Safe Storage and Labelling of Chemicals

1. Introduction

This document provides guidance for the safe labelling and storage of chemicals. Access to all laboratories, workshops and storage areas containing hazardous chemicals must be secured to prevent access by unauthorised personnel.

2. Chemical inventory

There must be a chemical inventory in every lab/ workshop where chemicals are stored. This information is available from the Chemical Risk Assessment - Pre-purchase form (this can be found on Staff H&S Intranet pages or PG H&S Intranet pages) and should include:

- Reference number (e.g. inventory number)
- Chemical name / concentration
- CAS number (Chemical Abstract System)
- Quantity stored
- Volume of container (largest size)
- Location (Building / Room number / Cabinet)
- Receipt date
- Expiry date (where relevant for safety)
- Hyperlink to latest safety data sheet
- Hazard classification (chemical symbols and hazard statements)
- Owner

Inventories must be formally audited by the faculty/ PSU, at least annually, to ensure they reflect current chemical stocks. The inventory must always be available to users, and to the HS&R Team and emergency services on request.

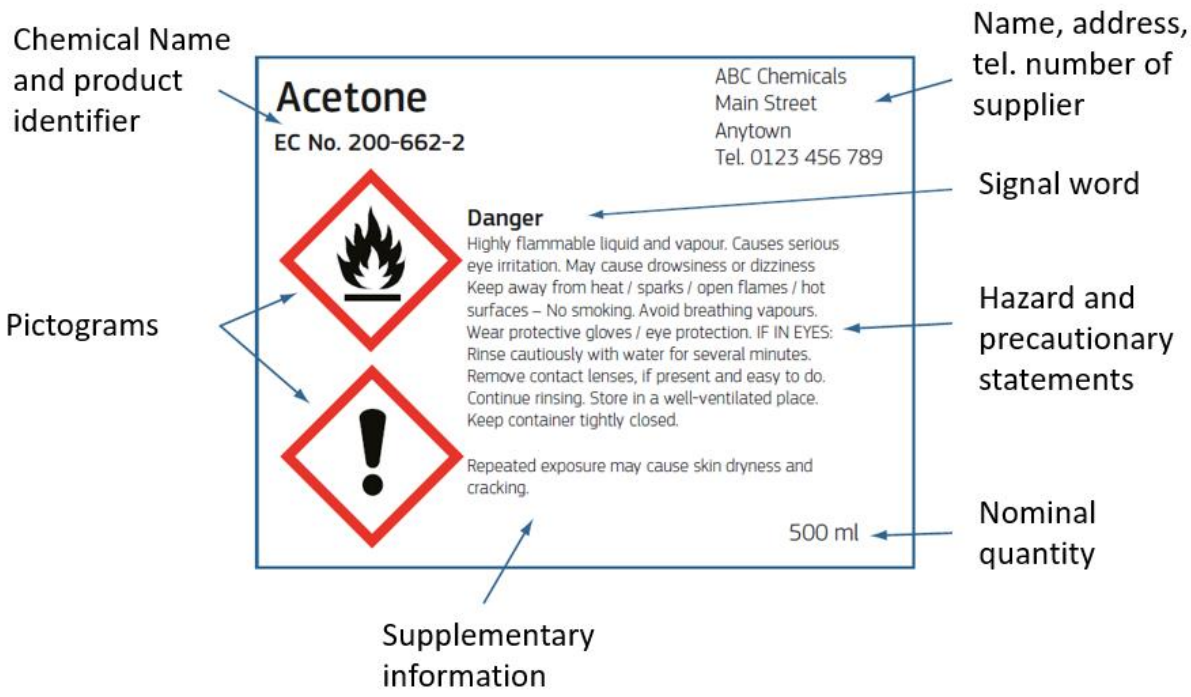
Items must be removed from the chemical inventory once they have been disposed of or used up.

An up to date safety data sheet (SDS) must be available for every chemical stored, this includes new and existing chemicals. The SDS provides users with information about recommended storage requirements (section 7) and chemical incompatibility (section 10).

An example inventory template can be found on the Staff H&S Intranet pages or PG H&S Intranet pages)

3. Labelling

All chemicals must be clearly labelled. Where practical, hazardous substances should be kept in their original packaging. The original packaging is always compatible with the substance within. Below is an example of a chemical label used when chemicals are supplied (GB CLP Regulation):



In addition to the information provided on a chemical label, the following information must be added:

- Reference number.
- Date of purchase.
- Owner (initials).
- Expiry date (if required for safety).

