



Australia's National
Science Agency

Chemical Storage Areas Technical Guide

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Disclaimer

This Chemical Storage Areas Technical Guide summarises legislative requirements and best practice specifications from Australian Standards, Model Codes of Practice and other reputable sources. While this guide covers most aspects of chemical storage it is not exhaustive. CSIRO will endeavour to maintain the guide to ensure it reflects current legislative obligations and best practice guidance.

CSIRO encourages the reader to consider all relevant legislative obligations and any recent updates to applicable guidance materials.

Note: In developing this guide, CSIRO has considered the following Australian Standards which were recently revised, namely - AS 2243.2 – 2006 Safety in laboratories part 2: Chemical Aspects, and AS 2243.10 – 2004 Safety in laboratories part 10: Storage of Chemicals were merged to form AS 2243.2 – 2021 Safety in laboratories part 2: Chemical aspects and storage.

CSIRO has identified the revised Australian Standard currently includes a number of matters which may receive further clarification in the future.

CSIRO recommends that in using this guide, where there is any uncertainty, the user completes a comprehensive risk assessment to identify all risks and control measures prior to undertaking the specific work.

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Chemical Storage Areas Guide – Overview and navigating this guide

All chemical related installations/modifications/maintenance must be undertaken by a qualified and experienced trades person.

General Storage Requirements

(pg. 5)

You must:

1. Follow **general chemical storage requirements**. (pg. 5)
2. Follow specific technical guidance safety advice for storing chemicals in/on a:
 - **Dangerous Goods (DG) cabinet** (pg. 9)
 - **General laboratory cabinet or cupboard** (pg. 11)
 - **Shelf, rack, bench, or pallet** (pg. 11)
 - **Refrigerator or freezer** (pg. 12)

Requirements in an area where packages are opened (e.g. laboratories)

(pg. 14)

Covered by AS 2243.2

You must:

- Follow **general storage requirements** in **s2.3** (pg. 7)
- Follow **additional requirements** in **s3.1** (pg. 14)
- Segregate **incompatible chemicals**. (pg. 14)
- Ensure suitable **ventilation**. (pg. 16)
- **Assess the risk** of a **hazardous atmosphere** forming where gas cylinders or cryogenics are present in an area. (pg. 16)
- NOT exceed the **aggregate storage limits** or **class specific limits** as specified in **s3.1**. (pg. 14)
- Minimize the number of DG Cabinets in a lab, where practical (pg. 19)
- NOT store **gas cylinders** in labs unless connected for use and reticulation into the lab is not practical. (pg. 15)

Requirements for separate stores containing mixed classes of DGs

(pg. 17)

You must:

- Use Table 3 to select the most appropriate requirements, to be applied in full, for the area. (pg. 17)
 - **s4.2** – stores containing small amounts of a **range of hazardous chemicals**. (pg. 18)
 - **s4.3** – stores containing moderate amounts of **lower to moderate risk substances** (e.g., paints, solvents) (pg. 21)
 - **s5** – stores containing only **one class of DGs**, see below (pg. 22)
- Additionally, follow **general storage requirements** in **s2.3** (pg. 7)

For stores containing **smaller quantities**, it may be more practical to work according to **requirements** of **s4.2** or **s4.3** (see above).

Requirements for areas containing only one class of DGs

(pg. 22)

- **s5.2** – Class 2 DGs (**gases and cryogenics**) (pg. 22)
- **s5.3** – Class 3 DGs (**flammable liquids**) (pg. 22)
- **s5.4** – Class 4.1, 4.2 & 4.3 DGs (**flammable solids, spontaneously combustible solids, dangerous when wet**) (pg. 24)
- **s5.5** – Class 5.1 and 5.2 DGs (**oxidisers and organic peroxides**) (pg. 25)
- **s5.6** – Class 6.1 DGs (**toxics**) (pg. 26)
- **s5.7** – Class 8 DGs (**corrosives**) (pg. 27)
- **s5.8** – Class 9 DGs (**miscellaneous or environmentally hazardous**) (pg. 28)

1 Introduction

This document provides information on the necessary aspects of, and establishes mandatory minimum requirements for, new chemical storage areas across CSIRO sites to comply with Commonwealth Work Health and Safety (WHS) Act and Regulations, Australian Standards and other model codes of practice. This is necessary to ensure all hazardous chemicals are stored and handled safely. Aspects of chemical storage and safety covered in this guide include:

- General requirements applicable to all chemical storage areas.
- Criteria for determining which type of chemical storage area is most appropriate depending on the flexibility required for the range of chemicals required to be stored.
- Specific requirements based on the size and scope of the chemical storage area required, either:
 - Chemical storage within laboratories, including dangerous goods cabinets.
 - Chemical stores separated from a laboratory, either attached to the laboratory or a freestanding building for the purpose of storing chemicals.

This document does not cover:

- The storage of compressed gases or cryogenics (DG Class 2 items). These are only briefly mentioned in this guide. Please consult the Reticulated Gas Installation and Maintenance Guide.
- The storage of radioactive substances (DG Class 7 items). Please refer to CSIRO's Radiation Safety guidance material.
- The storage of infectious substances, biologically hazardous materials or other materials requiring physical containment (PC) controls. Please refer to AS2243.3 Safety in laboratories Part 3: Microbiological safety and containment.
- Transit storage, i.e., areas where chemicals are only temporarily stored for <5 working days.
- The storage of chemicals at port facilities or on ship-board installations. Please refer to the IMDG code for requirements, though this document may provide additional guidance for ship-board laboratories, where this guide does not contradict the IMDG code.
- Storage of chemicals in quantities that exceed "minor storage", as defined by the relevant Australian Standard for each section. For storage areas containing quantities above minor storage, external professional advice must be sought.
- Storage of chemicals in bulk containers (i.e. individual containers > 450 L capacity or > 400 kg net mass)¹. Where bulk chemical installations are required, external professional advice must be sought.
- If there is any uncertainty regarding an installation, professional advice should be sought. All chemical installations/modifications/maintenance must be undertaken by a qualified and experienced trades person.

¹ Some legislation and Australian Standards define bulk containers as 500 kg or L. The values given in this guide represent the lowest threshold for being considered bulk quantities across any potentially relevant legislation and standards. For some classes of chemicals in some storage areas, bulk provisions may not apply until the 500 kg or L threshold.

2 General requirements for the storage of chemicals

2.1 Introduction

Hazardous chemicals are substances, mixtures or articles that can pose a health or physical hazard to humans and the environment. They may be solids, liquids or gases.

The basic principles of chemical storage aim to ensure:

- The health and safety of persons by eliminating the risk of exposure to hazardous chemicals.
- The environment is protected by preventing, containing, and cleaning any chemical spills.
- Chemicals are prevented from degrading over time, such as through exposure to heat or sunlight, to form potentially more hazardous by-products.
- Chemicals are prevented from reacting with other incompatible chemicals and subsequently undergoing uncontrolled reaction.
- Chemicals are protected from the effects of and/or contributing to the development of a fire.

2.2 Terms used in this document

- **Hazardous Chemical** means that one or more hazard categories under the Globally Harmonised System of Classification and Labelling of Chemicals (GHS) applies to the chemical.²
- **Dangerous Good (DG)** means that the chemical is assigned to a Dangerous Goods (DG) class under the Australian Dangerous Goods code. A chemical's DG class is listed in section 14 of the SDS.
- **Packing Group (PG)** means the assigned measure of Dangerous Goods' hazard rating. See Appendix B for more information.
- **Laboratory** means any building or part of a building used or intended to be used for scientific and related work, including research, quality control, testing, teaching or analysis. This may include workshops, process bays, sheds or other areas where chemical containers are opened or handled.³























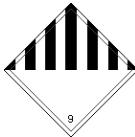
Other definitions for this guide are provided in Appendix B.

