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# The Storage and Handling of Small Quantities of Aerosol Cans



## Introduction

Aerosol cans are widely used for delivering personal-care products, paints, lubricants, insect repellent, gardening and automotive goods to consumers. They are stored in general purpose warehouses, store rooms, retail outlets, and in workplaces where they are usually stored in cupboards and open shelves. When exposed to fire, aerosol cans will either violently rupture or produce burning jets of flame. Both conditions expose adjacent aerosols and can result in more container failures. The only effective method of controlling this type of fire is the delivery of large quantities of water by sprinklers. If adequate protection is not provided, an aerosol fire will grow quickly and produce high temperatures, thick smoke and rocketing containers that can trail burning liquid to areas well away from the fire's origin.

Aerosol cans consist of steel or aluminium containers fitted with a plastic valve designed to discharge their contents as a fine mist, spray or stream. They usually contain liquid or powder product and a liquefied petroleum gas (LPG) propellant. The propellant creates the pressure necessary to eject the liquid or powder product in the desired form and is flammable. In many cases the liquid content is also flammable. Aerosol containers are designed to contain the pressure generated by the LPG at temperatures below 54°C.

When exposed to flame, aerosol containers experience temperatures and pressures significantly higher than they were designed to resist, causing them to rupture violently into large fire balls if the pressure is not vented. This occurs when the gas and liquid inside expands when heated increasing the pressure inside the container until the container cannot hold it any more and fails (ruptures). The contents of the can may be a flammable liquid that is vaporized by the heat and loss of containment. This gas or vapour may ignite causing an explosion or flash fire. This is known as a BLEVE, a Boiling Liquid/Expanding Vapour Explosion.

Some aerosol containers have a valve designed to melt in a fire and vent the pressure; these types of containers produce flaming jet that can last for several minutes. This may not cause the can wall to rupture, but if the product or the propellant are flammable, it can also still result in a fireball.



(Examples of an exploding aerosol can under BLEVE conditions)

### Regulations and Standards

Aerosol cans are classified as Dangerous Goods under Class 2, with a listed international reference number of UN1950. They are mainly identified with a red flammable gas diamond or in some cases, a flammable liquid diamond on the can.

Note: New Global Harmonised Labelling has been introduced and will replace the class diamond labels over the next few years.

Under all state Dangerous Goods Storage and Handling Regulations it makes reference to the placarding requirement for the various classes and divisions of dangerous goods. In respect of Aerosols the placarding exemption limit is 5000L. Therefore it is not a requirement to placard a premises, if they have 4999L or 16600 cans (of 300ml capacity) or less. That is still a lot of cans that does not have to be identified for. However they still have to be safely stored.

There is very little detail relating to the storage of aerosols in any of the respective State Regulations. However some states do provide information publications that do give some guidance for the storage of minor quantities of aerosols.

### Worksafe Victoria

Publication: The Safety Express – dated 16 August 2011. “Safely Storing Dangerous Goods”

“Many building owners use fire safety cabinets with a capacity to hold up to 250 litres. These cabinets are not mandatory but do provide an extra level of safety and assist in keeping the dangerous goods in one area. Aerosols, tins of paint and corrosive products can be stored in the same cabinet provided they have their own spill trays and are not placed above aerosols cans.”

Publication: Dangerous Goods (Storage and Handling) Regulations 2012.

There is no specific information on the storage of aerosols in the regulations.

Publication: Code of Practice for the Storage and Handling of Dangerous Goods 2013.

Again there is no specific reference to the storing of aerosols, only general guidelines for all chemicals. These include but not limited to:

- Storage in a designated area.
- Keep away from any sources of heat or ignition.
- Display appropriate safety signs.
- Display placarding if applicable.
- Ventilation.
- Spill Containment.
- Spillage clean up.
- Fire protection.
- Staff training and education.

#### Workcover Authority of NSW

**Publication:** Work Health and Safety Regulations 2011 which incorporates Hazardous Chemicals became effective 13 January 2012.

The Regulation does not provide any reference to storage of aerosols.

**Publication:** Storage and Handling of Dangerous Goods – Code of Practice 2005.

Under clause 10.4 Storing Aerosols and Small Disposable Cylinders, the code provides the following statement:

“Disposable cylinders are also known as cartridges, cartouches, receptacles and refills. Included in this section are:

- UN 1057 Lighters or Lighter Refills (cigarettes, containing flammable gas)
- UN 1950 Receptacles, Small, Containing gas (Gas Cartridges) (without a release device, non refillable)
- UN 3150 Devices, Small, Hydrocarbon Gas Powered, or Hydrocarbon Gas Refills for Small Devices (with release device).

