CHEMICAL STORAGE

CONTENTS

1 INTRODUCTION

Storage of chemicals is an important aspect of safe chemical management. Chemicals can pose risk of fire, explosion, dangerous reactions and/or environmental damage if they are not stored correctly. Large volumes of chemicals which are stored in the workplace for long periods of time can increase risk to the health and safety workers.

2 PURPOSE

This guideline has been developed to support implementation of the University's Chemical Safety Standards. Faculties, schools, research groups and professional services units are encouraged to use this document as a primary reference when developing local procedures for chemical storage.

The performance standards relevant to this guideline are as follows:

CHEMICAL SAFETY PERFOMANCE STANDARDS	
2	The quantity of hazardous chemicals procured, stored and used is actively minimised
4	Procurement, storage and use of high risk chemicals is approved by the relevant Head of School (or equivalent)
6	A register of hazardous chemicals used or stored in the workplace is regularly maintained and accessible to workers'
13	Flammable liquids and gases are separated from ignition sources
16	Hazardous chemicals are segregated and stored in accordance with recommendations of the SDS and applicable Australian Standards
17	Flammable, corrosive and toxic liquids held in quantities greater than 10 L per 50m^2 (in total) are segregated and stored in Australian Standard compliant chemical storage cabinets
18	The pack size of liquid, hazardous chemicals is limited to 5L within laboratories
19	The storage and use of cryogenic liquids, and asphyxiating and toxic gases is subject to a documented risk assessment with implemented risk controls

For storage requirements of compressed gases and cryogens, refer to the guideline for Working with gases. Specific recommendations for selected high risk chemicals are discussed in chemical infosheets.

3 GENERAL PRINCIPLES

The storage area selected for a chemical will depend on the:

- Quantity of the chemical to be stored
- Chemical compatibility

3.1 QUANTITY

When placing a chemical within a work area consideration should be given to the:

- Current total quantity of dangerous goods stored in that work area
- Container (or pack) size
- Frequency of use.

A ***Working volume*** is a small quantity of hazardous chemical required for routine day to day use. Working volumes may be stored on benches or shelves within a work area (laboratory, studio or workshop).The recommended container size is ≤ 1 L or kg. Larger containers of dangerous goods (e.g. 2.5 L glass bottles) must be placed in an appropriate chemical storage cabinet. Containers holding more than 5 L or kg are to be placed in a purpose built dangerous good depot outside of the work area. Refer section 4 for more information.

If the ***total aggregate volume*** of a specific dangerous good (DG) in a work area exceeds **10 L or kg** then a chemical storage cabinet must be used. For example, if there are 4 x 2.5 L bottles of flammable liquid (DG Class 3) in the work area then storage in a flammable liquids chemical storage cabinet is recommended. More information is given in section 4.2 .

A local workgroup must maintain a chemical register which lists the locations, quantities and chemical hazard classes of the chemicals in a work area.

3.2 CHEMICAL COMPATIBILITY

Compatible chemicals will not react dangerously if they come into contact. Chemicals stored together must be compatible. Incompatible chemicals are segregated and stored in locations where they cannot react. Commonly used chemicals which are incompatible are listed in Appendix A.

Use a Safety Data Sheet (SDS) to determine compatibility. Investigate the:

- Physical properties of the chemicals such as stability, boiling point, flash point, physical state
- Dangerous Goods (DG) classification
- Storage incompatibilities and reactivity

In general, the primary dangerous goods class is used to determine the correct storage location for a chemical, but all hazards should be considered. For example acetic acid is both corrosive and flammable but depending on the quantity stored and other substances in the DG chemical storage cabinet, it may be appropriate to store acetic acid in a corrosives cabinet or a flammable liquids cabinet. Acetic acid should not be stored with nitric acid.

3.2.1 GHS pictograms

Caution! A single pictogram from the Globally Harmonised System for the classification and labelling of chemicals (GHS) can represent many different hazard types and these may be incompatible. For example, the GHS flammable pictogram is displayed on containers of many different types of flammable materials (e.g. DG Class 3 flammable liquids, DG class 4 flammable solids, DG Class 5.2 organic peroxides and DG Class 2.1 flammable gas.), refer Figure 1. Many of these materials are incompatible. Only flammable liquids are to be placed in a DG Class 3 chemical storage cabinet.