Table 1 provides an overview of the Dangerous Goods classes, the class labels, and the equivalent GHS pictograms. A chemical may be hazardous under the GHS, but not classed as a Dangerous Good. Chemicals with more than one Dangerous Goods class generally should be stored based on their primary Class, though secondary or tertiary Classes should be considered for incompatibilities with other substances in the storage areas.

² See the definition of the Work, Health and Safety Regulations for chemicals which are classified under the GHS but are not considered hazardous in Australia (e.g. acute toxic category 5).

³ This definition of laboratory is sourced from Australian Standard 2982.

Table 1. Dangerous Goods Classes, Class labels and equivalent GHS pictograms (where relevant).

DG Class	Class label	Equivalent GHS Pictograms	DG Class	Class label	Equivalent GHS Pictograms	DG Class	Class label	Equivalent GHS Pictograms
CLASS 1 Explosives	 Some classes of explosive may not include the image.		CLASS 2 2.1 Flammable gas 2.2 Non-flammable non-toxic gas 2.2 (5.1) Oxidising gas 2.3 Toxic gas	   		CLASS 3 Flammable liquid	 	
CLASS 4 4.1 Flammable solid 4.2 Spontaneously combustible solid 4.3 Dangerous when wet	  		CLASS 5 5.1 Oxidising substances 5.2 Organic peroxides	 		CLASS 6 6.1 Toxic substance 6.2 Infectious substance	 	 Infectious substances are not covered by the GHS
CLASS 7 Radioactive material	 Radioactive materials are not covered by the GHS		CLASS 8 Corrosive substance			CLASS 9 Miscellaneous Goods		Miscellaneous goods are not covered by the GHS

2.3 General chemical storage requirements

2.3.1 General

All chemical storage areas must incorporate the following:

- All chemicals must be stored in a cool, dry area away from direct sunlight, heat or ignition sources. Liquids should be stored below solids, and as low as possible to the ground to minimize spills or breakages.
- Appropriate chemical spill clean-up materials (e.g., spill kits) must be available and accompanied by established processes for managing chemical spills. Where possible, bunding (such as trays resistant to the chemical being stored) of at least 25% of the maximum possible spill volume should be utilised.
- At least one fixed eyewash facility and safety shower, capable of hands-free operation once activated which meets the specifications of AS 4775. These must be positioned in accessible locations that are no more than 10 seconds away for any chemical store user's reach.
- Access to First Aid facilities and supplies.
- Hand washing facilities for personal hygiene must be available in, or immediately nearby the store.
- Ventilation must be suitable to ensure any flammable vapours do not exceed 5% of the applicable lower explosive limit (LEL) and any toxic vapours must not exceed the relevant exposure standard.
- Stores must be secured against unauthorised entry and kept clear of combustible matter or refuse.
- Chemicals and chemical storage cabinets must not block escape routes or emergency access points.
- Any staff who will access the chemical storage area must have received training in identifying chemical hazards, assessing risks associated with chemicals and be familiar with appropriate risk control measures.

2.3.2 Chemical containers

All hazardous chemicals stored must be:

- Labelled in compliance with the GHS, or with NOHSC⁴ if purchased prior to 1 January 2017. Labels must be in English.
- The minimum practical volume necessary for usage.

⁴ National Occupational Health and Safety Commission (NOHSC) provided criteria for the standardised categorisation and labelling of chemicals in Australia prior to the implementation of the GHS in 2011.

- Treated as full, unless the container has been emptied, cleaned and the label removed or completely defaced.
- Kept closed when not in use.
- Segregated from incompatible materials or other substances with which they may react dangerously, to prevent them from mixing, generally by a physical barrier or intervening space. Segregation distances may be flexible depending on the quantity of chemical stored.
- Where required, stored under specific conditions based on Section 7 of the Safety Data Sheet (e.g. low temperature, under inert atmosphere)
- Inspected at least annually to ensure they are undamaged, and the labelling remains legible.
- Disposed of, where they are no longer required, have exceeded their shelf life, where the container is damaged or the label is illegible.

2.3.3 Signage

- Chemical storage areas must include clear signage on entry doors to identify chemical classes contained within the area. Where quantities of chemicals stored in the work area do not exceed the Placard Quantity for any category of chemicals listed in Schedule 11 of the WHS Regulations, this can be a simple poster (see Appendix C for an example Area Hazard Poster). Full placard signage must **not** be displayed for areas which do not, or no longer contain Placard Quantities of the Class of chemical described on the placard.
- Where the quantities of chemicals in the area do exceed the Placard Quantity for any hazard class listed in Schedule 11 of the WHS Regulations, placards which meet Schedule 13 of the WHS Regulations must be displayed on workplace entrance(s), the building entrance(s) and the storage area entrance(s).
- If chemical holdings are reduced below the Placard Quantities in future, the placarding signage must be updated or removed to reflect the quantities held.

2.3.4 Documentation

- For any chemical storage area, an inventory of the chemicals held in that area must be maintained. Additionally, staff working in or with access to an area where chemicals are used or stored must also have access to the Safety Data Sheets of the chemicals held.
 - In CSIRO, we use ChemAlert to maintain our electronic inventory and provide access to Safety Data Sheets.

2.4 Types of chemical storage

2.4.1 Dangerous Goods Cabinets

Dangerous Goods cabinets are commonly used to store hazardous chemicals, as they provide greater protection from the chemicals stored within them in an emergency. They also provide protection of the chemicals stored from fire so that time is available for escape or fire fighting.

To be considered a Dangerous Goods cabinet, the cabinet must have:

- Signage indicating the Class(es) of Dangerous Goods stored within the cabinet. See below for more information on storing mixed Classes of Dangerous Goods in a single cabinet.
- Walls, floor, door and roof made of double-walled sheet steel construction with a space of at least 40 mm between the walls (can be air space or filled with non-combustible insulation).
- Any gaps sealed as far as necessary to prevent the spread of flame or heat.
- An inner base of the cabinet that forms a liquid-tight bunded compound at least 150 mm deep, designed in a way to prevent the compound from being used as a storage space, with all leakage directed into this lower compound.
- Shelves that are perforated to permit free air movement and which are capable of carrying the maximum load of chemicals to be stored on each shelf.
- Doors which are self-closing, close-fitting and held shut automatically by catches at two or more points. Where doors have a mechanism to hold them open, the mechanism will automatically release above 80°C.
- Be constructed of materials of any components critical to the cabinet's structural integrity that must not melt at a temperature <850°C (seals or gaskets are acceptable, but their use should be avoided if their failure could affect the protective function of the cabinet).
- For Dangerous Goods cabinets of >250 L capacity⁵
 - the top of the cabinet must be no more than 2 m tall, and all external surfaces of the cabinet must be constructed from sheet steel at least 1 mm thick.
 - The cabinet's lower compound must be capable of holding at least 25% of the design capacity of the cabinet or the volume of the largest package able to be stored in the cabinet, whichever is larger.

When using a Dangerous Goods Cabinet to store chemicals:

- In general, only a single Class of chemicals should be stored in a Dangerous Goods cabinet. Where more than one Class of chemicals is stored within a Dangerous Goods cabinet, an assessment of the risks should be undertaken, and incompatible chemicals must be prevented from mixing.