All other chemicals (e.g. decanted or made) should be labelled as follows:

- Chemical name.
- Concentration (if applicable).
- Hazard symbols.
- Date made.
- Made by.

There may be some situations where it is impractical to label a container (e.g. the use of very small vials). In cases like this a secondary container e.g. a rack or tray must be used, which must be labelled accordingly.

4. Storage

Buying an oversized storage cabinet can waste valuable space and does not allow for adequate segregation of incompatible substances. This should be considered when purchasing new cabinets. Larger cabinets can be purchased with segregated compartments. These are designed to provide safe, separate storage for a range of chemicals (e.g. cabinets for acids, alkalis, and flammables).

- **Storage cabinets:** Must be clearly labelled to indicate their contents, see Appendix 1. Report any damaged or defective cabinets to technical staff.

- **Central shelving** on benches should have raised edges/ lips to prevent items being pushed off the other side.
- **Hazardous chemicals:** Liquids should be stored below shoulder height. Do not store chemical bottles on the floor, or stack chemicals on top of each other.
- If chemicals are stored on high shelves, these shelves should only be used for infrequently used chemicals and suitable access equipment must be provided.
- **Fume cupboards**: These must be kept clear of chemicals and equipment that are not required for ongoing operational work. Items stored in fume cupboards disrupts the airflow making the fume cupboard less effective, this compromises the safety of the user. The storage of chemicals in fume cupboards (including chemical waste) can also increase the risk of fire, chemical spill, and reactions between incompatible materials. For more information see SOP-10101 Safe use of ducted fume cupboard (staff) or SOP-10101 Safe use of ducted fume cupboard (student).
- **Waste** should be stored in an appropriate chemical cabinet prior to disposal.
- **Storage Outdoors**: Chemicals stored outdoors must be stored in locked containers to prevent access by unauthorised personnel. Large quantities of flammables and other materials should be stored where there is no risk of spillage into the environment. They should be bunded or stored in a cabinet with sufficient drip tray volume to contain a leak. A suitable spill kit must be available in the vicinity.

4.1 Types of Storage Cabinet

Cabinet Type	Requirements
Shelving	• Locate on shelves that are out of direct sunlight. • Central shelving on benches should have raised edges/lips to prevent items being pushed off the other side. • Liquid bottles containing hazardous chemicals should be stored below shoulder height. • If chemicals are stored on high shelves, these shelves should be used for infrequently used chemicals and suitable access equipment should be provided.
Corrosives cabinets	• These cabinets are made of materials that are resistant to corrosion. • These cabinets should contain a spill tray to catch any leakage or spillage. The spill tray should have a volume that is 110% of the largest container. • These cabinets must be lockable. • These cabinets may be ventilated.
Fire resisting cabinets	• These cabinets must be of metal construction and have a minimum fire resistance of 30 minutes. (Some are built to 60 minutes and 90 minutes standard). • These cabinets should contain a spill tray to catch any leakage or spillage. The spill tray should have a volume that is 110% of the largest container. • These cabinets must be lockable. • These cabinets may be ventilated. • Newly purchased cabinets should conform to BS EN 14470-1:2004 - Safety storage cabinets for flammable liquids.

	• All fire resisting cabinets with damaged doors (e.g. not closing or locking effectively), must be replaced. • Fire resisting cabinets should be located away from doors, fire evacuation routes and sources of heat / ignition.
Metal cabinet	• These cabinets should contain a spill tray to catch any leakage or spillage. The spill tray should have a volume that is 110% of the largest container. • These cabinets should be lockable.
Ventilated cabinets	• Ventilated cabinets may be free-standing with their own extract and filtration system or may be situated beneath a fume cupboard and attached to the fume cupboard duct*. • They should contain a tray to catch any leakage or spill. The spill tray should have a volume that is 110% of the largest container. • They must be inspected and maintained in line with manufacturer's instructions (including replacement of filters if required).
Fridges and freezers	• If there is a need to store flammable materials the refrigerator must be intrinsically safe (of non-sparking design) to prevent ignition of the contents and clearly labelled. • Refrigerators used for the controlled temperature storage of chemicals must be dedicated and clearly labelled for that purpose and never used to store food or beverages that are for human consumption.
* Cabinets exhausted to a fume cupboard should form part of the 14-month statutory inspection and be maintained in line with manufacturers recommendations	

Ensure an up to date safety data sheet is available for every chemical stored, this includes new and existing chemicals. The SDS provides users with information about recommended storage requirements (section 7) and chemical incompatibility (section 10).