“Aerosols” mean non-refillable receptacles made of metal, glass or plastics containing gas compressed, liquefied or dissolved under pressure and fitted with a release device allowing the contents to be ejected as a gas or as solid or liquid particles in suspension in a gas or liquid.

If the quantity of aerosols or disposable cylinders kept exceeds 100 kg net, it is recommended that they be kept either:

- in groups of not more than 100 kg net and at least 6 m from each other
- in, or directly ventilated to, the open air and separated by at least 3 m from any combustible material.

If more than 1000 kg of aerosols or disposables of Class 2.1 (flammable) or 2.3 (toxic) are kept within any imaginary sphere of 5 m diameter, the following conditions should be observed:

- adequate ventilation to allow the safe dispersal of gas or vapours that might escape from leaking containers
- in an enclosure preventing the projection of containers if involved in a fire
- at least 5 m from any other Class of dangerous goods (other than aerosols) or any combustible material
- at least 3 m from any fixed ignition source (other than electric ceiling lighting).

**Australian Standards**

Publication: AS 1940 – The Storage and Handling of Flammable and Combustible Liquids.

In this Standard there is a brief reference to the storage of aerosols.

Section 3 – General Requirements – This section provides general requirements and recommendations that apply to stores of flammable liquid or combustible liquids, in quantities greater than those classified as minor storage in Section 2.

Note: Table 2.1 in Minor Storage does not refer to aerosols.

Also note: a flammable liquid storage cabinet located within or outside a building is classified as a package store.

Clause 3.6 – Restricted Usage:

“A storage that has a capacity greater than that given for minor storage shall only contain flammable or combustible liquids or both, unless the other products being stored will not react dangerously or be incompatible with the liquids.

If the store contains dangerous goods having a primary risk of other than Class 2, any other appropriate Australian Standards shall be consulted and the more stringent requirement shall apply.

“Aerosols of Classes 2.1 and 2.2 may be stored in a store for Class 3 dangerous goods if projectile protection (e.g. cages) is provided.

Publication: AS/NZS 3833-2007 – The Storage and Handling of Mixed Classes of Dangerous Goods, in Packages and Intermediate Bulk Containers.

Under Minor Storage it specifies the following criteria:

| Description                           | Kg or L | Kg or L | Kg or L | Kg or L             |
|---------------------------------------|---------|---------|---------|---------------------|
|                                       | PG I    | PG II   | PG III  | Combustible Liquids |
| Total quantity of all dangerous goods | 25      | 250     | 1000    | 1500                |

Note: 4 For the purpose of determining minor storage quantities,

- (a) Class 2 dangerous goods in retail packages (e.g. non-refillable lighters, butane lighters, barbecue gas in disposable containers), aerosols and substances and articles of Class 9 are regarded as PG III.

Under Retail Storage it specifies the following maximum storage quantities of retail packages.

| Class, Division and Description  | Maximum Storage Quantity kg or L | Separation Requirements   |
|--|----------------------------------|---|
| Aerosols (UN 1950) and other non-refillable pressure containers, e.g. cartouches | 2000 L                           | Class 2 and aerosols (UN 1950) shall be separated from flammable liquids by 1.5 m<br><br>Also Class 2 and aerosols shall be separated from flammable solids by 1.5 m. |

This section also states:

**Clause 3.5.8 Storage of Aerosols**

“Where aerosols are kept in retail distribution centres, they shall be either –

- (a) Stored within strong mesh enclosures (i.e. caged); or
- (b) Dispersed throughout the store.

Aerosols shall be –

- (i) Stored under cover and protected from exposure to the weather and direct sunlight;
- (ii) kept at least 3 m from any source of heat or ignition; and
- (iii) stored in a manner that reduces the risk of collapse of stacks or any damage to the aerosol containers.

Publication: AS 1596 - The Storage and Handling of LP Gas

Section 2: Minor Storage and Use.

**Clause 2.3 Minor Storage and Usage of LP Gas**

- (b) The total quantity of LP Gas kept (both in storage and connected for use) shall not exceed that stated in Table 2.1. The quantity includes LP Gas cylinders and non-refillable containers in use, whether full or nominally empty, but not those cylinders installed outdoors in accordance with Section 4 of this Standard and AS 5601/NZS 5261

Refer to Table 2.1 in the Standard.

There is no further reference in the Standard to aerosols or non-refillable containers although many of the same storage practises for cylinders may also apply to aerosols.

Publication: AS/NZS 2243.10 – Safety In Laboratories – Part 10: Storage of Chemicals.

Section 4 – Use and Storage of Chemicals and Gas Cylinders within a Laboratory.