⁵ The maximum size of a Dangerous Goods cabinet allowed in a laboratory is 250 L. For chemicals of Class 4.1, 4.2, 4.3, 5.1 or 5.2; the maximum cabinet size is 50 L. Cabinets of up to 850 L capacity may be used in a dedicated fire rated flammable liquids store but only on floors that have direct access from street or ground level and meet the other requirements listed in AS 1940.

For example, a Dangerous Goods Cabinet containing Class 8 corrosives, including nitric acid (which has a secondary Class of 5.1) and formic acid (which has a secondary Class of 3). It may not be practical to require separate cabinets for these two chemicals, but if stored in the one cabinet, they should be kept in separate secondary containment trays which are compatible with the acid in question to prevent them from mixing.

- Cabinets must not be stacked one on top of another or prevent access to emergency equipment or escape routes.
- Chemicals must not be opened or used on top of a Dangerous Goods cabinet.
- Dangerous Goods cabinets containing chemicals with a primary or subsidiary risk of Class 3, 4 or 5 must not be located within 3 m of an ignition source unless a hazardous zone assessment has been completed. See the Managing Hazardous Areas Technical Guide for more information and a worked example of completing an assessment of a flammable liquid cabinet in a laboratory in the Appendices of that Guide.
- Cabinets containing Class 5.2 Dangerous Goods must have doors with a self-closing mechanism with catches that will release in the event of a pressure build-up within the cabinet.⁶
- Cabinets used to store Class 8 Dangerous Goods must either be constructed of corrosion-resistant materials or be protected by a corrosion-resistant lining or coating.
- Where a Dangerous Goods cabinet is used to store volatile chemicals that present an inhalation risk (i.e. have an exposure standard or health effect by inhalation), ventilation must be considered (but is not mandatory if an assessment of the risk of exposure deems ventilation unnecessary).

For example, consider a cabinet containing a 2.5 L bottle of methanol, a volatile Class 3 and 6.1 liquid with an exposure standard. It is identified that the closed bottle and small quantity present a low risk of exceeding unsafe levels of methanol and therefore ventilation of the cabinet is not necessary. If a more toxic volatile liquid, or a substantially larger quantity were stored, then ventilation for the cabinet may be necessary.

- If an individual cabinet is vented, the ventilation must be to an external atmosphere (i.e. outside the building) in a manner that allows safe dispersal of vapours, fumes or dust. Each cabinet ventilation system must be completely independent unless an assessment has been conducted to ensure the vapours or evolved gases are compatible. Cabinets must not be ducted to a fume cupboard exhaust. Note that the fire resistance of the cabinet must not be compromised by ventilation ductwork connections⁷ and the fire resistance of building elements (e.g. walls) at exhaust ductwork penetrations must be maintained.

⁶ See AS 4362 section 4.8.3 (Class 5.1) or AS 2714 Section 4.6.1 (Class 5.2) for more information.

⁷ Flame arrestors and fire-collars should be installed.

2.4.2 Storing Chemicals in general laboratory cabinets or cupboards

Other cabinets or cupboards which do not meet the specifications of Dangerous Goods cabinets may be used to store chemicals, provided:

- The cabinet is made of a material which is resistant to moisture deterioration or spills, leaks or vapours from the chemicals enclosed.

For example, cabinets made from particle board may fail when subjected to moisture over time; cabinets made of metal or using metal supports or shelving should not be used to store chemicals which give off corrosive vapours as the metal will corrode over time.

- Secondary containment in the form of bunded trays is used.
- Cabinets do not enable the build-up of hazardous atmospheres such as toxic vapours.
- Cabinets have signage indicating the Class(es) of Dangerous Goods stored within them, such as the relevant DG or GHS pictograms.
- If a cabinet is used to store volatile chemicals which present an inhalation risk, ventilation must be considered. If an individual cabinet is vented, the ventilation must be to an external atmosphere (i.e. outside the building) in a manner that allows safe dispersal of vapours, fumes or dust. Each cabinet ventilation system must be completely independent (i.e. two cabinets cannot share ducting; a cabinet cannot be ducted to a fume cupboard exhaust).

2.4.3 Storing chemicals on a shelf, rack, bench or pallet

- Chemicals should preferentially be stored in Dangerous Goods cabinets or laboratory cabinets, wherever practical.
- Where chemicals are stored on a shelf, rack or bench, secondary containment should be used to prevent spills from spreading or incompatible chemicals from mixing.
- Bench, shelf, rack or pallet materials must be made of a material which is as resistant as practicable to the chemicals. The use of particle or similar boards is not recommended as they may fail when subjected to moisture or chemicals.
- Shelves must not exceed their maximum holding capacity and must be restrained against lateral movement.
- Hazardous chemicals stored on shelves above benches must not be stored higher than 1.5 m from the ground.
- Pallets of hazardous chemicals must not be stacked on top of one another.
- Chemical containers should not be stored directly on the floor (i.e. if stored on the floor, bunding such as a tray must be used).



Figure 1. Examples of using shelves to store chemicals.

2.4.4 Storing chemicals in a refrigerator or freezer

- Refrigerators or freezers intended for the storage of chemicals must not be used to store food or beverages.
- Refrigerators or freezers used to store Dangerous Goods must have the relevant DG Class Labels displayed on the door or lid.
- Flammable chemicals must not be stored in a refrigerator unless it is intrinsically safe (i.e. does not have spark or ignition sources which could interact with a flammable vapour. This may include internal motors, lights or thermostats which are not specifically designed to be spark-proof). It is permitted to use a domestic refrigerator for chemical storage, provided the refrigerator has been modified by a qualified electrician to remove all ignition sources.
- If a refrigerator is not intrinsically safe, it must be marked as unsuitable for the storage of flammable materials.
- If flammable chemicals are stored in a freezer an assessment of the risk must be made, taking into consideration any possible ignition sources, the temperature of the freezer and the physical properties (e.g. flash point and boiling point) of the chemicals being stored.
- Some temperature-sensitive chemicals (e.g. some Class 4 and 5.2 substances) may require the provision of temperature monitoring indicators and alarms for the refrigerator or freezer in which they are stored, to provide a warning if the maximum safe storage temperature is exceeded.



Figure 2. Examples of using a refrigerator to store chemicals.

2.5 Types of chemical storage areas

There are several types of chemical storage areas, each of which have specific requirements covered by one or more Australian Standards, including:

- Within a laboratory, workshop or other place where packages are opened.
- Separate store (internal or external) containing mixed classes of Dangerous Goods.
- Separate store containing only one class of Dangerous Goods.
- Storage of chemicals in a bulk tank.

Note: this guide does **not** include the storage requirements for bulk containers.

3 Chemical storage requirements for laboratories, workshops and other areas where chemical containers are opened.

3.1 General requirements

The storage of chemicals in a laboratory or other area where chemical containers are opened and used is covered by Australian Standard 2243.2.

In addition to the general requirements for all chemical storage areas listed in Section 2.3, the following general requirements for chemical storage in a laboratory apply:

- Total quantities and maximum container sizes of Dangerous Goods stored **outside** of Dangerous Goods cabinets (e.g. on benches, shelves or in general laboratory cupboards) must not exceed those listed in Table 2 below. For quantities greater than those in Table 2, dedicated Dangerous Goods cabinets must be used or a separate chemical storage area must be utilised.

Table 2. Quantities of chemicals allowed to be stored outside of Dangerous Goods cabinets in a laboratory.