Incompatible chemicals must be kept apart; this reduces the risk of hazardous chemical reactions and / or fire. Refer to the **generic chemical compatibility chart** below.

Further guidance on the correct segregation and labelling of storage cabinets is available in **Appendix 1** – Chemical storage; segregation and labelling.

The **generic chemical compatibility chart** below is useful for the safe storage of chemicals. More detailed information about chemical compatibility is contained in the safety data sheet (Section 10).

				Flammable Solid		Oxidising		Toxic		Corrosive	
		Flammable liquids	Readily combustible	Spontaneously combustible	Dangerous when wet	Oxidising substances	Organic peroxides	Toxic substances	Organic acids	Inorganic acids	Bases
	Flammable liquids		■	■	■	■	■	■	■	■	■
Flammable Solids	Readily combustible	■		■	■	■	■	■			
Flammable Solids	Spontaneously combustible	■	■		■	■	■	■	■	■	■
Flammable Solids	Dangerous when wet	■	■	■		■	■				
Oxidising	Oxidising substances	■	■	■	■		■	■	■	■	■
Oxidising	Organic peroxides	■	■	■	■	■		■	■	■	■
Toxic	Toxic substances	■	■	■		■	■				
Corrosive	Organic acids	■		■		■	■			■	■
Corrosive	Inorganic acids	■		■		■	■		■		■
Corrosive	Bases	■		■		■	■		■	■	

Separation may not be necessary (Refer to SDS, Section 10 - Stability and reactivity)

■ Keep apart

5. Housekeeping

- All newly purchased chemicals must have a Chemical Risk Assessment - Pre Purchase Form this can be found on Staff H&S Intranet pages or PG H&S Intranet pages.
- Ensure an up to date safety data sheet is available for every hazardous substance stored, this includes new and existing chemicals. The SDS provides users with information about recommended storage requirements (section 7) and chemical incompatibility (section 10).
- Do not overfill chemical containers; allow enough free head space (e.g. Winchesters only filled to the shoulder of bottle) to account for any expansion of the contents, preventing over pressurising of the container. Overfilling waste solvent bottles has resulted in Winchesters breaking in the waste store (particularly during hot weather).
- Never carry a bottle of chemicals by its top; carry Winchesters in carriers or baskets capable of providing proper support.
- Empty flammable containers should be stored in the same way as full containers until removed to the waste store.
- When handling chemicals a chemical risk assessment must be completed. Staff and students must use the Chemical Risk Assessment – Safe operating Procedure, this can be found on Staff H&S Intranet pages or PG H&S Intranet pages.
- Chemical risk assessment training is available to book on ABW (staff) or by emailing N.Dicataldo@swansea.ac.uk (PG students).

6. Stock control

- Good stock control should be maintained, this means a regular review of what is being stored. Be especially aware of time-sensitive compounds (e.g. ethers once opened and exposed to the air can produce peroxides which are highly explosive).
- The quantity of hazardous / dangerous substances must be kept to a minimum.
- Staff/ students should only purchase the minimum quantity of chemicals required for their work; the disposal of unused chemical can cost significantly more than the perceived savings made when buying chemicals in larger quantities, see Top tips for laboratory purchasing. Minimising the bottle size when purchasing also reduces the risk of larger spills.
- Any chemicals with a use by/ best before date must be disposed of once this date has expired.
- A significant number of laboratory solvents can undergo autoxidation under normal storage conditions to form unstable and potentially dangerous peroxide by-products. For further information about their safe use and storage of refer to Peroxide Forming Solvents.
- Any hazardous/ dangerous chemicals over 5 years old are to be disposed of unless justification can be supplied regarding its continued safe use and storage. This would also require an up-to-date risk assessment and Safe Operating Procedure (SOP)
- Individuals leaving the Univeristy are to follow the departure procedure, see 8-1-14 Departure and Decontamination of Laboratory and Workshop Space and Equipment. This includes the transfer or disposal of chemicals and updating the chemical inventory.

