the process of carrying out risk assessments. Details on the handling, storage and disposal of hazardous chemicals should be incorporated into risk assessments as should procedures for dealing with accidental spillages.

4. Risk Assessment

Risk assessments must always take account of the risks created by any chemicals which are used and must always address:

- Storage of chemicals
- Use of chemicals
- Disposal of waste
- Actions to be taken in event of a spillage.

For all activities involving the use of hazardous substances, a COSHH Risk Assessment form must also be completed and submitted to the LSC.

5. Storage of Chemicals

All chemicals must be correctly labelled. Materials purchased from suppliers should already be correctly labelled. When solutions are prepared in the laboratory or when chemicals are dispensed or repacked, they must be clearly labelled and any hazards indicated with appropriate hazard symbol labels.

- Correct chemical names are required (e.g. labelling a bottle only as ‘solution A’ would not be acceptable. What would happen if the bottle leaked or was knocked over when the person who made up the solution has left the University?)
- Durable labels are required (e.g. Felt pen on glass is not acceptable).
- Users are encouraged to date chemicals so as to identify when they arrive the School.

Chemicals must be stored so that they cannot accidentally come into contact with incompatible chemicals. When making arrangements for storing chemicals consider the effects of two chemicals coming into contact if there was a spillage or a leak. With some incompatible chemicals violent reactions can occur if the chemicals combine under uncontrolled conditions. With other chemicals uncontrolled mixing can result in the production of highly toxic gases or fumes.

Bottles containing liquids must be placed in suitable carriers for transport between storage areas outside the laboratory. Always check the integrity of wire carriers before using. When carriers need replaced, purchase totally enclosed ones with sealed lids. These help contain possible spillages and prevent point impacts on bottles.

Highly flammable liquids must be transported and stored in sealed carriers.

For the transport of dangerous chemicals in University vehicles consult the LSC or HS&W Team.

6. Highly Flammable Liquids (HFL)

See the University Health and Safety website for more information on Highly Flammable Liquids.

Highly flammable liquids (HFLs) should be treated carefully in order:

- They do not become a source of fire.
- They do not fuel an existing fire.

An HFL is a liquid with a flash point below 32°C. The flash point is the lowest temperature at which the liquid emits vapour at a concentration to form a combustible mixture with air. The flash points of common solvents in used in the School include:

- Ethanol +12°C
- Acetone -19°C

As the flash points of these liquids are below room temperature the liquids will always constitute a major fire and explosion hazard. Some liquids (e.g. Acetone) have flash points below the temperatures that may be found in a refrigerator or freezer and will therefore constitute an explosion hazard even when in cold storage **requiring that the fridge or freezer be spark-proofed**.

6.1 Work with Highly Flammable Liquids

Those working with HFLs must be aware of the flash points of the liquids and must take care to exclude ignition sources from the work area. The risk assessment for the work must address how this will be done.

In deciding what might be a possible source of ignition, note must be taken of the auto ignition temperature of the HFL. The auto-ignition temperature is the minimum temperature required to initiate combustion. It is not only sparks and naked flames that can be a source of ignition. If the vapour of the HFL comes into contact with a surface at a temperature in excess of the auto-ignition temperature, the vapour can ignite (e.g. the auto-ignition temperatures of diethyl ether is 160°C).

The temperature of the element of a heating mantle or the surface of a hot plate will be higher than the auto-ignition temperature of diethyl ether. Small quantities for immediate use should be stored on low shelving, well away from any source of heat (including sunlight).

All containers must carry the appropriate safety sticker labelling also applied to dilutions.

Disposal route should be pre-planned as part of the risk assessment; consult a Safety Coordinator if in doubt.

6.2 Storage of Highly Flammable Liquids

The School has two external, secure and vented stores for bulk chemicals. One store is designated for solvents and the other designated for formalin. The contents of the stores primarily belong to the School of Biological Sciences and will be run down as suitable storage elsewhere becomes available.

The total volume of Highly Flammable Liquids (HFLs) in any laboratory or room (other than the designated bulk solvent store) must be kept as low as possible and **must not exceed 25 litres**. A 50-litre limit is set by legislation.

All containers, including dilutions, must carry the appropriate safety sticker labelling. Bottles of HFLs temporarily removed from their storage cabinets should not be left on the open bench in direct sunlight. Disposal route should be pre-planned as part of the risk assessment. Consult the LSC if in doubt.

