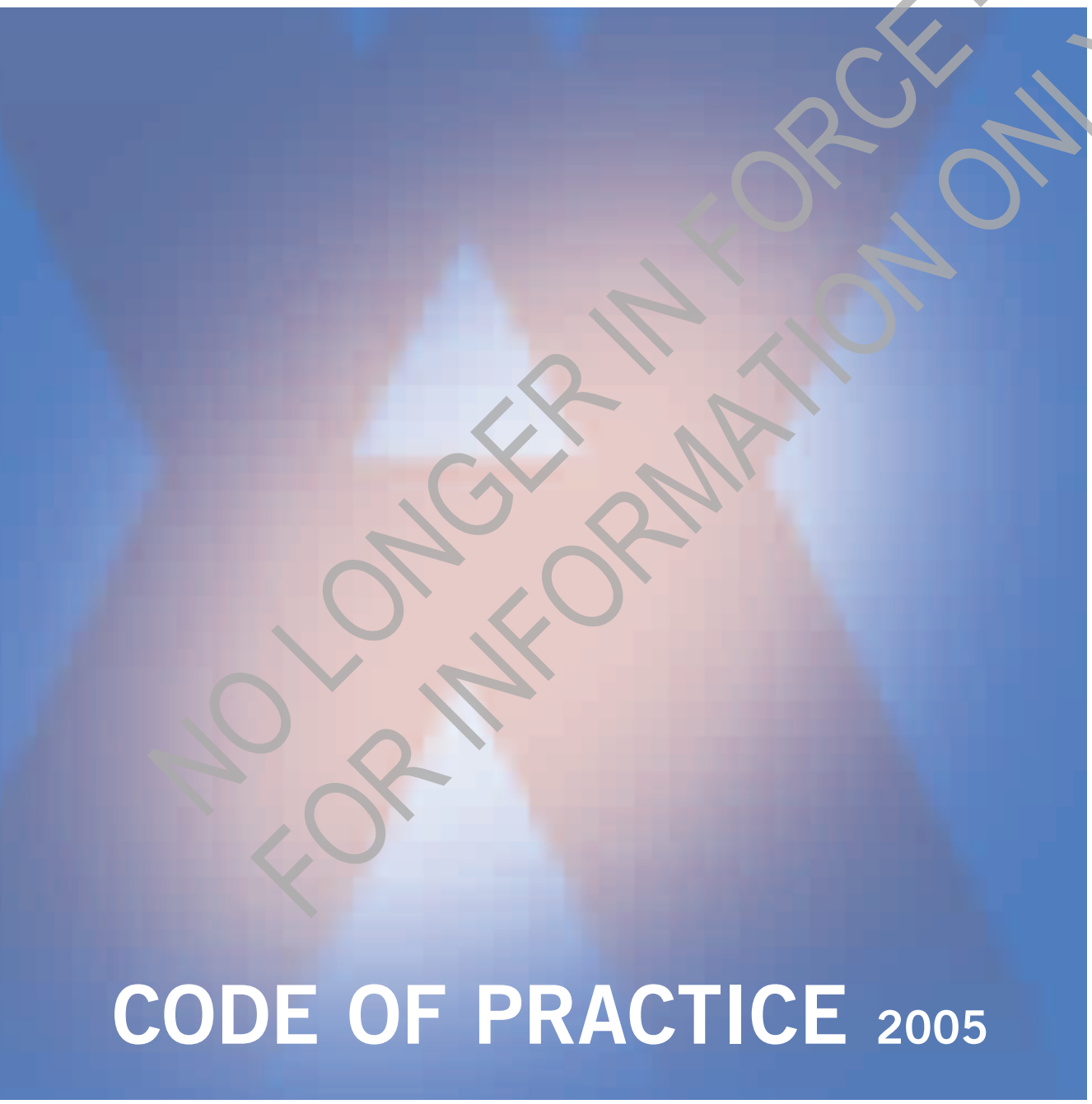
NSW GOVERNMENT

WorkCover NEW SOUTH WALES

STORAGE AND HANDLING OF DANGEROUS GOODS



CODE OF PRACTICE 2005

WORK SAFE HOME SAFE

This former code of practice under the OHS legislation is provided for the purpose of guidance only. Readers should not rely on statements in this document to ascertain requirements under the *Work Health and Safety Regulation 2011*. The information in this document should be used only as guidance on practical processes and controls to manage risks to health or safety.

WHAT IS AN APPROVED INDUSTRY CODE OF PRACTICE?

An approved industry code of practice is a practical guide to employers and others who have duties under the *Occupational Health and Safety Act 2000* (the OHS Act) and the *Occupational Health and Safety Regulation* (OHS Regulation) with respect to occupational health, safety and welfare.

An industry code of practice is approved by the Minister administering the OHS Act. It comes into force on the day specified in the code or, if no day is specified, on the day it is published in the NSW Government Gazette. An approved industry code of practice may be amended from time to time (or it may be revoked) by publication in the Gazette.

An approved industry code of practice should be observed unless an alternative course of action that achieves the same or a better level of health, safety and welfare at work is being followed.

An approved industry code of practice is intended to be used in conjunction with the requirements of the OHS Act and the OHS Regulation but does not have the same legal force. An approved industry code of practice is advisory rather than mandatory. However, in legal proceedings under the OHS Act or OHS Regulation, failure to observe a relevant approved industry code of practice is admissible in evidence concerning an offence under the OHS Act or OHS Regulation.

A WorkCover Authority inspector can draw attention to an approved industry code of practice in an improvement or prohibition notice as a way of indicating the measures that could be taken to remedy an alleged contravention or non-compliance with the OHS Act or OHS regulation. Failure to comply with an improvement or prohibition notice without reasonable excuse is an offence.

In summary an approved industry **CODE OF PRACTICE**:

- gives practical guidance on how health, safety and welfare at work can be achieved
- should be observed unless an alternative course of action that achieves the same or a better level of health, safety and welfare in the workplace is being followed
- can be referred to in support of the preventive enforcement provisions of the OHS Act or OHS Regulation
- can be used as evidence to support a prosecution for failing to comply with or contravening the OHS Act or OHS Regulation.