Type of chemicals		Maximum Quantity (kg or L)
Total quantity of mixed Dangerous Goods		250 total
Total Packing Group I substances		25 total
Flammable (Class 3) and Combustible Liquids:		
	PG I or PG II	Up to 50 per 50 m ² floor space*
	PG III	Up to 100 per 50 m ² floor space*
	Combustible	Up to 200 per 50 m ² floor space*
Non-Dangerous Goods		No limit (subject to WHS or OH&S regulations for hazardous substances).

Note: These quantities are intended to represent the day-to-day working stock and waste containers for chemicals on shelves, benches, and pallets in a laboratory or other working area. Chemicals being analysed, used, mixed, blended or reacted upon are not subject to these quantity limits while in active use.

* For an area less than 50 m² floor space, up to the maximum quantity of flammable and combustible liquids (50/100/200 L) may be stored, where the total quantity of chemicals outside of Dangerous Goods cabinets within the laboratory does not exceed 250 L total.

- Any individual chemical container must be ≤25 L unless a manual handling facility is provided in the work area. Containers used to hold chemical waste must be ≤25 L.
- Dangerous Goods cabinets in laboratories must have a capacity of 250 L or less.
- Dangerous Goods cabinets used to store Class 4.1, 4.2, 4.3, 5.1 or 5.2 chemicals must have a capacity of 50 L or less.

- Under-bench Dangerous Goods cabinets used to store Class 3 liquids must have a capacity of 30 L or less.
- Within a horizontal radius of 10 m, measured from any one cabinet, the aggregate storage capacity for all cabinets in that radius must not exceed 250 L or kg, including through intervening walls. Within this radius, any PG I dangerous goods from Classes 4.1, 4.2, 4.3, 5.1, 5.2 must not exceed 10kg or L for each class. An example layout is provided in Figure 3 at the end of this section.
- It is recommended to limit a laboratory to no more than 3 Dangerous Goods cabinets in any 250 m² area, where possible.

For example, a large open plan laboratory which contains multiple Dangerous Goods cabinets holding Class 3 liquids, Class 6.1 liquids and solids and Class 8 liquids as well as small quantities of other hazardous and non-hazardous chemicals.

The cabinets must have a maximum storage capacity of 250 L and must be separated in a way that there is no more than 250 L total storage in any 10 m radius. Best practice additionally limits any given area of 250m² to a maximum of three Dangerous Goods cabinets.

This arrangement of three cabinets could be repeated throughout a larger lab, provided these separation and area thresholds are maintained. The small quantities given in Table 2 (up to 250 kg or L spread across the whole lab) of mixed hazardous and non-hazardous chemicals stored in laboratory cupboards, on shelves or on benches are allowed in addition to what is stored in DG cabinets.

- Incompatible chemicals must not be stored together unless segregated. There is no minimal segregation distance for the small quantities of chemicals given in Table 2 in a **laboratory**, provided there is sufficient control to prevent two incompatible chemicals directly mixing in the event two containers break or leak at the same time⁸.

For example, acids and bases may be stored in a DG Class 8 cabinet together by storing the chemicals in separate bunded trays with sufficient capacity to prevent a leak or spill from mixing. A list of incompatible Class 8 substances is provided in Section 5.7 of this guide. An assessment of the risks and necessary controls to prevent these from mixing should always be made before storing together.

- Aerosols of DG Class 2.1 or DG Class 2.2 used in quantities and for purposes consistent with household use (e.g. spray lubricants, spray paints, fly spray), may be stored in laboratories or work areas without restriction. These aerosols are not required to be listed on the chemical inventory.⁹
- Gas cylinders must not be stored in a laboratory unless they are secured and connected for use when an outdoor store with reticulation into the laboratory is not practical. Cylinders must have a water capacity of ≤70 L (for reference, a G-size cylinder has a water capacity of ~ 50 L).

⁸ Refer to the chemicals' SDS (in particular, sections 7,10 and 14) for information on incompatibility with other chemicals.

⁹ This does not apply where large quantities of aerosols are stored, or where they are used in a manner not consistent with household use, e.g. where they are used as a reagent in a chemical process.

- Cryogenic liquid containers in a laboratory must be ≤ 250 L. For cryogenic liquids which are toxic or flammable, this container size is reduced to ≤ 5 L and must be kept in a specially ventilated enclosure (i.e. they may not be stored in the laboratory when not in active use). It is recommended that Dewars > 5 L capacity are not kept in laboratories but returned to central, well ventilated storage areas when not in use, where possible.
- Where gas cylinders or cryogenes are present in a laboratory or workshop, an assessment of the risk must be made to identify the potential for a hazardous atmosphere to form. See the Reticulated Gas Installations and Maintenance Guide and the Managing Hazardous Areas Technical Guide (where flammable gases are present) for more information.
- The ventilation within a laboratory must be suitable to ensure any flammable vapours do not exceed 5% of the applicable lower explosive limit (LEL) and any toxic vapours must not exceed the relevant workplace exposure standard. This includes when chemical containers are opened for decanting or other use. Depending on the volatile nature of the chemicals in use, this may be achieved *via* either natural or mechanical ventilation, see Section 5 of AS/NZS 2982 for further specifications. Each laboratory must have a dedicated ventilation system not shared by other storage areas, and exhaust air must discharge outside the building away from protected places.¹⁰
- For a workshop, the ventilation must be adequate to prevent the build-up of a hazardous atmosphere, based on the chemicals and processes undertaken.

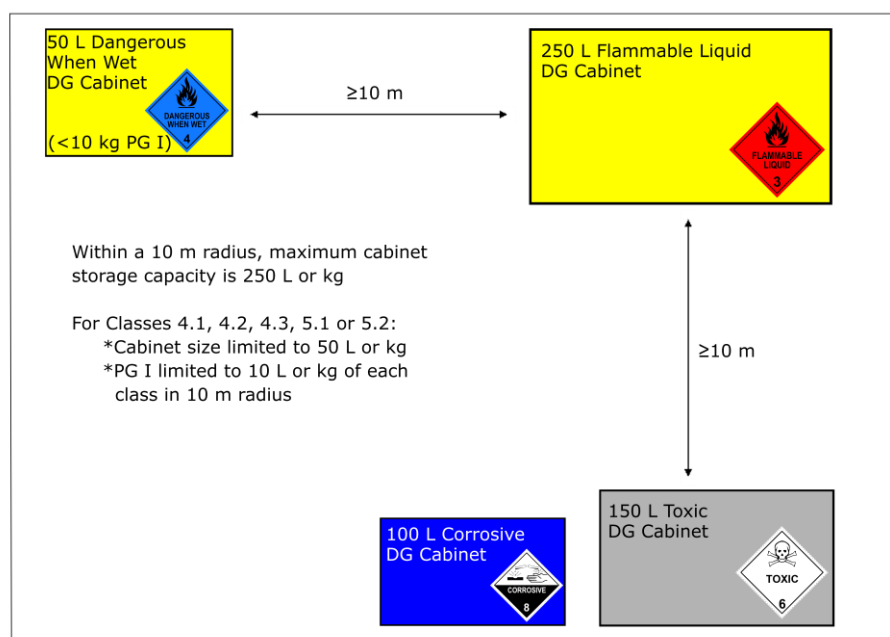


Figure 3. Example layout of laboratory Dangerous Goods cabinets which meets the minimum separation distances. Note, the best practice recommendation to limit the 250m² area to 3 cabinets is not quite met here, though the cabinets have been minimized to four.

¹⁰ See Appendix B for the definition of a protected place.

4 Chemical storage requirements for separate stores containing mixed classes of Dangerous Goods

4.1 General requirements

The storage of mixed classes of Dangerous Goods in a separate store includes areas such as:

- A separate storeroom attached to a laboratory area
- A chemical storage room inside a building, where laboratory work is not undertaken in the room
- A chemical storage room, shed, or similar, which is outside the building.