7. Disposal

Dispose of hazardous chemicals that are no longer required. For more information see:

- Chemical Waste store user procedure
- Chemical waste disposal form
- Chemical waste disposal label

- All lab users must be aware of the discharge to drain procedure. This document provides clear guidance on what can and cannot be disposed of to drain in order to maintain legal compliance and protect the environment.
- When transporting waste to the chemical waste stores on each campus, ensure an appropriate trolley and spill kit is available to ensure safe transportation i.e. use a bunded trolley with edge guarding and wheels that are appropriate for the terrain.
- **Do not** transfer dangerous goods between campuses.
- Remove a chemical from your chemical inventory once you have used it or disposed of it.

8. Regulated and High Hazard Chemicals

There are chemicals that require more stringent controls (including additional storage requirements) due to potentially significant health or safety effects and/or regulatory requirements. These include:

- Class 1 explosives and Class 4 desensitised explosives* Explosives Regulations 2014
- Chemicals listed in Schedules 1 and 2 of the Chemical Weapons Convention (CWC)
- Controlled drugs Misuse of Drugs Act 1971, Misuse of Drugs Regulations 2001
- Drug precursors, Schedule 1. https://www.gov.uk/government/publications/precursor-chemicals-wallchart-for-domestic-licensing
- Schedule 1 Poisons https://www.legislation.gov.uk/uksi/1982/218/pdfs/uksi_19820218_en.pdf

Contact healthandsafety@swansea.ac.uk, prior to purchase.

Appendix 1 – Chemical storage, segregation and labelling.

Class	Dangerous Goods Symbol & Classification (SDS Section 14)	GHS Symbol & Hazard Codes (SDS Section 3)	Chemical Storage – Cabinet Type	Warning Sign (to be displayed on the cabinet, including suggested wording)	Description
	Not applicable	 Chemicals with the Health Hazard Symbol only or no GHS symbol.	**General storage / shelving**		**General storage** These chemicals can be stored on open shelves (out of direct sunlight) or in a labelled cabinet.
Class 3 – Flammable liquid	 **Class 3 Flammable Liquids**		**Fire resisting cabinet**		**Flammable liquids** These must be stored in a dedicated fire resisting cabinet, used for Class 3 flammable liquids only (see SDS Section 14). *Do not store other flammable materials in this cabinet, (e.g. any Class 4 Flammable solids – see below).* Flammable liquids must not be stored in refrigerators unless it is **spark-proof** and labelled.

		H224 Extremely flammable liquid and vapour. H225 Highly flammable liquid and vapour. H226 Flammable liquid and vapour.			A maximum of 50 litres of extremely, highly flammable and those flammable liquids with a flashpoint below the maximum ambient temperature of work area may be kept in a laboratory/ workshop. No more than 250 litres for other flammable liquids with a higher flashpoint of up to 55°C may be stored in a laboratory/ workshop. Flammable liquids should be returned to the fire resisting cabinet immediately after use. 500ml working volume may be kept on open bench, then returned to the storage area overnight. Empty flammable containers should be stored in the same way as full containers until removed to the waste store. Flammable liquids with **secondary hazards** (e.g. toxic/ corrosive) should be stored in a separate fire resisting cabinet. If it can be *safely stored within the flammable cabinet*, it should be on a separate shelf, in a secondary container or drip tray; refer to the SDS.

<table>
<tr>
<td rowspan="2">Class 4 – Flammable solids
4.1 Flammable solid</td>
<td>Class 4.1
Flammable solids</td>
<td> 
H228 Flammable solid.
H206* Fire, blast projection hazard; increased risk of explosion if desensitizing agent is reduced.
H207* Fire or projection hazard; increased risk of explosionif desensitising agent is reduced.
H208* Fire hazard; increased risk of explosion if desensitizing agent is reduced.</td>
<td rowspan="2">Fire-resisting Cabinet</td>
<td rowspan="2"> 
Flammable solid
 
Danger: Explosive atmosphere</td>
<td rowspan="2">These chemicals should be stored in a dedicated fire resisting cabinet, used for Class 4.1 chemicals only (see SDS Section 14). Do not store them with flammable liquids.

Flammable solids (4.1)
These are readily combustible solids that can be ignited by brief contact with a source of ignition, or are sensitive to friction, and that will continue to burn after removal of the source of ignition.