FOREWORD

This code of practice provides comprehensive practical guidance on the safe storage and handling of substances and articles classified as dangerous goods, apart from explosives, infectious substances and radioactive substances.

This code of practice outlines control measures focussed on physically containing the hazards and risks posed by dangerous goods. Personal exposure risks are covered in the NSW *Code of practice for the control of workplace hazardous substances*.

In 2003 a review of the regulation of dangerous goods led to major reform. The regulation of the storage and handling of most classes of dangerous goods will now come within the *Occupational Health and Safety Regulation 2001*, under the *Occupational Health and Safety Act 2000*. Explosives will come under the *Explosives Act 2003* and the *Explosives Regulation 2005*. The previous legislation, the *Dangerous Goods Act 1975* and the *Dangerous Goods (General) Regulation 1999*, will be repealed.

The effect of these reforms is to place dangerous goods within a risk management framework, consistent with all other types of hazards found within workplaces. This code of practice provides advice on applying this risk management framework to dangerous goods. These principles are extended to include aspects of public safety.

This code of practice also incorporates a number of Australian Standards applying to dangerous goods. Formerly, compliance with these Australian Standards was mandatory. In the new arrangements compliance with these Standards is recommended; these Standards having the evidentiary status of codes of practice.

This code of practice applies to workplaces regardless of quantities stored, handled or used. However, the guidance is provided in relation to quantities so that those workplaces with small quantities do not necessarily need to observe all chapters. This code of practice applies to non-workplaces where the quantities of dangerous goods stored or handled are above certain amounts.

This new legislation is based upon the *National Standard for the Storage and Handling of Dangerous Goods* declared by *the National Occupational Health and Safety Commission* in 2001.

This code of practice is based upon a similar code produced by the State of Victoria, and the national code declared by the National Occupational Health and Safety Commission (NOHSC).

CONTENTS

CHAPTER 1 – ESTABLISHMENT

1.1 TITLE

This is the *Code of practice for the storage and handling of dangerous goods*.

1.2 PURPOSE

This code of practice provides practical guidance to occupiers of premises on the safe storing and handling of dangerous goods, so that all persons (including members of the public) are not exposed to risks to their health and safety arising from dangerous goods at the occupier's premises.

This will assist employers, self-employed persons, and controllers of premises meet their legal obligations to store and handle dangerous goods without risk to the health and safety of workers and the community.

1.3 SCOPE

This code of practice applies to risks to all persons, including workers and the public, arising from dangerous goods that are stored or handled:

- at places of work
- at premises that are not workplaces where dangerous goods or combustible liquids are in quantities above those shown in Appendix 1.

The term "handled" is broadly defined and includes all aspects of use (see the definition in section 1.10).

This code of practice does not apply to the following:

- Dangerous goods in Class 1 (explosives), Class 6.2 (infectious substances) or Class 7 (radioactive substances).
- Pipelines when extending across the boundary of a premises, which are regulated under the *Pipelines Act 1967*.
- Dangerous goods during transport when subject to the regulations for road, rail, sea or air transport, and port operational areas.
- Gas installations to the extent covered by the *Dangerous Goods (Gas Installations) Regulation 1998* under the *Gas Supply Act 1996*.
- Dangerous goods when in: fuel tanks or batteries in systems connected to and essential for the operation of plant, vehicles or boats; portable fire fighting equipment or portable gas cylinders for medical purposes, when deployed for use; pneumatic tyres; or refrigeration equipment of less than 12 litres water capacity in use.
- Naturally occurring gas in an underground mine.
- Personal use products, such as food, therapeutic agents, cosmetics, tobacco and toiletries, where the use is not related to a work activity.

Other specific legislation or codes of practice may apply to some of the above matters excluded from the code of practice.

Personal exposure risks (except to biological or radio-active hazards) are covered in the NSW *Code of practice for the control of workplace hazardous substances*.

This code of practice does not provide detailed guidance on supplier obligations for dangerous goods and hazardous substances. Manufacturers and importers should consult the most recent editions of the following two codes, published by the National Occupational Health and Safety Commission (NOHSC):

- *National code of practice for the preparation of material safety data sheets*
- *National code of practice for labelling workplace chemicals (hazardous substances and dangerous goods).*

These are available on the web site: www.nohsc.gov.au.

1.4 COMMENCEMENT

This code of practice takes effect on 1 September 2005.

1.5 AUTHORITY

This is an industry code of practice approved by the Minister for Commerce and the Minister for Mineral Resources where it relates to mines, under section 43 of the *Occupational Health and Safety Act 2000*.

1.6 OTHER RELEVANT LEGISLATION

The *Electricity Safety (Electrical Installations) Regulation 1998* provides that all electrical installations must comply with AS/NZS 3000 SAA Wiring rules which references other standards relevant to hazardous areas related to dangerous goods (eg see section 9.8 ignition sources in hazardous areas).

The transfer and handling of dangerous goods at all premises, such as deliveries of goods and loading or unloading of vehicles, must comply with the provisions of: *Road and Rail Transport (Dangerous Goods) (Rail) Regulation 1999;* and the *Road and Rail Transport (Dangerous Goods) (Road) Regulation 1998.* These NSW Regulations bring into force the ADG code in relation to the transport of dangerous goods (except explosives). Transport is defined widely and includes packing, loading and unloading of dangerous goods and the transfer to and from a vehicle for the purpose of their transport.

Pipelines are covered under the *Pipelines Act 1967* and the *Pipelines Regulation 2000* which incorporates AS/NZS 2885 *Pipelines – Gas and liquid petroleum* and the *Gas Supply (Safety and Operating Plans) Regulation 1997*.

Protection of the environment is covered by other laws, notably the *Protection of the Environment Operations Act 1997* and is not specifically addressed in this code of practice. However, the control measures described here will also serve to protect the environment.