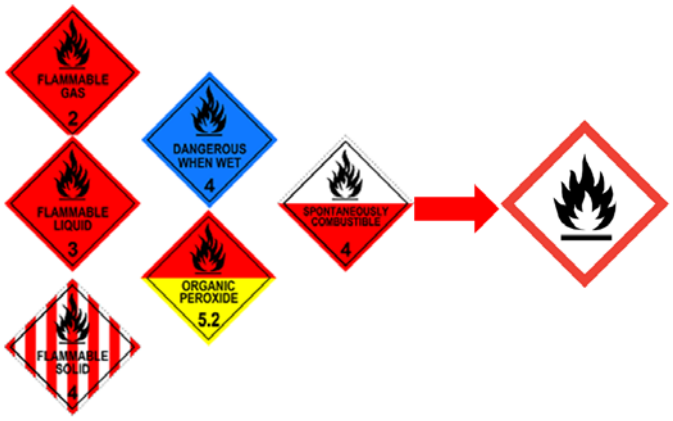

Figure 1: Multiple flammable materials represented by single GHS pictogram

3.2.2 Compatibility within a DG class

Even within a single dangerous goods class incompatibilities can arise. Highly reactive chemicals such as organic peroxides, pyrophoric chemicals, hydrofluoric acid, perchloric acid may need to be stored separately from other chemicals of the same class.

3.2.3 Container compatibility

Store a chemical in the original container whenever possible. Chemical containers, particularly lids and stoppers, can react with the chemical contents and degrade over time. When decanting a chemical from a supplier reagent container, always:

- **Ensure the new container is compatible with the chemical to be stored.** For example, Metal lids should not be used with strong acids; strong oxidising agents should be stored in Teflon FEP (fluorinated ethylene propylene) or Teflon PFA (perfluoroalkoxy) containers. Refer to the Cole-Palmer chemical resistance chart.
- **Avoid re-using containers.** Never use food or drink containers for chemical storage. Spill proof, pyrex or 'safe-break' containers are desirable. If supplier bottles are re-used ensure complete decontamination and removal of previous label.
- **Ensure caps, lids and stoppers are secure to prevent leaks and evaporation of contents.** A limited exception is freshly-generated mixtures such as acids and organics that may generate gas pressure sufficient to burst a tightly sealed bottle. Commercially available vent caps can be purchased or keep the lid loose until the reaction is complete, and then tightly close the lids. Detail these specific procedures in a safe work procedure.

3.2.4 Segregation

Generally segregation is achieved by distance separation or by using physical barriers. For example a separation distance of 3 m is required for the storage of containers of Class 3 flammable liquids and Class 8 corrosives. Class 3 flammable liquids should also be separated by 3 m from ignition sources.

For working volumes, a physical barrier may be used by placing chemicals in a:

- **Separate cupboard or on different shelves**. Clearly identify laboratory shelving or cupboards with a DG class diamond if it is dedicated to one DG class.
- **Plastic spill tray or tub or "secondary containment"**. Secondary containment is recommended for liquids. Ensure the material of the spill tray is compatible with the chemical and will contain the volume of the largest container.

It is also good practice to:

- Always store **liquid chemicals below** or separate to **solid** chemicals.
- Keep storage on shelves below shoulder height.
- Ensure materials that react with water are not stored in areas where they may be exposed to water (e.g. under of sink or with aqueous solutions).

Non-hazardous and compatible chemicals can be stored together alphabetically on a laboratory shelf or within a storage cupboard.

3.3 AGE

Chemical storage areas should be inspected regularly. Ensure outdated or unwanted items, illegible labels and leaking containers are identified and immediate action taken.

Chemicals and containers can degrade over time, for example, picric acid, perchloric acid and diethyl ether can produce explosive products. When a chemical arrives into the workplace it is good practice to write the **date of arrival** on the container. **Regularly remove** chemicals from the work area that are not routinely used.