There are several Australian Standards which may be applicable to the storage of chemicals in a store separate from a laboratory, as reflected in this Section and in Section 5 of this guide. Each standard has different threshold quantities for minor storage and may include additional specific requirements for the storage area.

The most appropriate set of requirements should be selected for the storage area, using Table 3 below. Once chosen, the minimum requirements for that standard (provided in the relevant section of this guide) must be applied in full.

Note: Even where a limited quantity of chemicals is used in a mixed class chemical store, the additional requirements in Section 5 for specific classes should still be considered and implemented where practicable (e.g. the separation of different types of Class 8 chemicals listed in section 5.7).

Table 3. Overview of standards which may be applied to a separate chemical storage area.

Australian Standard	Overview of requirements	Section of this Guide
AS 2243.2	This Standard is most appropriate for stores containing a wide range of hazardous chemicals, but limits the total quantities of chemicals to those given in Table 4. This standard has only minimal segregation distances between different classes, though incompatible materials must still be segregated (e.g. through separate bunded trays).	4.2
AS/NZS 3833 – minor storage	This standard may offer larger allowable volumes for individual containers or for a given storage area than AS2243.2. Where minor storage quantities are not exceeded, this standard has very few additional requirements pertaining to the store (e.g., ventilation, fire suppression systems). This standard may be more appropriate for stores containing moderate quantities of lower-risk (PG II-III) chemicals such as paints, solvents or hazardous chemicals with agricultural applications.	4.3
Individual DG class – minor storage	Where only one Dangerous Goods class will be stored, the standard for that class may be used. See Section 5 of this guide for the minor storage requirements for each class. For small quantities it may still be preferable to use AS 2243.2.	5

4.2 Separate Chemical stores meeting AS 2243.2 requirements

In addition to the general requirements for chemical storage listed in Section 2.3:

- The store must not contain gas cylinders or cryogenic liquids.
- Where possible, the store should not contain other laboratory items such as glassware or apparatus, though the storage of other non-hazardous chemicals is permitted.
- All internal stores should be located on the floor directly accessible from street level where possible. For stores located on any other floor of a building, a risk assessment must be conducted and documented to identify any risks posed to other floors or evacuation routes.
- An external store must be separated from neighbouring buildings, or from site boundaries by:
 - 3 m, if the aggregate hazardous chemicals kept in the store is ≤ 1000 kg or L
 - 5 m, if the aggregate hazardous chemicals kept in the store is between 1000 kg or L and 4500 kg or L.
 - No separation distance is required if fire walls or vapour screens complying with Australian Standard 1940 are installed.
- Any individual chemical container holding liquids must be ≤ 250 L. This includes chemical waste containers.
- The aggregate maximum quantities of chemicals held in the store must not exceed Table 4 (noting there are different allowances for indoor stores, indoor stores which are fire rated and external stores).
- The maximum quantity of chemicals in any one chemical storage cabinet must be ≤ 250 L or kg.
- Where mixed Classes of Dangerous Goods are stored together in one cabinet in a chemical store, a risk assessment must be conducted, and each different Class stored in the one cabinet must be limited to 50 L or kg. Note that where there is any doubt about the compatibility of the Dangerous Goods, they must be stored in separate chemical storage cabinets.
- Dangerous Goods cabinets containing chemicals must be separated by a minimum distance of 300 mm of clear air space.
- For any Dangerous Goods cabinet containing PG I chemicals, the whole contents of that cabinet must be considered as PG I.

For example, an internal store with a 250 L flammable liquids cabinet containing a 2.5 L bottle of diethyl ether (DG Class 3 PG I) along with other Class 3 PG II and PG III totalling 40 L would not be permitted as minor storage. The presence of the PG I container in this cabinet means that the aggregate 42.5 L must all be considered PG I and this volume exceeds the allowed quantity for PG I in Table 4, of 25 L in any one store.

If the diethyl ether was stored in a separate smaller flammable liquids cabinet, then these quantities would be allowed as minor storage.

Table 4. Maximum quantities of Dangerous Goods permitted in dedicated chemical stores where mixed classes of Dangerous Goods are held.

Type of store	Type of chemicals	Maximum quantity (kg or L)	
Internal store	Total quantity of mixed Dangerous Goods	250 total	
	Total quantity of PG I materials	25 total	
	Flammable (Class 3) and Combustible Liquids:		
	PG I or PG II combined	Up to 50 per 50 m ² floor space*	
	PG III	Up to 100 per 50 m ² floor space*	
	Combustible liquids	Up to 200 per 50 m ² floor space*	
Internal fire rated store	Total quantity of mixed Dangerous Goods or other Hazardous Chemicals	2000 total	
	AND EITHER		
	PG I	Up to 25	
	PG II	Up to 250	
	PG III	Up to 1000	
	Combustible liquids	Up to 1500	
	OR		
	Unless packages are stored in Dangerous Goods Cabinets which are ≥300 mm apart, <ul style="list-style-type: none"> Incompatible Dangerous Goods classes must be segregated by 3 m within the store Substances which may react dangerously when mixed must be segregated by 5 m within the store and must have separate bunding or spillage collection tanks. 		
	External store	Total quantity of mixed Dangerous Goods or other Hazardous Chemicals:	1000 total (requires minimum 3 m separation distance between store and any protected place) 4500 total (requires minimum 5 m separation distance between store and any protected place)
		AND EITHER	
PG I		Up to 25	
PG II		Up to 250	
PG III		Up to 1000	
Combustible liquids		Up to 1500	
OR			
Unless packages are stored in Dangerous Goods Cabinets which are ≥300 mm apart, <ul style="list-style-type: none"> Incompatible Dangerous Goods classes must be segregated by 3 m within the store Substances which may react dangerously when mixed must be segregated by 5 m within the store and must have separate bunding or spillage collection tanks. 			

* For an area less than 50 m² floor space, up to the maximum quantity of flammable or combustible liquids (50/100/200 L) may be stored.

Note: Where there are no specific segregation distances listed, incompatible chemicals must still be segregated in a way that prevents them from mixing (e.g. separate secondary containment tubs).

- The store floor must be made of non-absorbent, non-combustible materials which are as resistant as practicable to the chemicals stored.
- The store must contain a spill catchment mechanism (e.g. bunding of containers or a floor pit) which is sufficiently impervious to retain the spillage until clean-up measures can be taken. Where bunding under the chemical containers is used, the capacity must be at least equal to the volume of the largest container stored in the bunded area.
- Where incompatible chemicals are stored in the same area, the spill catchment system must prevent these substances from coming into contact with one another in the event of a spill (e.g. separate bunding containers or pits for each incompatible class).
- Similar to laboratory ventilation requirements, the store's ventilation must be suitable to ensure any flammable vapours do not exceed 5% of the applicable lower explosive limit (LEL) and any toxic vapours must not exceed the relevant exposure standard. The needs of the ventilation system may differ depending on the volatile nature and quantity of chemicals stored, but the store must be designed with the principles of Section 4.5 of AS/NZS 1940, including:
 - A preference for mechanical ventilation over natural ventilation.
 - Where stores are mechanically ventilated, the ventilation system must be exclusive to the room. There must be no recirculation of exhaust air, except for a cool room where a risk assessment has been conducted and control measures put in place to prevent the build-up of a hazardous atmosphere. The ventilation system must either: operate continuously; or operate whenever a person is occupying the store *and* be fitted with an airflow failure warning device.
 - Further specifications, such as the location of vents/ducting and exhaust velocities is provided in AS 1940.
- If the store has been designated a hazardous area (i.e. there is potential of an explosive atmosphere due to flammable gases, vapours, particles, etc.), it must not contain any ignition sources. See the Managing Hazardous Areas Technical Guide for more information.
- The store must either:
 - Have an automatic fire extinguishing system which is compatible with the chemicals being stored, or;
 - Be equipped with an alarm which will activate when the concentration of flammable or toxic vapour exceeds set limits, when there is smoke, or when heat is generated.