1.7 INCORPORATION OF AUSTRALIAN STANDARDS AND OTHER PUBLICATIONS AS PART OF THIS CODE OF PRACTICE

1.7.1 Australian Standards

The following Australian Standards, as amended from time to time, and relevant to the storage and handling of dangerous goods, are incorporated to form part of this code of practice as provided by section 41(2) of the *Occupational Health and Safety Act 2000*:

AS 1020 *Control of undesirable static electricity*

AS 1319 *Safety signs for the occupational environment*

AS 1345 *Piping*

AS 1375 *SAA industrial fuel-fired appliances code*

AS 1530 *Methods for fire tests on building materials, components and structures. Specification of fire ratings*

AS/NZS 1596 *The storage and handling of LP Gas*

AS 1692 *Tanks for flammable and combustible liquids*

AS 1697 *SAA Gas pipeline code*

AS/NZS 1768 *Lightning protection*

AS/NZS 1850 *Portable fire extinguishers*

AS/NZS 1851 *Maintenance of fire protection equipment* (Part 1 Portable fire extinguishers and fire blankets, Part 2 Fire hose reels)

AS 1894 *The storage and handling of non-flammable cryogenic and refrigerated liquids*

AS 1915 *Electric equipment for explosive atmospheres – battery operated vehicles*

AS 1939 *Degrees of protection provided by enclosures of electrical equipment* (IP code)

AS 1940 *The storage and handling of flammable and combustible liquids*

AS/NZS 2022 *Anhydrous Ammonia – Storage and handling*

AS/NZS 2106 *Determination of flashpoint of flammable liquids (closed cup)*

AS 2118 *Automatic fire sprinkler systems*

AS/NZS 2430.3 *Classification of hazardous areas* (all parts)

AS 2441 *Installation of fire hose reels*

AS 2507 *The storage and handling of agricultural and veterinary chemicals*

AS 2658 *LP gas – portable and mobile appliances*

AS 2714 *The storage and handling of hazardous chemical materials – Class 5.2 substances (organic peroxides)*

AS 2832 *Guide to cathodic protection of metals* (all parts)

AS 2896 *Medical gas systems – installation and testing of non-flammable medical gas pipeline systems*

AS/NZS 2906 *Fuel containers – portable – plastics and metal*

AS/NZS 2927 *The storage and handling of liquefied chlorine gas*

AS 3780 *The storage and handling of corrosive substances*

AS/NZS 3833 *The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers*

AS 3961 *Liquefied natural gas – storage and handling*

AS 4041 *Pressure piping*

AS/NZS 4081 *The storage, handling and transport of liquid and liquefied polyfunctional isocyanates*

AS 4289 *Oxygen and acetylene gas reticulation systems*

AS 4326 *The storage and handling of oxidising substances*

AS 4332 *The storage and handling of gases in cylinders*

AS/NZS 4452 *The storage and handling of toxic substances*

AS/NZS 4681 *Storage and handling of Class 9 (Miscellaneous) dangerous goods*

AS 4745 *Code of practice for handling combustible dusts*

AS 5601 *Gas installations*

1.7.2 Other documents

The following document, as amended from time to time, and relevant to the storage and handling of dangerous goods, is incorporated to form part of this code of practice as provided by section 41(2) of the *Occupational Health and Safety Act 2000*:

ALPGA standard: *AG 901 Code of Practice for NGV Refuelling Stations*

1.8 OTHER RELEVANT APPROVED INDUSTRY CODES OF PRACTICE

The following Australian Standards are also approved industry codes of practice, adopted by the *Code of Practice for Technical Guidance* (2001), and may be relevant:

AS 1716 *Respiratory protective devices*

AS 2337 *Gas cylinder test stations* (all parts)

AS 2359 *Powered industrial trucks* (all parts), including part 12 *Hazardous areas*

AS 3873 *Pressure equipment – Operation and maintenance*.

1.9 MANDATORY DESIGN STANDARDS

The design of most types of pressure equipment and gas cylinders must comply with the following standards:

AS 1210-1997 *Pressure vessels*

AS 1228-1997 *Pressure equipment – boilers*

AS 2971-1987 *Serially produced pressure vessels*

AS /NZS 3509-1996 *LP Gas vessels for automotive use*

AS 3892-2001 *Pressure equipment – installation*

AS 4343-1999 *Pressure equipment – hazard levels*

AS 4458-1997 *Pressure equipment – manufacture*

AS 2030.1-1999 *The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases – Part 1: Cylinders for compressed gases other than acetylene*

AS 2030.2-1996 *The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases – Part 2: Cylinders for dissolved acetylene*

AS 2030.4-1985 *The verification, filling, inspection, testing and maintenance of cylinders for storage and transport of compressed gases – Part 4: Welded cylinders – insulated*

The design standards above are required by clause 94 and schedule 1; and clauses 103 (manufacturer's duty), 107 (design registration) and 113 (item registration) of the *Occupational Health and Safety Regulation 2001.* Certain design standards are also mandatory under legislation described in section 1.6 above.

1.10 DEFINITIONS

Definitions are taken from the OHS Act or from the OHS Regulation, or from other relevant legislation or Australian Standards. Where developed specifically for this code of practice, this is indicated in a note.

The following terms used in this code of practice have these meanings:

ADG Code means the *Australian Code for the Transport of Dangerous Goods by Road and Rail* approved by the Australian Transport Council and published by the Australian Government from time to time.

Note: This is adopted into law in transport legislation and the OHS Regulation. This is the source of the definition and classification of dangerous goods and a list of deemed dangerous goods.

area includes a volume, place and a location.

Note: This definition has been developed for this specific code of practice.

article means an item (other than a fluid or particle) which is formed to a specific shape, surface or design, has an end use that depends in whole or in part on its shape, design or surface, and which undergoes no change in chemical composition or physical state during the end use except as an intrinsic part of that end use.

bulk means:

a. a quantity of dangerous goods in a container that has a capacity greater than the maximum container size specified for packaged dangerous goods of that type, or

b. solid dangerous goods that are not in a container in an undivided quantity exceeding 400 kg.