Degradation of a chemical may also produce gases that generate pressure inside a sealed storage container. The first sign of deterioration may be noticeable changes to the container such as:

- Internal pressure (a bulging container)
- Vacuum (a collapsed container)
- Deposits on the lid or stopper (powder or crystalline residue)
- Crystals within the liquid, or around neck of a bottle
- A dried-out solid in the jar (if is supposed to be a liquid)
- Any other signs of chemical decomposition e.g. discolouration.

Do not move or open the chemical container and seek advice as soon as possible.

3.4 TEMPERATURE

Never store chemicals in direct sunlight. Light (e.g. UV radiation) and heat can affect the chemical stability of many chemicals.

Ensure the integrity of the chemical by storing it at the appropriate recommended temperature. Some chemicals are most stable below room temperature, requiring storage in a cold room, fridge or freezer, refer 4.1.2.

3.5 SECURITY

All chemicals must be kept away from the public and placed in an “authorised entry only” laboratory or workspace, or secured in a chemical store.

Some chemicals have regulatory requirements which require additional storage requirements, for example:

- Restricted schedule 4 drugs, highly dangerous schedule 7 poisons and schedule 8 drugs.
- Restricted and prohibited carcinogens.
- Radioactive isotopes
- Illicit drug precursors
- Chemicals of security concern

These chemicals may require a separate and secure locked storage area and processes for tracking use (Refer to the guidelines for Working with carcinogens and Working with scheduled poisons). Chemical storage cabinets, particularly for carcinogens or highly toxic chemicals, should be locked to prevent unauthorised access.

Refer to Appendix B for some common mistakes when storing chemicals.

4 STORAGE AREAS

General considerations for chemical storage areas are:

- An area that is well lit and adequately ventilated to prevent the accumulation of vapours.
- Chemicals protected from temperature fluctuations, direct sunlight and moisture.
- Chemicals stored in closed, labelled containers.

- Chemicals stored separately from other consumables (plasticware, glassware, paperware) and equipment.
- The area is able to be locked or access restricted to authorised personnel.
- Shelving not above shoulder height or 1.5 m and cannot move laterally.
- Shelving and cupboards are non-porous, chemically and corrosion resistant.
- The load on the storage shelf is below the maximum load capacity limit.
- Chemicals are placed back from the edge of the shelf.
- No chemical packages stored on the floor (also cardboard boxes and styrofoam should not be placed on the floor as they are combustible and easily contaminated in the event of a spill or flood).
- Fire- fighting apparatus and spills kits that are appropriate for the volumes of chemicals.

4.1 OPERATIONAL WORK AREAS

The quantity of hazardous chemicals held within an operational work area should always be actively minimised. Chemicals used infrequently should be stored outside of the immediate work area. It may be appropriate to decant smaller working volumes from larger pack sizes to place in the work area and keep larger containers within a dangerous goods store.

Table 1 lists the maximum working volumes and container sizes permitted in a work area within The University of Sydney. These have been described in the University Chemical Safety Standards and are based upon Australian Standard 2243:10 [1]. Note these total quantities are dependent on the floor area (size) of the workspace.

Dangerous Goods Class		GHS symbol	Maximum working volume (L or Kg) / 50 m^2 workspace	Maximum lab container size (L or Kg)
	Class 3 (Flammable liquid)		10	5
	Class 4.1 (Flammable solid) Class 4.2 (Spontaneously combustible solids) Class 4.3 (Dangerous when wet)		As low as possible < 2.5 kg packing group 1 < 5 kg packing group 2 < 10 kg packing group 3	1
	Class 5.1 (Oxidising substances) Class 5.2 (Organic peroxides) (other than ammonium nitrate)		As low as possible <10	1
	Class 6.1 (Toxic)		10 liquid* 20 solid*	5
	Class 8 (Corrosive)		10 liquid 20 solid	5 20 (diluted only)

Table 1: Maximum working volumes within a work area

*Class 6, Packing Group 1, highly hazardous toxic materials (e.g. inorganic cyanides) should be placed in locked storage with restricted access and limited to 10 kg aggregate total whether solid or liquid.