All HFLs in a laboratory must be stored in specially designed and approved fire-resisting cabinets. Ordinary metal storage cabinets are not acceptable. Cabinets should be located away from exits from the laboratory. Cabinets must be conspicuously marked with the approved labels to indicate that they contain HFLs. Cabinets should be used only for solvents and never for oxidants, acids, alkalis or other materials that could react with the solvents or cause corrosion of the cabinets. Large volumes (>500 ml) containers of HFLs should not be stored on the open bench or in fume cupboards.

6.3 Refrigerator Storage

If it is necessary to place HFLs in a refrigerator or freezer it must be spark proofed and protected against an explosion. Even a very small amount of HFL in an ordinary refrigerator or freezer can create an explosive atmosphere, which can then be ignited by a very low energy spark (e.g. from a thermostat). The consequences can be devastating. It is very likely that the resulting explosion will, at the very least, completely destroy the laboratory containing the refrigerator or freezer. Even in a protected refrigerator the HFLs must be kept in closed containers impervious to the solvent concerned. Many plastics are not suitable.

All refrigerators, freezers and cold rooms which are not spark proofed must be labelled with a sign indicating that they are not suitable for storage of any HFL (in either open or closed containers). Even if the flash point of the liquid is above that of the working temperature inside the refrigerator, storage is still not permitted. If the cooling system were to fail, the temperature could rise above the flash point and an explosive atmosphere could result.

6.4 Empty Bottles, Containers and Drums

Empty bottles that contained HFLs should first be vented in a fume cupboard to avoid build-up of explosive vapours and then washed out before re-use (e.g. for waste) or disposal. Caps should also be removed.

Hot working on, or near, drums of HFLs, whether empty or full, is prohibited. Even if they appear empty there exists enough volatile vapour to cause a violent explosion if exposed to a source of ignition. A local incident highlights the deadly effects of such an explosion.

7. Responding to Chemical Spills

All spills should be cleaned up as quickly as possible, even if it is a non-hazardous substance (eg water) as it will be a slip hazard.

However, if you do not know how to clean up a hazardous chemical you may make it worse. Actions in the event of a chemical spill should be written into risk assessments and SDS be readily available.

7.1 Minor Spills

For minor, less serious spills (e.g. small scale, low hazard materials):

- Simply clearing the immediate area may be sufficient.
- If possible, clearly identify the spill with a sign.
- Consult the appropriate risk assessments for the activity to establish the hazards associated with the spilled or released materials and appropriate clean up method.
- The supervisor/PI and/or the LSC should be contacted for advice if necessary.
- Make use of emergency chemical spillage kits containing gloves, apron, absorbent pads for 2 people (assistance may be required).

In both case review the risk assessment that governed the relevant activity in the context of the spill event.

7.2 Serious Spills

If the spill is so large or the hazard too great, that it cannot be safely cleaned-up, then the Emergency Services should be contacted.

For serious spillage involving a hazard giving rise to risk of fire or inhalation (e.g. corrosive fumes, organic vapours, fine dust), immediately:

- Evacuate the area.
- Call 999 and ask to speak to the Fire and Rescue Service, explain to SFRS control room what the circumstances are, give them as much info as possible.
- They will mobilise a fire crew in a fire appliance with chemical suits and breathing apparatus and a Hazmat supervisor officer (Station Commander or above). Depending on the level of spill and the chemical they may send specialised appliances and crews trained in Hazmat. (DIM vehicle is based at North Anderson Drive and Incident support based at Altens).
- Have the Supervisor/PI/Researcher/Technician/LSC available ready to advise the emergency service when they arrive.
- On arrival of emergency services the first officer on the scene will ask:
    - Is the area evacuated?
    - What chemical has been spilled?
    - How much chemical has been spilled?
    - What steps have already been taken to minimise the amount (eg cover with spill kit)?
    - How to deal with spill (eg does it react with water)?
- With that specialist advice will depend on the action taken by hazmat crews, (eg Breathing apparatus and fire kit or the full chemical suit) depends on the danger.

Revision Record			
Issue	**Name**	**Date**	**Reason for review**
1	ES	31/05/2022	Transfer from main handbook
1.1	ES	26/01/2023	Added section on spill response