Note: The maximum sizes of packages are determined by the ADG Code. This means that a container over the following capacities is a bulk container – 500 L for gases, and 450 L container capacity or 400 kg mass (whichever is the lesser) for solids and liquids, including a C1 combustible liquid. An example of (b) is a pile not otherwise contained. The volume for gases is the water capacity of the container. A bulk container is an item of plant.

Note: All bulk storage requires placards.

bund means an embankment or wall, which may form part of the perimeter of a compound, designed to contain spills of liquids – both the bund and the compound floor must be sufficiently impervious to retain spillage or leakage.

Class means the Class allocated to the dangerous goods under the ADG Code.

Class label, for a Class, means the label specified in the ADG Code for the Class of dangerous goods.

C1 combustible liquid means a combustible liquid within the meaning of AS 1940 *The storage and handling of flammable and combustible liquids*, that has a flash point of greater than 60.5 degrees Celsius but not greater than 150 degrees Celsius.

C2 combustible liquid means a combustible liquid within the meaning of AS 1940 *The storage and handling of flammable and combustible liquids,* that has a flash point of greater than 150 degrees Celsius.

combustible material means any type of combustible material, and includes without limitation C2 combustible liquids and empty combustible containers, such as paper bags, fibre board drums and boxes, plastic containers and liners for containers, and wooden boxes and barrels.

Note: This definition has been adopted for this specific code of practice.

compatible, in relation to two or more substances, means the substances will not react together to cause, or substantially increase the likelihood of, a serious incident (within the meaning of section 87 of the OHS Act).

competent person for any task means a person who has acquired through training, qualification or experience, or a combination of them, the knowledge and skill to carry out that task.

confined space, in relation to a place of work, means an enclosed or partially enclosed space that:

- is not intended or designed primarily as a place of work
- is at atmospheric pressure while persons are in it
- may have an unsafe atmosphere with potentially harmful contaminants, and an unsafe level of oxygen or stored substances that may cause engulfment
- may (but need not) have restricted means of entry and exit.

Examples of confined spaces are as follows:

- storage tanks, tank cars, process vessels, boilers, pressure vessels, silos and other tank like compartments
- open-topped spaces such as pits or degreasers
- pipes, sewers, shafts, ducts and similar structures
- shipboard spaces entered through a small hatchway or access point, cargo tanks, cellular double bottom tanks, duct keels, ballast and oil tanks and void spaces (but not including dry cargo holds).

Note: This definition does not apply below ground in a coal mine.

consumer package means a container that is intended for retail display and sale, and includes a container that is transported and distributed as part of a larger consolidated container that consists of a number of identical consumer packages.

container means anything in or by which dangerous goods are or have been wholly or partly encased, covered, enclosed, contained or packed (whether empty, partially full or completely full) and includes any components or materials necessary for the container to perform its containment function.

Note: A container is an item of plant.

controller of dangerous goods premises means the controller of premises at or in which dangerous goods to which section 135A of the Act applies are stored or handled. A controller of premises includes: (a) a person who has only limited control of the premises concerned, and (b) a person who has, under any contract or lease, an obligation to maintain or repair the premises concerned.

Note: Section 135A of the OHS Act and clause 144D of the OHS Regulation apply workplace provisions to non-workplaces when dangerous goods are handled or stored over the quantities specified – see Appendix 1.

dangerous goods means the following (whether or not they are packaged for transport or under pressure):

- substances or articles defined under the ADG Code as:
  - dangerous goods of Class 2, 3, 4, 5, 6.1, 8 or 9
  - goods too dangerous to be transported
- C1 combustible liquids.

Note: Gases are dangerous goods whether or not packaged for transport or under pressure, despite the ADG Code definition of the sub-Classes in Class 2. However, goods that are classified as dangerous goods solely for the purposes of air transport are not dangerous goods for the purposes of this code of practice. AS 1940 provides the criteria for C1 combustible liquids (see the definition above). Many dangerous goods are also classified as hazardous substances. The meaning of dangerous goods in parts of the OHS Regulation other than chapter 6A differs by excluding C1 and including classes 1, 6.2 and 7.

emergency service includes any of the following:

- the Ambulance Service of NSW
- New South Wales Fire Brigade
- the NSW Rural Fire Service
- NSW Police
- the State Emergency Service
- the New South Wales Volunteer Rescue Association Incorporated
- an accredited rescue unit within the meaning of the *State Emergency and Rescue Management Act 1989*.

employee means an individual who works under a contract of employment or apprenticeship.

employer means a person who employs persons under contracts of employment or apprenticeship.

Note: The term "employer" when used in most parts of the OHS Regulation includes a self-employed person (for example, in relation to their duties to others at the workplace).

fire brigade means the New South Wales Fire Brigade or the NSW Rural Fire Service, whichever is appropriate.

fire protection system includes fire detection, fire suppression and fire fighting equipment, which may be fixed or portable.

fire risk dangerous goods means dangerous goods of Class 2.1, 3, 4, 5 or Subsidiary Risk 2.1, 3, 4, 5, and C1 combustible liquids, that burn readily or support combustion.

food includes:

a. a substance prepared for or intended or represented as being for human or animal consumption

b. a substance intended to be an ingredient of, or an additive to, a substance referred to in paragraph (a).

food packaging means:

- a container that contains, or is designed or intended to contain food
- material designed or intended to be used in a container that is designed or intended to contain food.

gas cylinder means a particular rigid pressure vessel, exceeding 0.1 kg but not exceeding 3,000 kg water capacity, without openings or integral attachments on the shell other than at the ends, designed for the storage and transport of gas under pressure.

goods too dangerous to be transported has the same meaning as in the ADG Code.

Note: These are goods that are extremely unstable or have other characteristics making them unsuitable for transport. They are named in appendix 5 of the ADG code. Some meet the classification criteria in the ADG Code and some are dangerous for transport for other reasons.

handling, in relation to dangerous goods, includes conveying, manufacturing, processing, possessing, using, preparing for use, treating, dispensing, packing, selling, offering for sale, supplying, transferring, loading and unloading, rendering harmless, abandoning, destroying and disposing of dangerous goods.

hazard means anything (including work practices or procedures) that has the potential to harm the health or safety of a person.