4.1.1 Fume cupboards

Fume cupboards are not designed or intended for the storage of chemicals. A fume cupboard is a work area for the handling of chemicals. Excess storage of chemicals or equipment in a fume cupboard can disrupt the air flow and reduce the effectiveness of the ventilation for fume extraction. View "Using a fume cupboard" tutorial video.

4.1.2 Cold storage

Only store a hazardous chemical in a fridge or freezer if required by the physical properties and stability of the chemical (refer to the safety data sheet). When storing chemicals in fridges or freezers:

- For the cold storage of flammable liquids use only an intrinsically safe (spark proof) laboratory fridge and freezer.
- Segregate DG classes within a fridge (small tubs or trays may be adequate). Two small (bar) fridges may be preferable to a large fridge if chemicals are incompatible.
- Place appropriate signage on the door e.g. the dangerous goods class symbols, "No flammable liquids" (if the fridge is not intrinsically safe) and "No food or drink", refer Figure 2. This placarding is commercially available from safety suppliers.
- Monitor the temperature and level of frost or moisture in the fridge/freezer and defrost as necessary.
- Regularly remove unused and unwanted material which takes up valuable storage space.
- Seal all chemicals tightly within a fridge or freezer as these appliances do not have interior venting
- The placement of a domestic fridge or freezer within a work or storage area must be 3 m from a potential hazard zone caused by flammable liquids (e.g. DG class 3 flammable liquids cabinet). A fridge motor which is often at the base of the fridge can act as an ignition source.

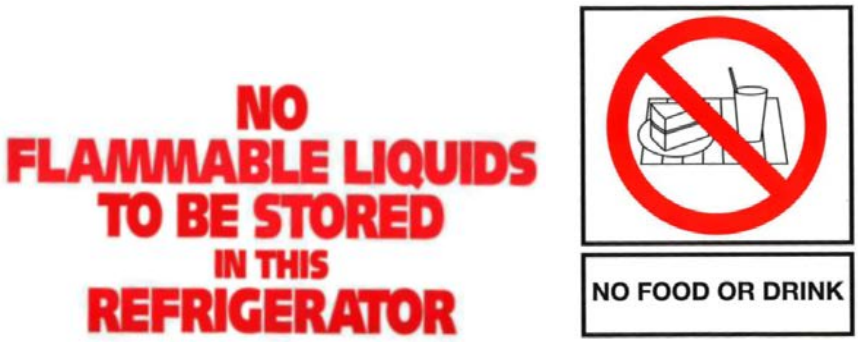

Figure 2: Appropriate signage for a fridge or freezer

Cold rooms have closed air-circulation systems that re-circulate escaped vapors within the chamber. The refrigeration coils in cold rooms are often aluminum and subject to damage from corrosive atmospheres. The electrical systems normally have vapour-proof lights and power outlets, but extension cords and power-boards will compromise these safety features. Cold rooms are not acceptable for storage of flammables, dry ice and highly toxic liquid chemicals or compressed gases.

Figure 3 illustrates a process for determining dangerous goods storage in the work area.