**Table 1 – Quantities of Hazardous Chemicals Permitted to be Stored in a Laboratory other than in a Chemical Storage Cabinet.**

| Type of Substance or Class of Dangerous Goods | Maximum per 50 m <sup>2</sup> kg or L | Maximum pack size kg or L      | Conditions for Storage  | Alternative Storage Options   |
|---|---------------------------------------|--------------------------------|---|-------------------------------|
| Class 9 and aerosols                          | 50 for liquids<br>100 for solids      | 5 for liquids<br>20 for solids | Labelled standard laboratory cupboard or in small amounts throughout the laboratory | AS/NZS 4681 or<br>AS/NZS 3833 |

**4.5 Method of Keeping Chemicals**

Clause 4.5.1 Enclosed Storage – “All chemicals should be stored in chemical storage cabinets or laboratory cupboards.

Clause 4.5.2 Open Storage – “Chemicals kept on shelves or racks shall be subject to the following restrictions:



- (a) For shelves over benches, chemicals shall not be stored on shelves higher than 1.5 m from the floor.
- (b) Shelving and its fixtures shall be compatible with the goods stored, or shall be suitably protected from the goods.  
Note: The use of particle or similar boards is not recommended as they may fail when subject to moisture or chemicals.
- (c) The maximum holding capacity of the shelving systems shall not be exceeded.  
To assist housekeeping, chemical packages should not be kept on the floor.
- (d) Shelves used for chemical storage shall be restrained against lateral movement.

Liquids of any kind should not be stored above solids to reduce risk of contamination. Liquids should be stored as low as possible to reduce risk of breakage and spillage.

**Section 5 – Storing Chemicals in a Separate Store.**

**Table 2 – Maximum Storage Quantities**

| Type of Goods              | PG I           | PG II and PG III | Other          |
|----------------------------|----------------|------------------|----------------|
| Class 2 Aerosols (UN 1950) | Not applicable | 100              | Not applicable |

**5.5 - Method of Storage**

**Clause 5.5 – Chemical Storage Cabinets**

Chemical storage cabinets shall be used within a store to prevent contact between incompatible substances and to reduce the rate of fire spreading. Dangerous goods and combustible substances shall be stored in chemical storage cabinets except as allowed in Table 2.

The maximum quantity of chemicals in any one chemical storage cabinet shall not exceed 250 L or 250 kg. The quantity of particular classes of dangerous goods in one cabin shall be further limited

as specified in Table 2. If a chemical storage cabinet contains any quantity of dangerous goods of PG I, the whole contents shall be regarded as PG I.

Note: Smaller cabinets may be preferred for chemicals assigned to some packing groups.

Chemical storage cabinets shall comply with Clause 3.3 apart from cabinet separation requirements. Cabinets shall be separated from each other by not less than 250 mm airspace, which shall remain clear and accessible at all times.

There is nothing in this standard which provides any further guidance for specifically storing aerosols in a cabinet, cupboard or open shelving.

Publication: Deakin University – Dangerous Goods Guidelines.

This publication provides basic information on storing dangerous goods. In the document it refers to a table for Laboratory Quantities which are able to be stored in laboratories inside, outside and within 10 metre radius of storage cabinets:

| Description of Dangerous Goods | Packing Group | Outside Storage Cabinets          | Outside Storage Cabinets  | Inside Storage Cabinets | Maximum quantity in 10m radius for Packing Group |
|--------------------------------|---------------|-----------------------------------|---------------------------|-------------------------|--|
|                                |               | Maximum Qty per 50 m <sup>2</sup> | Maximum Pack Size L or kg | Maximum Quantity        | PGI PG II & III                                  |
| Aerosols                       | N/A           | 50                                | 5                         | 250 L                   | 10 L/kg 250 L/kg                                 |

Publication: The University of Queensland – Safe Storage of Chemicals – Guidelines.

This document is similar to the Deakin University Guideline. It also has a table for Chemical Storage Limits in a laboratory.

| Type of Substance or Class of Dangerous Goods | Maximum per 50 m <sup>2</sup> kg or L | Maximum pack size kg or L      | Alternative Storage Options   |
|---|---------------------------------------|--------------------------------|-------------------------------|
| Class 9 and aerosols                          | 50 for liquids<br>100 for solids      | 5 for liquids<br>20 for solids | AS/NZS 4681 or<br>AS/NZS 3833 |

Reference to aerosols only.

### Chemical Storage in Cabinets.

Chemical storage cabinets for the storage of dangerous goods are required where the storage quantities exceed those listed in the table above. The cabinets shall comply with the design requirements of AS1940 or the design criteria in the relevant standard.

The following requirements apply to the storage of chemicals within cabinets at University of Queensland.

- When storing flammable substances, the contents of the cabinet shall not exceed 100 L

Other requirements also apply.

### Summary

As you can see there is not one definitive answer for storing aerosols in small or minor storage quantities. The application also differs from an industrial storage requirement as against a laboratory storage requirement.