Note: For dangerous goods and hazardous substances, this primarily includes the intrinsic property of the substance (or substance contained in an article), or method of containment (eg a substance at high temperature or a gas under pressure). In this code of practice, it also includes hazards impinging on the safety of the dangerous goods (see chapter 6).

hazardous area means an area or space in which the atmosphere may contain or may be reasonably expected to contain any material or substance (including but not limited to combustible dusts, combustible fibres, flammable liquids, flammable vapours, flammable gases, flammable or combustible fumes) at a concentration that is capable of being ignited by an ignition source.

Note: Flammable liquids cover aerosols or sprays of flammable liquid.

hazardous substance means a substance that:

- is listed in the *List of Designated Hazardous Substances*
- fits the criteria set out in the *Approved Criteria for Classifying Hazardous Substances*, as published by the National Occupational Health and Safety Commission.

Note: The criteria and list are updated from time to time. While these categories overlap with dangerous goods classifications, they essentially cover personal exposure risks from substances that have chemical health effects. Many dangerous goods will also be hazardous substances.

hot work means work that involves an ignition source or heat source.

ignition source means a source of energy sufficient to ignite combustible dusts, combustible fibres, flammable vapours, flammable gases or flammable or combustible fumes, and includes the following:

- a naked flame
- exposed incandescent material
- hot surfaces
- radiant heat
- a spark from mechanical friction
- a spark from static electricity
- an electrical arc
- any electrical, electronic, mechanical or other equipment.

incident means any incident listed below occurring at or in a place of work is, if it is an incident that presents a risk to health or safety and is not immediately threatening to life:

- an injury to a person (supported by a medical certificate) that results in the person being unfit, for a continuous period of at least seven days, to attend the person's usual place of work, to perform his or her usual duties at his or her place of work or, in the case of a non-employee, to carry out his or her usual activities
- an illness of a person (supported by a medical certificate) that is related to a work process and results in the person being unfit, for a continuous period of at least seven days, to attend the person's usual place of work or to perform his or her usual duties at that place of work
    - damage to any plant, equipment, building or structure or other thing that impedes safe operation
    - an uncontrolled explosion or fire
    - an uncontrolled escape of gas, dangerous goods or steam
    - a spill or incident resulting in exposure or potential exposure of a person to a notifiable or prohibited carcinogenic substance
    - removal of workers from lead risk work due to excessive blood lead levels
    - exposure to bodily fluids that present a risk of transmission of blood-borne diseases
- the use or threatened use of a weapon that involves a risk of serious injury to, or illness of, a person, such as:
    - a robbery
    - electric shock that involves a risk of serious injury to a person,
- any other incident that involves a risk of:
    - explosion or fire
    - escape of gas, dangerous goods or steam
    - serious injury to, or illness of, a person
    - substantial property damage.

Note: Notification of incidents is required by section 86 of the OHS Act and defined in clause 341 of the OHS Regulation. "Serious incident" is also defined (see below) in clause 344 of the OHS Regulation. "Place of work" is extended to non-workplaces where dangerous goods are stored or handled in quantities exceeding those shown in appendix 1 of this code of practice.

incompatible means those substances that are not compatible. See the definition of compatible.

IBC (intermediate bulk container) means a rigid or flexible portable packaging for the transport or storage of dangerous goods that:

- has a capacity of not more than:
  - for solids of Packing Group I packed in a composite, fibreboard, flexible, wooden or rigid plastics or wooden container – 1,500 litres
  - for solids of Packing Group I packed in a metal container – 3,000 litres
  - for solids or liquids of Packing Groups II and III – 3,000 litres.
- is designed for mechanical handling
- is resistant to the stresses produced in usual handling and transport.

location – see 'storage location'.

must indicates a mandatory requirement (a requirement of an Act or Regulation).

MSDS means material safety data sheet.

occupier of premises

occupier, in relation to premises where dangerous goods are stored or handled, means the following:

- if dangerous goods are stored or handled at an employer's place of work – the employer
- a controller of dangerous goods premises.

Note: Controller of dangerous goods premises is defined above.

OHS Act means the *Occupational Health and Safety Act 2000.*

OHS Regulation means the *Occupational Health and Safety Regulation 2001.*

Note: This Regulation is automatically repealed every five years, unless the repeal is postponded and replaced by a regulation with a new date.

package means the complete product of the packaging of the dangerous goods and consists of the goods and their packaging. Packaging is the container in which the goods are received or held for transport, and includes anything that enables the container to receive or hold the goods or to be closed.

Note: When provided for use at work, packaging is an item of plant.

packaged dangerous goods means:

- Class 2 dangerous goods that are in a container with a capacity of not more than 500 L; or
- goods too dangerous to be transported or dangerous goods of another Class that are in a container with:
  - a capacity of not more than 450 L, and
  - a container with a net mass of not more than 400 kg, or
- C1 combustible liquids in a container with a capacity of not more than 450 L.

Note: Volumes are water capacity of the container.

Packing Group means the Packing Group allocated to the dangerous goods under the ADG Code.

Note: This is often abbreviated PG. It is a classification assigned to some classes of dangerous goods based on the degree of hazard – I being the highest and III the lowest level of hazard. It does not apply to gases.

PG – see Packing Group.

person includes an individual, a corporation, and a body corporate or politic.

pipework means a pipe or assembly of pipes, pipefittings, valves and pipe accessories.

pipeline means pipework that crosses the boundary of a particular premises. A pipeline begins and ends at the nearest fluid or slurry control point (along the axis of the pipeline) to the boundary of the premises concerned.

place of work means any premises where persons work.

Note: Section 135A of the OHS Act and clause of the OHS Regulation extend workplace provisions to non-workplaces when dangerous goods are handled or stored over the quantities shown in appendix 1.

plant includes any machinery, equipment or appliance.