Where a sprinkler-based fire suppression system (water or foam) is installed, there must be a mechanism to contain the effluent of 20 minutes of operation within the building (but not necessarily within the store itself).
- The store must have at least one fire extinguisher compatible with the chemicals being stored immediately outside the door to the store, with a minimum size equivalent to a 2A 60B(E) for powder-type extinguishers or a 2A 20B for foam extinguishers. Additional fire extinguishers should be considered for larger stores.
- Have PPE appropriate for the chemicals stored available at or just inside the door of the storage area (e.g., gloves, safety glasses, lab coats).
- For an external store, the store must be separated from protected places by a minimum distance of $\geq 3\text{m}$ (up to 1000 kg or L total Dangerous Goods) or $\geq 5\text{m}$ (up to 4500 kg or L total)

4.3 Chemical stores meeting AS 3833 minor storage requirements

In addition to the general requirements for chemical storage listed in Section 2.3:

- The aggregate maximum quantities of chemicals held in the store must not exceed those listed in Table 5 per 500 m² floor or ground space.

Table 5. Maximum quantities (L or kg) of chemicals to be stored in a location to meet the requirements of minor storage AS3833 (per 500 m²)

Type of Goods	Packing Group I (kg or L)	Packing Group II (kg or L)	Packing Group III (kg or L)	Combustible Liquids (kg or L)
Class 5.2	10 total			N/A
Total quantity of all Dangerous Goods	25	250	1000	1500

The maximum allowance of each of the groups can be stored concurrently (i.e. a store could contain 25 L of PG I plus 250 L of PG II)

Where the chemicals being stored are Class 3 Dangerous Goods of Packing Group II or III that are a suspension or solution of at least 10% non-volatile materials consistent with the definition of 'Manufactured Product' in Australian Standard 3833, the maximum storage allowance is doubled. Chemicals meeting this definition include most solvent-based paints, lacquers, and polishes.

- The store must be separated from other minor stores by at least 10 m.
- The transfer of dangerous goods from the store to the point of use must be carried out in a manner that minimizes the possibility of spillage or fire.
- A fire extinguisher of suitable type must be installed in each minor store, located so that it is immediately accessible in an emergency along an exit route.
- PPE such as gloves, safety glasses and lab coats must be available at or just inside the door of the storage area.

Additionally, for an outdoor store:

- the ground around the store must be kept clear of combustible vegetation or refuse to a distance ≥ 3 m.
- the store must be separated by at least 3 m from:
 - Any building that is not another minor chemical store, laboratory or workshop (e.g., offices, cafeterias)
 - Any place accessible to the general public where people are likely to congregate (e.g., public lawn areas, emergency evacuation points)
 - Any environmentally sensitive areas
 - A ship at permanent berthing facilities
 - The property boundary
- The effluent or flow of a chemical spill or leak must be prevented from reaching any adjacent buildings or facilities, the property boundary or any watercourse. This may be achieved using a natural ground slope or through a diversion channel, kerb, or bund.

5 Chemical storage requirements for a minor storage area containing only one class of Dangerous Goods

5.1 Introduction

Where a storage area will contain only one class of Dangerous Goods, the requirements for that class may be used. For stores containing smaller quantities of chemicals, it may be more practical to work to the requirements of AS 2243.2 or AS 3833 (see sections 4.2 or 4.3, respectively).

5.2 Class 2 Dangerous Goods (Gases and cryogenics)

See the Reticulated Gas Installations and Maintenance Guide for more information on dedicated storage areas for Class 2 Dangerous Goods.

5.3 Class 3 Dangerous Goods (Flammable Liquids)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities and container sizes of chemicals held in the store must not exceed those listed in Table 6.

Table 6. Minor storage thresholds for a store containing only DG Class 3 substances.

Storage location type	PG I or II	PG III	Combustible liquids
Laboratory *, **	50 L per 50m ² floor space; or 50 L in a room ≤50m ² floor space PG I containers ≤2.5 L ***	100 L per 50m ²	200 L
Workshop (indoors)	1 L per 2m ² of floor space	1 L per 1 m ² of floor space	4 L per 1m ² of floor space
Outdoor shed or detached out-building which is: 1 m from building 3 m from building, or separated by a wall with a FRL of 180/180/180	100 L 250 L	250 L 250 L	500 L 500 L

* These limits will not apply to a laboratory constructed and equipped as a flammable liquid storage room and only flammable liquids are being handled there.

** These limits do not apply to materials being analysed, used, mixed, blended or reacted upon, where stored on a laboratory bench or in a fume cupboard.

*** This container size may be exceeded if the chemical is essential for daily operations and the person(s) using it are trained to understand the risks and appropriate risk controls.

- A chemical storage cabinet or cupboard which is used to store flammable liquids must not be used to store any other classes of Dangerous Goods. Where flammable liquids have subsidiary risks, these substances must be segregated either by separate storage locations or by providing secondary containment to prevent the incompatible liquids from mixing.

For example, acetic anhydride (DG 8(3)) and methanol (DG 3 (6.1)) react aggressively when mixed and must be stored in a way that prevents the two chemicals from mixing.

- Flammable liquids should be stored as far away from oxidising agents and organic peroxides as is practical. For example, if these chemicals are stored on an open shelf or bench, they should be placed on separate benches, or at opposite ends of the shelf.
- There must be no uncontrolled ignition sources in any space where a flammable mixture of vapour and air could be present.
- Class 3 liquids must be stored away from heat sources.
- If any of the following are exceeded, or a process is occurring that is likely to emit significant flammable vapours, a hazardous area classification must be made (see the Managing Hazardous Areas Technical Guide for more information):
 - 100 L in closed containers
 - 25 L for decanting purposes
 - 5 L in open containers for occasional use
 - 1 L in open containers for continuous use
- If the store is located above another floor, it must not jeopardize the safety of any lower areas of the building, including mechanisms to prevent flammable vapours and spilled liquids escaping to other areas of the building.
- Where there is more than one minor store on the same premises, stores must be separated by at least 20 m (indoor stores) or 15 m (outdoor stores).
 - If two buildings are separated by at least 5 m of open space or by a fire rated wall, each building may have their own indoor minor store quantity.
- Spills or leaks must be cleaned up immediately and prevented from reaching ignition sources, stores of other chemicals, combustible materials or from flowing into drains or onto neighbouring property.
- When decanting Class 3 liquids, dispensing pumps or self-closing metal taps should be used in order to reduce the hazards of splashing, spillage and vapour escape while filling the container.
- Where >100 L of flammable liquids or >1000L of combustible liquids are stored or decanted, there must be at least one portable fire extinguisher suitable for the chemicals stored.
 - Note, this requirement does not apply on farms.
- Decanting of flammable liquids shall only occur in a fume cupboard or location with a dedicated exhaust system that is able to locally capture flammable vapours.
- In areas where flammable liquids are decanted, a sign complying with AS 1319 must be displayed, with the following wording:
DANGER—FLAMMABLE LIQUIDS—NO SMOKING—KEEP FIRE AWAY

5.4 Class 4.1, 4.2 and 4.3 Dangerous Goods (Flammable solids, Spontaneously combustible solids, and Dangerous when wet)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities and container sizes of chemicals held in the store must not exceed those listed in Table 7.