Desensitised explosives* (4.1B)
These are explosive substances which are wetted, diluted, dissolved, or suspended with a phlegmatiser to suppress their explosive properties. Care must be taken that the phlegmatiser does not dry out during long term storage. The manufacturer should provide information about the shelf-life and instructions on verifying desensitization. Examples include picric acid, urea nitrate and 1- Hydroxybenzotriazole (Hobt).

These substances should be stored in a locked cabinet and regularly inspected for signs of drying (e.g. around bottle stoppers and caps and within the bottle) and the checks documented. Any leaks of spills should be dealt with immediately.

Self-reactive substances. These are thermally unstable liquid or solid substances or mixtures liable</td>
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<td> 
Class 4.1
Self-reactive substances and mixtures</td>
<td> 
H242 Heating may cause a fire.</td>
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					to undergo a strong exothermic decomposition even without the participation of oxygen (air). Examples include various azo compounds.
Class 4 – Flammable solids 4.2 Sponteniously combustible substance	 **Class 4.2 Pyrophoric liquids and solids**	 H250 Catches fire spontaneously if exposed to air.	**Fire resisting cabinet**	 Spontaneously combustible  Danger: Explosive atmosphere	In small quantities, these should be stored in a dedicated fire resisting cabinet, used for Class 4.2 chemical only (see SDS Section 14). **Do not store them with flammable liquids.** Class 4.2 includes pyrophoric liquids and solids and self-heating substances and mixtures **Pyrophoric solids and liquids** A pyrophoric liquid or solid is a substance which, even in small quantities, is liable to ignite within 5 minutes of coming into contact with air. Pyrophoric substances have packaging that is designed to exclude air. If air enters a damaged package the substance may start to burn at room temperature or when gently heated. Examples include yellow phosphorus and some metal alkyls. **Self-heating substances and mixtures** Oxidative self-heating substances may react with the air, and so raise the temperature to the point at which spontaneous combustion takes place. This is normally a slow process which can be controlled by restricting the pack size, limiting storage duration, monitoring temperatures or excluding air.
	 **Class 4.2 Self-heating substances and mixtures**	 H251 Self-heating: may catch fire. H252 Self-heating in large quantities; may catch fire.			

Class 4 – Flammable solids 4.3 Substances and mixtures which, in contact with water, emit flammabale	 **Class 4.3 Dangerous when wet**	 H260 In contact with water releases flammable gases which may ignite spontaneously. H261 In contact with water releases flammable gases.	**Fire resisting cabinet**	 	**Dangerous when wet** In small quantities these should be stored in a dedicated fire resisting cabinet, used for Class 4.3 chemicals (see SDS Section 14). **Do not store with flammable liquids.** These substances react with water and evolve flammable gases. Fire involving or in the vicinity of such materials should not be tackled with water. Examples include calcium carbide, metal hydrides, powders of reactive metals such as magnesium or aluminium, and alkali metals such as sodium and potassium.
Class 5 – Oxidising substances **5.1 Oxidising substance**	 **Class 5.1 Oxidising Substance**	 **Oxidiser** H271 May cause fire or explosion: strong oxidiser. H272 May intensify fire; oxidiser.	**Corrosive cabinet**	 	**Oxidiser** These should be stored in a dedicated corrosive cabinet, used for Class 5.1 chemicals (see SDS Section 14). Do not store them in a wooden cupboard. Some oxidisers are incompatible from each other and need to be stored apart, check the SDS (Section 10). These may be solid or liquid. Oxidisers may be very reactive and should be stored separately from other chemicals. Never store oxidisers with flammable liquids (*their symbols look similar*),

					reducing agents or near combustible materials (e.g. paper/ cardboard).
Class 5 – Oxidising substances 5.2 – Organic perosides	 **Class 5.2** **Organic peroxides**	 H242 Heating may cause a fire.	**Fire resisting cabinet**		**Organic peroxides** These should be stored in a dedicated fire resisting cabinet, used for Class 5.2 chemicals (see SDS Section 14). Minimise the quantity stored and contact your H&S Lead. Some organic peroxides require temperature control. The manufacturer should provide information about the shelf-life and instructions on verifying desensitization, where applicable. Organic peroxides* are a particularly reactive type of oxidising substance. They may be solids, liquids or pastes, and have one or more of the following properties: • liable to explosive decomposition. • burn rapidly and intensely even in the absence of oxygen. • sensitive to impact or friction. • react dangerously with other substances • decompose at comparatively low temperatures and/or cause spontaneous ignition if spilt onto combustible material. Organic peroxides must be stored separately from flammable, corrosive and toxic materials.