Note: Generally speaking, dangerous goods are usually contained within an item of plant. Plant includes things such as: articles, pipework, road tankers and associated transfer equipment. Section 135 of the OHS Act extends plant provisions to non-workplaces for pressure equipment (including gas cylinders).

premises includes any place, and in particular includes:

- any land, building or part of any building
- any vehicle, vessel or aircraft
- any installation on land, on the bed of any waters or floating on any waters
- any tent or moveable structure.

protected work means any:

- dwelling house
- government or public building, church, chapel, college, school, hospital, theatre or public hall
- shop, factory, warehouse, store or other building or any timber yard, in which any person is employed or engaged in a trade, business or profession
- building or structure in or about which persons are usually present or from time to time assemble
- reservoir used for the supply of reticulated water to the public.

public place means any place other than private property, open to the public, which the public has the right to use and which includes a public road.

reasonably practicable – this is not defined in legislation, but see the advice in section 8.2.

relevant transport code means the ADG Code, the International Civil Aviation Organization's *Technical Instructions for Safe Transport of Dangerous Goods by Air*, the International Maritime Organization's *International Maritime Dangerous Goods Code*, or the International Air Transport Association's *IATA Regulations* as appropriate.

Note: See the definition of 'transit' below.

retail warehouse operator means a person who operates a warehouse at which unopened packaged goods intended for retail sale are held, but does not include a retailer.

retailer means a person who sells goods to members of the public who are not themselves engaged in any further resale of those goods.

risk means the likelihood of an injury or illness occurring and the likely severity of the injury or illness that may occur.

Note: Risk includes risks to the health and safety of any workers and any member of the public, both on the premises and outside of the premises where the dangerous goods are stored or handled, and regardless of whether the premises is a workplace.

self-employed person means a person who works for gain or reward other than under a contract of employment or apprenticeship, whether or not employing others.

Note: Self-employed persons have the same duties as employers in some clauses of the OHS Regulation.

segregation means separation from other substances (including dangerous goods) so that a loss of containment cannot cause a serious incident.

separation in relation to the separation of dangerous goods from a person, property or thing, means the physical separation of the dangerous goods from the person, property or thing, by either distance or a physical barrier.

Note: See also segregation.

serious incident means either an incident that has resulted in a person being killed or any of the following incidents at or in relation to a place of work:

- an injury to a person that results in an amputation of a limb
- the placing of a person on a life-support system
- any incident listed below that presents an immediate threat to life:
  - the loss of consciousness of a person caused by impact of physical force, exposure to hazardous substances, electric shock or lack of oxygen
  - any major damage to any plant, equipment, building or structure
  - an uncontrolled explosion or fire
  - an uncontrolled escape of gas, dangerous goods or steam
  - imminent risk of explosion or fire
  - imminent risk of an escape of gas, dangerous goods or steam
  - a spill or incident resulting in exposure or potential exposure of a person to a notifiable or prohibited carcinogenic substance
  - entrapment of a person in a confined space
  - collapse of an excavation
  - entrapment of a person in machinery
  - serious burns to a person.

Note: This is defined in section 87 of the OHS Act and clause 344 of the OHS Regulation. "Incident" is defined above and in clause 341 of the OHS Regulation. "Place of work" is extended to non-workplaces where dangerous goods are stored or handled in quantities exceeding those shown in appendix 1 of this code of practice.

should means a recommendation.

Note: Such recommendations have the legal standing of evidence accorded to codes of practice by section 46 of the OHS Act.

source of ignition – see ignition source.

stability refers to chemical stability and reactivity unless the context demands otherwise.

Note: In some contexts, this includes physical or mechanical stability of plant. This definition has been developed for the specific purposes of this code of practice.

storage location means any place or area where one type of dangerous goods or compatible dangerous goods are kept either in bulk or in a quantity exceeding the relevant quantity specified in the column headed "Placarding quantity" in the Table to Schedule 5 [of the OHS Regulation] (and includes a building, structure, room, compartment, tank or other bulk container, store, or receptacle in or on which dangerous goods are stored in bulk or handled above the "Placarding quantity" in the Table to schedule 5).

Note: Schedule 5 of the OHS Regulation is shown in appendix 2 of this code of practice.

storing includes storing as a bailee or in any other capacity.

Subsidiary Risk has the same meaning as in the ADG Code.

Note: Subsidiary Risk is a secondary hazard of a substance or article as assigned by the ADG Code, the primary hazard being indicated by the Class.

substance means any natural or artificial substance, whether in solid or liquid form or in the form of a gas or vapour, and includes dangerous goods.

Note: Dangerous goods includes articles. This definition has been developed for the specific purposes of this code of practice.

tank means a container, other than an IBC, that is used, or designed to be used, to transport or store dangerous goods in the form of a gas or a liquid in bulk and includes fittings, closures and any other equipment that forms part of the container.

Note: *bulk* and *IBC* are defined above.

transfer means the movement of dangerous goods including from place to place within a premises or into or from a container or package, and includes pumping, dispensing, and decanting.

Note: This definition has been developed for this specific code of practice.

transit means dangerous goods at premises that:

- are part of a transport load in compliance with the relevant transport code
- are loaded on a vehicle, vessel or aircraft, or being transhipped from one vehicle, vessel or aircraft to another
- are not intended to be at the premises for more than five consecutive days (not including public holidays) and have not been at the premises for more than five consecutive days (not including public holidays)
- are not intended to be consumed or processed at the premises and have not been consumed or processed at the premises
- are not intended for sale at the premises.

Note: See also the definition of relevant transport code.

transport, in relation to dangerous goods, includes:

- the packing, loading and unloading of the goods, and the transfer of the goods to or from a road vehicle or rail wagon, for the purpose of their transport
- the marking of packages and unit loads containing dangerous goods, and the placarding of containers, vehicles and rail wagons in which dangerous goods are transported
- other matters incidental to transport.

use plant means work from, operate, maintain, inspect or clean plant.

water capacity, of a container, means the total internal volume of the container in litres of water measured at a temperature of 15 degrees Celsius.

Note: The volumes of gas containers are usually measured in terms of water capacity. The reference to litres in relation to dangerous goods of Class 2 means the water capacity of the container that holds those dangerous goods.

worker means any person working or engaged in the storage or handling of dangerous goods at a particular premises, and includes an employee or a self-employed person.