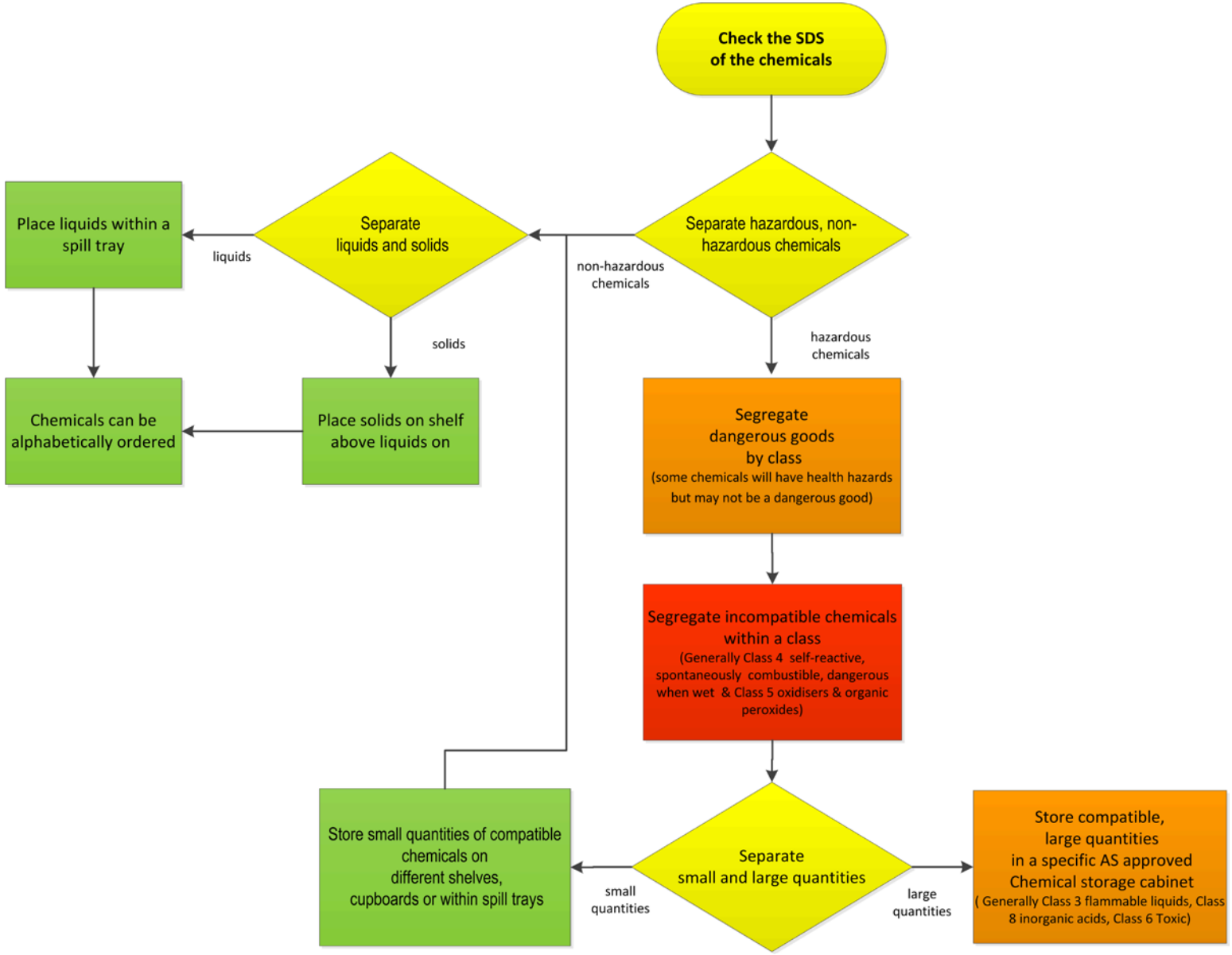

Figure 3: A recommended process when storing chemicals in the work area

4.2 CHEMICAL STORAGE CABINETS

Larger quantities of dangerous goods (e.g. > 10 L flammable liquids) or large pack sizes (e.g. > 2 L container of flammable liquid) must be stored in an Australian Standard [1] approved chemical storage cabinet.

Chemical storage cabinets will:

- Contain spills
- Segregate between incompatible materials
- Protect contents from damage.

A chemical storage cabinet also provides separation between the large volumes of chemicals stored in the cabinet and a fire. An Australian Standard approved cabinet must be constructed to withstand a fire for at least 10 minutes to allow the evacuation of workers.

Chemical storage cabinets commonly used for segregation of dangerous goods are shown in Table 2:

DG class	Dangerous Good	Example
Class 3	Flammable non-halogenated solvents	Acetone, Acetonitrile, Ethanol, Hexane, Petroleum ethers, Methanol
Class 6.1	Toxic chemicals	Dichloromethane, Chloroform or high risk acutely toxic chemicals
Class 8	Corrosive inorganic acids	Hydrochloric acid, Sulphuric acid, Phosphoric acid. On a separate shelf Nitric acid which is an oxidsing acid. Acetic acid, a flammable organic acid must be stored separately to Nitric acid.