Table 7. Minor storage thresholds for a store containing only DG Class 4 substances.

DG Class 4 sub-group	Maximum quantity per 100 m ² floor space (kg or L)	Maximum container size (kg or L)
Division 4.1 self-reactive and related substances or desensitized explosives Division 4.2 pyrophoric substances	2.5	1
Other DG 4 PG I substances	5	1
Other DG 4 PG II substances	10	1
Other DG 4 PG III substances	20	5

Note: The aggregate quantity of Class 4 dangerous goods of all categories held in a storage area should not exceed the maximum quantity specified for the least dangerous category being kept, i.e. if a mix of PG II and PG III substances are held, the total quantity of Class 4 substances must not exceed 20 kg or L per 100 m².

Note: There may be additional limitations for desensitised explosive substances, based on state or territory legislation.

- A chemical storage cabinet or cupboard which is used to store any of the DG 4 classes must not be used to store any other classes of Dangerous Goods. This includes storing DG Class 4.1 from DG Class 4.2 and DG Class 4.3 substances in different cabinets.
- Flammable solids should be stored as far away from oxidising agents and organic peroxides as is practical. For example, if these chemicals are stored on an open shelf or bench, they should be placed on separate benches, or at opposite ends of the shelf.
- Substances in DG Class 4.3 (dangerous when wet) spontaneously react with water to emit flammable gases and must be stored in a way to prevent mixing or interaction with water or mixtures containing water. In particular, avoid cupboards or benches near or under sinks, water baths and equipment using a water condenser.
- Special consideration shall be given to the provision of fire extinguishing media when used to protect Class 4.3 storage areas (e.g. class D type portable fire extinguishers should be provided; foam or water portable fire extinguishers are not suitable).
- Due to the varied hazards and incompatibilities of Class 4 substances, a risk assessment must be completed for the storage area.
- Where there is more than one minor store on the same premises, stores must be separated by at least 20 m (indoor stores) or 15 m (outdoor stores). If two buildings are separated by at least 5 m of open space or by a fire rated wall, each building may have their own indoor minor store quantity.

5.5 Class 5.1 and 5.2 Dangerous Goods (Oxidisers and Organic peroxides)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities and container sizes of chemicals held in the store must not exceed those listed in Table 8.

Table 8. Minor storage thresholds for a store containing only DG Class 5 substances.

DG class	Maximum container size (kg or L)	Maximum quantity (kg or L)		
		PG I	PG II	PG III
Class 5.1	-	50	250	1000
Class 5.2	5	20 total		

This table does not apply to ammonium nitrate. See AS 4326 Section 9 for the specific additional storage requirements related to ammonium nitrate.

There are additional allowances for DG 5.1 PG IIIs on a farm. See AS 4326 Table 2.1.

- A chemical storage cabinet, cupboard or refrigerator which is used to store any DG Class 5.1 or DG Class 5.2 substances must not be used to store any other classes of Dangerous Goods. This includes separating Class 5.1 substances from Class 5.2 substances.
- Any incompatible Class 5.1 or 5.2 substances will be further segregated (e.g. using separate banded containers) to prevent the substances from mixing in the event of a spill or leak.
- Class 5.1 and 5.2 substances must be stored on non-combustible surfaces which are not liable to attack or damage from the chemicals being stored.
- Class 5.1 and 5.2 substances must be kept at least 3 m away from heat sources.
- Class 5.2 substances must be stored at or below the recommended storage temperature in the product's Safety Data Sheet.
- Where Class 5.2 substances are stored outside of a Dangerous Goods cabinet, they should be kept in a dedicated fire-resistant metal cupboard or lidded bin designed to retain any spillages. The cupboard or bin must be able to withstand temperatures >750°C and prevent or retard the passage of flame and hot gases.
- The exhaust from any mechanical ventilation system in a Class 5.1 or 5.2 store must be directed away from sources of ignition and areas where people are likely to congregate.

5.6 Class 6.1 Dangerous Goods (Toxics)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities of chemicals held in the store must not exceed those listed in Table 9.
 - There may be additional storage restrictions for highly toxic substances (e.g. Schedule 7 poisons¹¹) which may vary based on state or territory legislation.
- Packages containing inorganic cyanides must not be stored with acids or in any other way that will allow reactions with incompatible chemicals.

Table 9. Minor storage thresholds for a store containing only DG Class 6.1 substances.

Storage location type	Maximum quantity (kg or L)		
	PG I	PG II	PG III
Laboratories, workshops and other storage areas	10	100	1000
Farms > 2 hectares	10	100	3500

For DG Class 6.1 substances stored on farms, the following additional storage requirements apply:

- Substances must be for agricultural, horticultural, floricultural or pastoral purposes.
- The area around storage area must be kept clear of combustible materials, vegetation or refuse to a distance of ≥ 3 m.
- The store must be separated from other buildings where chemicals are not used, or by any area which is publicly accessible by ≥ 10 m, and separated from the property boundary by ≥ 15 m.
- Where there are two or more minor stores on the same property, each may be treated as a separate minor store if separated by ≥ 100 m.

¹¹ Refer to the Commonwealth Standard for the Uniform Scheduling of Medicines and Poisons (SUSMP).

5.7 Class 8 Dangerous Goods (Corrosives)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities of chemicals held in the store must not exceed those listed in Table 10.
 - The aggregate quantity of must not exceed the maximum quantity for the least dangerous PG being kept (e.g. if only PG I and PG II are kept, aggregate quantity must be limited to 250 L or kg).

Table 10. Minor storage thresholds for a store containing only DG Class 8 substances.

Maximum quantity (kg or L)		
PG I	PG II	PG III
50	250	1000

- The store must be at least 10 m from any other chemical storage area.
- Class 8 substances must be stored in a manner that will prevent reactions between:
 - acids and alkalis
 - acids and hypochlorites
 - acids and cyanides
 - acids and Class 4.3 dangerous goods
 - oxidizing acids and combustible materials
 - other incompatible acids

This can include using secondary containment or bunding to ensure these substances will not mix if spilled or the containers leak.

5.8 Class 9 Dangerous Goods (Miscellaneous or Environmentally hazardous)

In addition to the general requirements for chemical storage listed in Section 2.3:

- The maximum quantities of chemicals held in the store must not exceed those listed in Table 11 per 500 m² floor or ground space.
- Where there are two or more minor stores present, they must be separated by ≥10 m (≥20 m if both stores are Group 3 – Elevated temperature substance (as per Table 11)).
- Class 9 Dangerous Goods of Groups 1, 2 and 5 (as per Table 11) may be stored together, however only a cumulative 1000 kg or L (100 kg or L for PG I) may be stored.

Table 11. Minor storage thresholds for a store containing only DG Class 9 substances.

Type of DG 9		Maximum quantity (kg or L)	
		PG I	Total
Group 1	Environmentally hazardous substances (UN 3077 or UN 3082)	100	1000
	Agricultural chemicals	1000*	10000
Group 2	Equipment containing small quantities of dangerous goods Life-saving appliances (UN 2990 and UN 3072) Lithium batteries or equipment (UN 3091) Air bag inflators (UN 3268) Chemical or first aid kit (UN 3316)	No limit for minor storage	
Group 3	Elevated temperature substances Liquids (UN 3257)	N/A	100
	Solids (UN 3258)	N/A	1000
Group 4	Specially controlled substances Asbestos (UN 2212 or UN 2590)	N/A	Not permitted for minor storage
	Polychlorinated biphenyls (PCBs; UN 2315)	N/A	Only small items permitted (e.g. capacitors)
Group 5	Other Class 9 dangerous goods Solid carbon dioxide (dry ice; UN 1845) Ammonium nitrate fertilizer (UN 2071) Polymeric beads (UN 2211) Plastics moulding compound (UN 3314)	100	1000

* Only one store of PG I materials exceeding 1000 kg or L is permitted on any one site

Additional criteria to meet minor storage requirements for specific sub-categories:

Agricultural chemicals

- Agricultural chemicals must be kept in packages or IBCs not exceeding 1500 L each.