Note: This definition has been developed for the specific purposes of this code of practice. Premises is defined above.

workplace – see place of work.

CHAPTER 2 – PLANNING TO IMPLEMENT THIS CODE OF PRACTICE

This code of practice does not go into details as to who bears the obligations, but describes the steps that should be taken to ensure health and safety, and thereby comply with the law. The person (individual or corporation) who has the obligation to comply with legislation, and make use of the advice in this code of practice, will vary with circumstances. For full details of legal obligations, the OHS Act and the OHS Regulation need to be consulted.

This chapter focuses on implementing safety by planning and applying risk management principles to the use of dangerous goods, including the storage and handling of containers.

2.1 THE RISK MANAGEMENT APPROACH OF THIS CODE OF PRACTICE

"Risk management" is a way of organising efforts to determine safe systems of handling and storage. Following this procedure will help identify safety issues unique to the nature of your particular premises.

2.1.1 Steps in risk management

Risk management involves the following four steps:

1. Identifying all hazards. This includes examining all activities, work processes, plant, substances, work environment, layout and condition of the premises, and any other factors that may affect safety. Specifically include the dangerous goods classification of container contents, and any dust or gas hazards that may arise from the nature of the substances and articles in use, handled or stored. This is explained in chapter 3, with further technical details in chapter 6.

2. Secondly, assessing the risks. Risk is a combination of the likelihood and the severity of any harm that the hazards might give rise to. Factors contributing to the risk should also be identified. It helps to prioritise risks so that the most serious ones can be tackled first. This should include an evaluation of the effectiveness of existing control measures. With dangerous goods, the quantity stored and in use is one indicator of the level of risk: the greater the quantity the greater the risk. Risk assessment is explained in chapter 7.

3. Thirdly, eliminating or reducing the risk(s) identified in step 2, by applying the "hierarchy of control" measures (detailed below in section 2.3). Controls are outlined in chapter 8 and detailed in chapters 9 to 11. Identify any record keeping necessary to ensure controls are maintained.

4. Finally, to ensure that safety is maintained, monitor and review the control measures to ensure they are working, and respond to changes in work practices, activities or other conditions. Supervision is essential to ensure workers and the public follow correct practices.

The first three steps must be carried out before work commences – this code of practice will help you do this. If there are only small quantities in packages at the premises, this process can be simplified as explained in section 2.1.4 on page 27.

Employers must consult with employees about these steps – see section 2.2.

2.1.2 Key risks to assess

Experience indicates the following risks are important and should be examined in the risk assessment, where relevant to the type of handling or storage:

- escape or spillage of goods
- fires or explosions resulting from the nature of the dangerous goods
- chemical reactions between incompatible goods, or self-reacting goods
- related issues such as confined spaces entry
- associated plant and equipment, such as that used for bulk handling and transfer of goods or in a manufacturing process (eg sources of ignition).

If monitoring and reviewing indicates on-going problems, this could indicate a need to re-design the relevant aspect of the handling and storage system. Controlling the risk of injury usually also controls the risks to property and the environment.

You should write down your risk management activities and reasons for selecting controls. A record of the risk assessment must be kept by the occupier of the premises where the dangerous goods are stored or handled (see section 7.3).

Further guidance on the principles of risk management can also be found in WorkCover's *Workplace Safety Kit, Small Business Safety Starter Kit*, and in general terms in the *Code of Practice on Risk Assessment.*

2.1.3 Steps to take

A stepwise process needs to be developed, for example:

1. Decide who will do it.
2. Identify the dangerous goods in use and storage and the associated hazards.
3. Identify areas and persons at risk.
4. Review information, including relevant MSDS and other sources of advice such as relevant Australian Standards.
5. Identify external hazards and how these could impinge on the dangerous goods.
6. Estimate risks in each situation.
7. Reach conclusions about risks.
8. Identify and evaluate suitable control measures.
9. Adopt control measures.
10. Review the effectiveness of control measures.

2.1.4 How this code of practice is organised

An analysis of the hazards and risks with the particular type of dangerous goods at your premises will indicate which sections of this code of practice are relevant. The Class category assigned to the goods is a key indicator of the hazard. Chapter 3 provides advice on identifying dangerous goods and obtaining information – this advice is essential, regardless of the classification and quantities of goods.

The total quantity stored and in use is a key indicator of risk. For example, some aspects of this code may not be relevant to your premises if you have low quantities in packages. A systematic application of risk management should indicate relevant control measures, using this code as a guide.

For relatively low quantities of dangerous goods, chapter 4 provides advice on what is termed "small" quantities in this code (similar to the term "minor storage" used in a number of Australian Standards). These "small" quantities are defined as being below the placard levels in schedule 5 of the OHS Regulation, shown in appendix 2 of this code of practice. For retail premises, chapter 5 provides advice in relation to consumer packages in "small" quantities (but not bulk).

For premises that exceed these "small" quantities, further detailed guidance on identifying hazards is provided in chapter 6, and details of risk assessment are provided in chapter 7. Chapter 8 gives a detailed explanation of applying the hierarchy of control. Chapters 9 to 11 provide information on specific control measures and references to relevant Australian Standards.

Over certain quantities, the OHS Regulation requires certain additional steps and chapters 12 to 17 provide additional advice about:

- notification of the premises details to WorkCover
- placards for storage areas
- manifests listing the dangerous goods at the premises
- written emergency plans.

2.2 EMPLOYER'S OBLIGATION TO CONSULT WITH EMPLOYEES ABOUT RISK MANAGEMENT

A duty for employers to consult with employees is provided by sections 13 to 19 of the OHS Act. Details of consultation arrangements are provided in chapter 3 of the OHS Regulation. This does not apply to self-employed persons, but coordination with other duty holders may – see section 2.6.

A suitable method of consultation must be put in place. Further advice on consultation with employees and setting up suitable arrangements is provided in the WorkCover *Code of practice: OHS consultation*.

Employers should consult with employees about implementing this code of practice. It may help if hazardous substances issues (such as exposure of workers to atmospheric contaminants) are discussed at the same time. For example, when discussing the physical risk of the flammability of the vapour produced by a substance, it may be appropriate to also discuss inhalation and toxicity risks.