Table 2: Examples of common chemicals held in a chemical storage cabinet

Small under-bench chemical storage cabinets with capacity of 30 L are recommended for use in the average-sized laboratory. A 250 L cabinet should not be placed in a work area, two separated 100 L cabinets is preferable.

Further considerations include:

- Only closed containers or those containers fitted with a tap are stored in a DG cabinet.
- A ventilated dangerous goods cabinet is not normally required with standard activities, but is an option for large stocks.

4.2.1 Location

A workplace may require chemical storage cabinets for different dangerous goods classes. In general, the total combined volume of all the dangerous goods cabinets in a standard laboratory must not exceed 250 L within a 10 m radius. For example, a 100 L class 8 corrosives cabinet, a 100 L class 3 flammable liquids cabinet and a 50 L Class 6.1 toxic cabinet could be stored within a 10 m radius. Any other chemical storage cabinet would need to be 10 m from this group (and that includes through intervening walls unless they are fire rated).

Chemical storage cabinets must not be located:

- Near emergency exits and at least 3 m from any exit doors
- Under stairs or in public corridors
- Close to safety showers or eye wash
- Above one another

Flammable liquid cabinets (Figure 4) must have ignition sources (e.g. fridges, freezers, electrical sockets, vacuum pumps and all floor mounted electrical equipment) separated by a distance of 3 m measured laterally, and to a height of 1 m above the top of the cabinet [2].

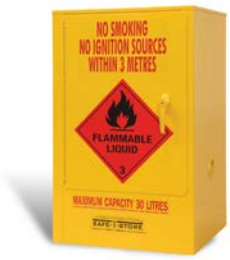

Figure 4: AS approved DG Class 3 flammable liquids cabinet

4.3 DANGEROUS GOODS DEPOTS

If the volume of chemicals in the laboratory exceeds working volumes or the capacity of the chemical storage cabinets, then a dangerous goods (DG) depot should be used (Figure 5). These purpose built stores are located away from the routine work area, often external to a building. DG Depots are often dedicated to one particular dangerous goods class, for example a Class 3 flammable liquids dangerous goods depot, and must not contain other items, e.g. lab consumables.

Quantities of chemicals which are greater than the "placarding quantity" must be stored in a dangerous goods depot. DG depots have a number of specific regulatory design requirements. These requirements are dependent upon both the quantity stored as well as the mixtures of chemicals stored. An assessment of risk and requirements for the storage of large amounts of dangerous goods must be completed.

If chemicals are ordered in larger package sizes (e.g. 20 L or 200 L drums) they must be delivered directly to the DG depot and decanted to smaller volumes before entering the internal work area. There are increased requirements if unpacking or decanting is to take place within depots.

Safety, Health and Wellbeing must be contacted if quantities in a storage area exceed "placard" quantities .There are legislative reporting requirements and details of dangerous goods depots must be entered into the University chemical manifest. For more information refer to the guideline for Dangerous Goods Depots.

Figure 5: Class 3 flammable liquids Dangerous Goods depot

5 REVIEW AND EVALUATION

Performance standards and the associated procedures and guidelines will be reviewed by Safety Health & Wellbeing at least once every two years to identify and implement opportunities for improvement.