Equipment containing explosive and pyrotechnic devices (UN 2990, 3072 3268)

- Equipment containing explosive devices must be kept locked in a secure store, e.g. distress flares.
- Explosive or pyrotechnic devices must not be removed from equipment and stored separately.
- There may be additional State or Territory requirements for the storage and handling of devices.

Elevated temperature liquids and solids (UN 3257, 3258)

- Consider whether heat shielding and/or heat protection should be used to protect people, equipment and other materials from the effects of radiant heat.
- If heat shielding is not used, ensure elevated temperature liquids or solids have a separation distance of at least 3 m from people, equipment or materials (distances of up to 15 m should be considered). Ensure spill prevention measures such as bunding are resistant to the elevated temperature of the material.

Asbestos (UN 2212 or UN 2590)

- In most States and Territories, special legislative and regulatory requirements apply to the storage and handling of these substances. External expert advice must be sought for the design of storage areas which will hold asbestos.

Polychlorinated biphenyls (PCBs) (UN 2315)

- In most States and Territories, special legislative and regulatory requirements apply to the storage and handling of these substances. External expert advice must be sought, except for small items containing PCBs which are in good condition (e.g. capacitors from fluorescent lights that show no signs of leakage or damage).

Solid carbon dioxide (dry ice – UN 1845)

- Any storage area where dry ice is kept must have adequate ventilation to prevent the development of an asphyxiant or toxic atmosphere (see the Reticulated Gas Installations and Maintenance Guide for some threshold quantities).
- Storage areas must be equipped with PPE suitable for handling dry ice, such as cryogenic gloves or tongs.

Ammonium nitrate fertilizer that does not meet the criteria for DG Class 5.1 (UN 2071)

- Must not be kept next to combustible materials, or any other incompatible substances. This includes petrol, diesel, oil, wooden pallets, hay, sulfur, charcoal, chlorates, or dry pool chlorine.

Polymeric beads and plastics moulding material (UN 2211 and UN 3314)

- Unless packaged in closed bags or drums, these items must be kept in well ventilated areas at least 3 m from ignition sources.

6 Appendices

6.1 Appendix A – Codes, Standards and other Information Sources

The following Australian Standards and Codes of Practice are referenced in this document:

- AS 1940 - The storage and handling of flammable and combustible liquids
- AS 2243.1:2005 – Safety in Laboratories – Planning and Operational Aspects
- AS 2243.2 – Safety in Laboratories – Part 2: Chemical Aspects and Storage
- AS 2714 – The storage and handling of organic peroxides
- AS 2982:2010 – Laboratory Design and Construction
- AS 3780 - The storage and handling of corrosive substances
- AS 3833 - The storage and handling of mixed classes of dangerous goods, in packages and intermediate bulk containers
- AS 4326 - The storage and handling of oxidizing agents
- AS 4452 - The storage and handling of toxic substances
- AS 4681 - The storage and handling of Class 9 (miscellaneous) dangerous goods and articles
- AS 4775 - Emergency eyewash and shower equipment
- AS 5026 - The storage and handling of Class 4 dangerous goods
- Australian Dangerous Goods Code – Edition 7.7

6.2 Appendix B – Definitions

Article

A manufactured item, other than a fluid or particle, that:

- (a) Is formed into a particular shape or design during manufacture; and
- (b) Has hazard properties and a function that are wholly or partly dependant on the design.

Articles can include equipment which contain hazardous chemicals inside them such as a mercury thermometer.

Bulk or bulk container

A DG Class 2 container > 500 L;

or a container in any other DG class > 450 L or with a net mass > 400 kg.

Bunding

The use of a barrier, pit or secondary containment to prevent the spread of a chemical spill or leak. For small chemical containers, this can be as simple as a chemically resistant plastic tub.

Combustible Liquid

Any liquid, other than a flammable liquid, that:

- (a) has a flash point; and
- (b) has a fire point that is less than its boiling point.

See AS 1940 Section 1.4.9 for more details.

Incompatible

Substances which, when brought in contact with one another, may react or combine in a manner that could increase the hazard of an individual substance, for example, by causing a fire, explosion, violent reaction, liberating flammable or poisonous gases; could cause the deterioration of the container or substance; could otherwise cause injury to people or endanger property.

This definition also includes substances which are declared by a relevant regulatory authority (e.g. by state, territory or federal legislation) to be incompatible.

Ignition source

A source of energy sufficient to ignite a flammable or explosive atmosphere.

It may include naked flames, hot surfaces, exposed incandescent material, electrical arcs, hot particles, electrical discharge including from static electricity, chemical reactions, high intensity electromagnetic radiation including visible light or ultraviolet radiation, mechanical sparks, fixed and portable electrical equipment, portable tools or vehicles such as forklifts.

Minor Storage

Many Standards relating to the storage of chemicals have designated “minor storage” quantities, above which there are additional more stringent requirements for store construction, ventilation and segregation distances. The specific numbers associated with minor storage vary between standards, and for different Dangerous Goods Classes.

This guide focuses on storage areas holding minor storage quantities. If a store is required to hold more than minor storage quantities, a qualified Dangerous Goods consultant must be engaged.

Packing Group (PG)

An assigned measure of Dangerous Goods’ hazard rating.

For Dangerous Goods in Classes 3, 4, 5, 6.1, 8, or 9:

Packing Group I	High danger items
Packing Group II	Medium danger items
Packing Group III	Minor danger items

Class 1, 2 and 6.2 chemicals do not use Packing Group assignments. For Class 7 chemicals, the Packing Group order is reversed (i.e. Packing Group I is the lowest danger rating for Class 7 items).

Protected Place

Any of the following:

- A dwelling, residential building, place of worship, public building, school or college, hospital, theatre and any building or open area where people are accustomed to assemble (e.g. an emergency evacuation point or large meeting space).
- A factory, workshop, office, store, warehouse, shop or building where people are employed, which sits outside the designated area of the Dangerous Goods store/laboratory in question
- Any storage facility for Dangerous Goods that exceeds minor storage quantities which sits outside the designated area of the Dangerous Goods store/laboratory in question
- A ship lying at permanent berthing facilities
- An environmentally sensitive area, such as a water catchment area or national park

See AS 2243.2 – Section 1.4.34 or AS 3833 – Section 1.4.46 for more information.


Segregation


Keeping incompatible goods apart from one another in one room, using a physical barrier or an intervening space.

UN Number


United Nations number – a four-digit number which is used globally to identify specific classes of Dangerous Goods. See the Australian Dangerous Goods Code section 2.0.2 for more information.

6.3 Appendix C – Example Area Hazard Poster for areas where placarding quantities are not kept





HAZARDS in this Work Area




Precautionary Measures Required



Building 004 – Ex Building Room 103 – Working lab	Name	Out of Hours Contact Number
Area Custodian	A. Custodian	(00) 4272 7476
Other	B. Custodian	(00) 6253 7233

Last updated: 17 August 2021