Class 6 – Toxic substances	 **Class 6.1 Toxic substances**	 **H340 May cause genetic defects.** **H341 Suspected of causing genetic defects.** **H350 May cause cancer.** H351 Suspected of causing cancer. H360 May damage fertility or the unborn child. H361 Suspected of damaging fertility or the unborn child. **H334 May cause allergy or asthma symptoms or breathing difficulties if inhaled.**	**Metal cabinet, lockable with a bund**		**Mutagens, Carcinogens & Reprotoxic substances and asthmagens only.** These chemicals must be stored in a **locked** cabinet with access restricted to authorised, trained users. Where fumes or odours can be evolved, they must be stored in cabinets with adequate **extraction ventilation**. An inventory of chemicals stored within the cabinet must be maintained. The quantities stored must be kept to a minimum.

Class 6 – Toxic substances	 **Class 6.1 Toxic substances**	 **H300 Fatal if swallowed.** **H310 Fatal in contact with skin.** **H330 Fatal if inhaled.** H301 Toxic if swallowed. H311 Toxic in contact with skin. H331 Toxic if inhaled.  H370 Causes damage to organs. H371 May cause damage to organs. H372 Causes damage to organs through prolonged or repeated exposure. H373 May cause damage to organs through prolonged or repeated exposure.	**Metal cabinet, lockable with a bund** **Ventilated cabinet**	 Toxic, non-halogenated  Toxic, halogenated	These are substances which if inhaled, ingested or absorbed through the skin may cause serious adverse health effects. In the event of fire, there may be a failure of many containers due to the effects of flame and heat, as well as posing an immediate threat to anybody in the vicinity, e.g. firefighters. The toxic substance can also be spread large distances in the plume of smoke, or it may be washed into watercourses by firefighting operations. **Non-flammable, halogenated solvents** Do not store with flammable liquids or other organic liquids as violent reactions may occur with some solvents.

		H304 May be fatal if swallowed and enters airways H305 May be harmful if swallowed and enters airways.			

<table>
<tr>
<td rowspan="2">Class 8 – Corrosive substances</td>
<td rowspan="2"> 

Class 8
Corrosive material</td>
<td rowspan="2"> 
Corrosive

H290 May be corrosive to metals.
H314 Causes severe skin burns and eye damage.
H318 Causes serious eye damage.</td>
<td>Corrosive cabinet</td>
<td> 
</td>
<td rowspan="2">Corrosive substances
These should be stored in a dedicated corrosive cabinet, used for Class 8 chemicals (see SDS Section 14). Inorganic acids, organic acids and alkalis/bases must be in separate cabinets. Corrosive liquids must not be stored above shoulder height.

Hazardous substances may be classified as corrosive because they burn the skin on contact or burn the mucous membranes of the respiratory tract by inhalation. Corrosive substances can cause serious eye damage.

Corrosive substances will react with incompatible materials e.g., unsuitable packaging or metals (including shelving that is not corrosion resistant). Leaking corrosive substances may damage the packaging of other dangerous substances, thus creating further leaks.

Corrosive (inorganic acid) / Corrosive (organic acid), have a pH less than 7.
Separate storage cabinets are required to separate inorganic and organic acids; there is a risk of violent reactions if some inorganic and organic acids are stored together.</td>
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<tr>
<td>Corrosive cabinet</td>
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					Nitric acid is corrosive, toxic and an oxidiser, it may be stored in the Corrosive (inorganic acid) cabinet inside a secondary container. *Hydrofluoric acid* must always be stored in a dedicated, locked cabinet, with access restricted to users who are trained in the safe handling of HF. Label: 
			Corrosive cabinet		**Corrosive (alkali / base), pH of greater than 7.** Even although these materials are marked with a corrosive label, they must be stored separately from acids since any accidental mixing of the concentrated materials will generate large quantities of heat and fumes.

*A significant number of laboratory solvents can undergo autoxidation under normal storage conditions to form unstable and potentially dangerous peroxide by-products. They may be labelled EUH019 — 'May form explosive peroxides'. For essential information about their safe use and storage of refer to Peroxide Forming Solvents.