6 REFERENCES

1. AS/NZS 2243.10:2004 Safety in laboratories – Storage of chemicals
2. AS/NZS 1940:2004 The storage and handling of combustible liquids
3. AS/NZS 2243.2:2006 Safety in laboratories - Chemical aspects
4. AS/NZS 3833:2007 The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers
5. AS 3780:2008 The storage and handling of corrosive substances
6. AS 4326:2008 The storage and handling pf oxidizing agents
7. AS/NZS 4452:1997 The storage and handling of toxic substances
8. AS/NZS 5026:2012 The storage and handling of Class 4 dangerous goods
9. Placarding for the Storage of Hazardous Chemicals, SafeWork NSW [accessed September 2017]
10. Manufacturing Chemists' Association, *Guide for Safety in the Chemical Laboratory,* pp. 215–217, Van Nostrand

7 DOCUMENT CONTROL

Acknowledgements	Canadian Centre for Occupational health and Safety, Dangerously reactive liquids and solids,[accessed September 2017] Cole-Palmer Chemical Compatibility database, [accessed September 2017]
Related Documents	WHS_CHE_STD_1_Chemical Safety Standard WHS_CHE_GUI_1_Working with Gas Cylinders guideline WHS_CHE_INF_1_Hydrofluoric acid infosheet WHS_CHE_INF_1_Perchloric acid infosheet WHS_CHE_INF_1_Picric acid infosheet

Version Control	Date released	Author/s	Custodian	Approved by	Amendment
1.0	20/3/2017	WHS Specialist (Chemical)	Manager, Work Health & Safety Services	Director, Safety Health & Wellbeing	Original
1.1	13/9/2017	WHS Specialist (Chemical)	Manager, Work Health & Safety Services	Manager, Work Health & Safety Services	Minor changes to Table 1.

Printed copies of this document are uncontrolled. Verify version before using.

APPENDIX A COMMONLY USED CHEMICALS WHICH ARE INCOMPATIBLE

A wide variety of chemicals react dangerously when mixed with certain other materials. Some of the more widely-used incompatible chemicals are given below, but always used the SDS as a point of reference.

(Adapted from Manufacturing Chemists' Association, *Guide for Safety in the Chemical Laboratory,* pp. 215–217, Van Nostrand [10])

CHEMICAL	KEEP OUT OF CONTACT WITH
Acetic acid	Chromic acid, nitric acid, perchloric acid, peroxides, permanganates and other oxidizers
Acetone	Concentrated nitric and sulfuric acid mixtures, and strong bases Chloroform (in presence of base)
Acetylene	Copper tubing, Chlorine, bromine, copper, fluorine, silver, mercury or their salts
Acids	Inorganic cyanides, alkalis
Alkali metals Alkaline earth metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia, anhydrous	Mercury, calcium hypochlorite, chlorine, iodine, bromine, hydrofluoric acid, hydrogen fluoride
Ammonia solution	Chlorine, iodine, bromine,
Ammonium nitrate	Acids, metal powders, flammable liquids, chlorates, nitrites, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenic materials	Any reducing agent
Azides (sodium azide)	Acids e.g sodium azide and carbon disulphide
Bromine	Ammonia, acetylene, butadiene, butane, hydrogen, sodium carbide, turpentine, or finely divided metals.
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Chlorinated Solvents (Chloroform, dichloromethane-DCM, trichloroethylene)	Alkali metals – lithium, potassium, sodium, Non-halogenated flammable solvents (ethanol, methanol, acetone) e.g chloroform and powdered alumimium or magnesium
Chlorates	Ammonium salts, acids, metal powders, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, glycerin, turpentine, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, butane, methane, propane (or other petroleum gases), hydrogen, sodium carbide, turpentine, benzene, finely divided metals, alcohols