AS 1940 provides the most definitive recommendation, that for small quantities of aerosols they can be stored in a flammable liquid storage cabinet which provides both containment and initial fire resistance to protect the containers from an ignition source or a fire.

However they can also be stored in open mesh type cages which allows for any dispersion of a leaking aerosol to atmosphere. Whilst this type of storage will provide containment to prevent the aerosols from being a missile in a fire situation, it does not provide any initial fire protection.

Pratt Safety Systems provide an extensive range of flammable liquid storage cabinets and aerosol storage cages to suit most applications.

For larger storage requirements this may require a dedicated store or large mesh enclosures within a store.

If you are in any doubt, we suggest you contact your local Worksafe office for further assistance and guidance.

### Something Else To Think About.

There have been many reported accidents involving aerosols. Here are just a few.

1. A man has serious burns after exploding aerosol cans caused a fireball in a car wreckers yard in Clayton, in Melbourne's south this morning. The man was treated for burns to his face and hands and has been taken to the Alfred Hospital burns unit.

Metropolitan Fire Brigade Commander Mick Coombes says the victim was using a forklift to flatten the aerosol cans. "A spark ignited and some of the fumes and a fireball was the result," he said. "When it was reported to use we received it as explosions which probably was the aerosol cans themselves exploding." Melbourne 24 Nov 2007.

2. Two chefs received flash burns to their upper bodies when an aerosol can of cooking oil exploded in a busy café. As a result of the explosion, a large window at the front of the café blew outwards. Luckily, no patrons or other staff members were injured.

At the time of the incident, two chefs were in the open plan kitchen cooking breakfast in frying pans placed on lit gas burners. The aerosol can was placed on the kitchen work bench next to lit gas burners. As a result, the contents inside the aerosol can heated up, causing them to expand until the can could not withstand the internal pressure. The base of the aerosol can blew out, causing the contents to be released in the atmosphere.

The propellant inside the can (17 percent propane and 83 percent butane) was ignited by the naked flame resulting in an explosion. Worksafe WA, May 2010

3. Two women suffered life-threatening injuries Sunday afternoon at Robert Crown Memorial State Beach in Alameda when an aerosol can placed near a hot barbecue exploded, according to fire officials. The women were taken by helicopter to Santa Clara Valley Medical Centre for treatment. Alameda, Calif USA, 29 Sept 2013

4. A teenager suffered horrific burns after he and four mates threw aerosol cans into a blaze started in a wheelie bin. All five needed treatment after the bin exploded, but Jordan Lewis, 15, may require skin grafts after third degree burns to his entire face.

Mum Mandy, 40, said: "It was awful when he came running home. He was just screaming and screaming, his face covered in blood."

"He should have known better, but I'd say to anyone who is tempted to do the same in the future to have a look at Jordan's injuries."

Pal Francis Kavanagh, 14, of Rochdale, Greater Manchester, who was treated in hospital for burns, said: "I'll never do anything like that again." UK News 8 Nov 2012



5. Car safety involves more than driving defensively, keeping your vehicle in good working order and always being alert. It also covers things that have little to do with the operation of the vehicle. For instance, keeping aerosols in your vehicle can be extremely dangerous. An aerosol could be a can of starter fluid, spray paint, flat tire repair or even hairspray. Regardless of the product, you should not store aerosol cans in your car.

**Dangers of Aerosols in Vehicles -** Aerosols, when kept in overheated conditions, can become volatile and explosive. Many aerosol cans, whatever the contents, warn explicitly against keeping them in areas where the temperature reaches 120 degrees F or more. During the summer, the inside of a car can reach 130 degrees F or hotter. At these temperatures, aerosols become over-pressurized and can explode at any time.

An exploding aerosol could cause broken windows or injured passengers.

**Improving Car Safety -** To improve your car safety, keep anything in an aerosol can out of the car. Flat tire repair in an aerosol can also presents risk, but if you insist on keeping it in the car for emergencies, store it in the trunk. Don't store anything else in the vehicle at any time, but especially during the summer months.

Car safety is not merely a matter of good driving. It also means being safe with flammable and explosive materials that are commonly used with automobiles.



6. A fire was called in around 1:30 p.m. Wednesday afternoon after an aerosol can exploded at a home on E. Fourth Ave. After arriving, responders controlled the fire in 21 minutes. There was about \$40,000 worth of damage to the house and its contents. The homeowner was injured and taken to St. Francis Hospital under a code red, according to Fire Marshal Dennis Darby. Winfield Fire and Police Departments, Arkansas City Fire Department, Burden Fire Department and Cowley County Sheriff's Department responded to the call. "We are very appreciative of everyone who came out to help," said Darby.

Posted: Thursday, April 18, 2013 12:00 am  
Winfield Daily Courier



These are just a small selection of reported accidents involving aerosol cans.