CHEMICAL	KEEP OUT OF CONTACT WITH
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids, organic or inorganic
Cyanides	Acids
Diethyl ether	Chlorine or chlorine atmosphere
Dimethyl sulphoxide (DMSO)	Chromium trioxide
Ethanol	Silver nitrate, calcium hypochlorite
Flammable solvents (ethanol, methanol, acetone)	Oxidising agents, ammonium nitrate, bleach, chromic acid, hydrogen peroxide, nitric acid, potassium permanganate, sodium hypochlorite, sodium peroxide, halogens Reducing agents – sodium borohydride, lithium aluminium hydride Concentrated acids - sulphuric acid, hydrochloric acid
Fluorine	All other chemcials
Hydrides (sodium hydride)	Waste
Hydrocarbons (butane, propane, benzene)	Generally, fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Acids – Nitric acid, alkali
Hydrofluoric acid	Ammonia, aqueous or anhydrous, bases and silica
Hydrogen peroxide	Copper, chromium, iron, most metals or their salts, alcohols, acetone, organic materials, aniline, nitromethane, flammable liquids, sulphuric acid, acetic acid
Hydrogen sulphide	Fuming nitric acid, other acids, oxidizing gases, acetylene, ammonia (aqueous or anhydrous), hydrogen
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Acids - Sulphuric acid
Nitric acid (concentrated)	Acetic acid, acetic anhydride, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids, flammable gases, copper, brass, any heavy metals , reducing agents (e.g. hydrazine)
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxidisers (e.g. Peroxides, perchlorates, nitrates, iodates, permanganates)	Organic matters wood and paper, flammable solvents, reducing agents, dehydrating agents e.g. sulphuric acid Some extremely strong oxisiders e.g. Perchloric acid, can be stored in tray with sand

CHEMICAL	KEEP OUT OF CONTACT WITH
Oxygen	Oils, grease, hydrogen; flammable liquids, solids, or gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, and oils
Peroxides, organic	Acids (organic or mineral), avoid friction, store cold
Phosphorus (white)	Air, oxygen, alkalis, reducing agents
Phosphorous pentoxide	water
Picric Acid	Heavy metal salt (lead, mercury, silver) and ammonia and ethanol
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate and perchlorate	Sulfuric and other acids, alkali metals, magnesium and calcium.
Potassium permanganate	Glycerin, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, chloroform, carbon dioxide, water ,
Sodium nitrite	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric Acid	Potassium chlorate, potassium perchlorate, potassium permanganate (or compounds with similar alkali metals, such as sodium, lithium, etc.)
Tellurides	Reducing agents

APPENDIX B COMMON CHEMICAL STORAGE MISTAKES

Common chemical storage mistakes evidenced in work areas have included:

- Storing dichloromethane and chloroform in a class 3 flammable cabinet. These solvents are class 6 Toxic solvents and must NOT be placed in a flammable cabinet.
- Storing strong acids and bases together, in a corrosives cabinet. These chemicals will react vigorously and exothermally. Corrosives cabinets are primarily used for inorganic acids such as hydrochloric, sulphuric, phosphoric and nitric acid. Note that nitric acid is also an oxidizing acid and should be stored separately where possible and not near acetic acid.
- Acetic acid is a flammable organic acid (boiling point 118.1 ^{o}C , flashpoint 39 ^{o}C). Its primary DG class is Class 8 corrosive, small volumes can be stored in a corrosive cabinet, but separate to inorganic acids. For larger volumes, consideration should be given to its flammability by placing in a Class 3 flammable liquids cabinet, but separate to organic solvents.
- Storing liquids and sometimes large packages above shoulder height. This presents manual handling risks and a higher risk of chemical exposure to the eyes (even when safety glasses are worn).
- Placing flammable solvent cabinets near ignition sources such as a fridge, vacuum pump or other electrical equipment. All potential ignition sources must be at least 3m from a Class 3 flammable liquids cabinet.
- Placing flammable liquids cabinets near entrance/ exit door. Chemical storage cabinets should be 3 m from an exit.
- Placing a chemical storage cabinet on top of another chemical storage cabinet.
- Buying large quantities of a chemical simply because it may be cheaper and then storing it for years.
- Storing chemicals under a sink (only appropriate for cleaning materials).
- Storing a large number of items in a fume cupboard which disrupts air flow and hence the effectiveness of the fume cupboard.
- Not taking action when degraded labels or leaking or deteriorating containers are observed.
- Not immediately cleaning up spilt chemicals or chemical residue on bottles and shelving.
- Blocking exits, aisles and emergency equipment (fire extinguishers, safety showers, eye wash and spills kit).
- Chocking doors open resulting in lower chemical security.
- Not having appropriate or current information on laboratory entrance signage or warning signs

Any of these conditions should be corrected immediately. Inspections of chemical storage areas on a routine basis will help to correct deficiencies and prevent accidents.