2.2.1 When to consult

Whenever employers undertake a risk assessment or determine control measures, they must consult with employees as part of this process and take their views into account.

As examples, consultation should take place when:

- evaluating the safety issues as part of the process of purchasing a new type of dangerous goods or plant to be used with dangerous goods. This includes such matters as the safety features of the plant used with dangerous goods, its location and compatibility with other plant or equipment in the workplace
- developing safe work procedures for related tasks, such as decanting, loading, unloading and using bulk handling equipment
- developing inspection and maintenance procedures
- developing emergency procedures to address risks such as fires and explosions
- investigating the causes of injuries, accidents or other incidents (such as "near misses") that may arise
- considering modifications to the containers of dangerous goods or associated plant.

2.2.2 Topics for discussion

When undertaking consultation employers should share all relevant safety information with employees. This must include information provided by the manufacturer or supplier of goods and plant, health and safety issues that may arise from the use of goods or plant, and how these issues will be addressed. Employees should be given sufficient time to consider this information and discuss any issues they may have with their employer.

Examples of particular topics to discuss during consultation include:

- selection of suitable Personal Protective Equipment (PPE), when chosen as a control measure
- best ways of communicating health and safety information, including providing information to contractors or other workers at the site
- effective ways of providing signage
- establishing administrative procedures such as hazard and accident reporting
- accessing emergency response procedures for the site
- coordination with contractors and other workers at the site (eg vehicle drivers loading or unloading).

2.2.3 Information to make available

The following information should be made available to OHS Representatives during consultation (including the information that must be made available to relevant employees):

- labels on containers and MSDS (see chapter 3)
- the register of substances (ie both dangerous goods and hazardous substances, see section 3.5)
- any written risk assessment reports
- any relevant manufacturer's information relating to the use of plant
- the emergency plan (where one is required by the OHS Regulation)
- the manifest for the premises (where one is required by the OHS Regulation).

2.3 PREVENTING ACCIDENTS AND INJURIES – ELIMINATION AND THE HIERARCHY OF CONTROL

2.3.1 Legal obligation to apply the hierarchy of control

After identifying the hazards and assessing the risks, the key step is to determine the safeguards or work systems that are needed to keep people safe. As indicated above, employers must involve employees when making these decisions.

The hierarchy of control must be followed when choosing control measures recommended in this code of practice. Many of the measures will be those described in relevant Australian Standards (see the list in section 1.7). Premises where the controls were adopted from the relevant Australian Standards prescribed in the old (repealed) dangerous goods regulation will largely be conforming with this code of practice. The hierarchy of control is detailed in chapter 8, however the principles are outlined in sections 2.3.2 and 2.3.3 below.

2.3.2 Eliminating the risk

The first consideration is to keep people from being exposed to a hazard in the first place. This is called eliminating the risk.

For example, the risk associated with using a paint with a flammable solvent can be eliminated by:

- a non-flammable solvent (eg changing to a "water-based" paint)
- using a different system (eg powder coating instead of painting).

Elimination of the hazard gives the best level of safety, and must be adopted unless it is not reasonably practicable. If elimination is not reasonably practicable, then the following hierarchy of controls must be considered (see 2.3.3 below).

2.3.3 Controlling the risk

Controlling dangerous goods occurs at three levels:

Level 1. Containment – the first level of control is to contain the dangerous goods to prevent escape. Effective containment will eliminate some risks.

Level 2. Spill or leak control – these are the controls that function if an escape does occur to contain or limit the effects of the escape (eg bunding to limit the spread of a liquid; warning devices that detect a gas leak).

Level 3. Fire control and emergency response – these are the steps to be taken if containment fails, and in case the level 2 controls fail to prevent a serious incident.

The hierarchy of control measures is listed below in order of effectiveness. Work through the sequence, starting with (a) which represents the highest level. Determine the control from the highest level reasonably practicable, and develop each control measure for each risk identified. The term "reasonably practicable" is explained in section 8.2.

a. Substituting the system of work, substance or plant for something less hazardous (eg change the type or reducing quantities of goods kept on site).

b. Isolating the hazard (eg introduce a restricted work area or enclose the system, separate goods from other hazards or segregate incompatible substances).

c. Introducing engineering controls (eg forced ventilation to remove fumes).

d. Administrative controls – examples are:

   - modifying the system of work (eg changing the times at which certain tasks are done);
   - hazard warning signs, specific training and work instructions.

e. Personal protective equipment (PPE), such as eye, respiratory and hand protection to protect the worker.

In some situations a combination of control measures may be needed.

Administrative controls require frequent reviews of the risks and systems of work. Workers should be trained to implement all relevant controls. When adopting administrative controls, training of workers about each control is important to ensure that workers know how to implement these. Supervision is necessary to ensure that workers use controls.

2.3.4 Using PPE as a control measure

PPE should only be used when other control measures are not reasonably practicable, or when, after implementing other controls, a residual risk remains. PPE may be necessary as part of emergency procedures.

However, the need to use PPE typically used in the industry such as hard hats, respirators, gloves, eye protection and safety boots should be carefully considered.

Where the chosen measures to control risks include the use of PPE, the employer (or self-employed person) must provide each person at risk with the PPE and provide training on its use and maintenance (OHS Regulation, clause 15). Careful supervision and monitoring are needed to ensure that workers use and maintain PPE properly.

Any new control measures should be evaluated to ensure that they are effective and that new hazards are not introduced (directly or indirectly).

A further explanation of using the hierarchy of control is provided in chapter 8.

2.4 PLANNING TO DEAL WITH SERIOUS INCIDENTS – EMERGENCY PROCEDURES, FIRES AND CONFINED SPACES ENTRY

Employers, self-employed persons and occupiers must provide for emergencies.

Fire risks of dangerous goods should be identified, especially those related to the dangerous goods classification – see the definition of "fire risk dangerous goods" in section 1.10. Any confined spaces at the premises (including those associated with plant) should be identified.

Emergency procedures, including fire fighting, should be developed on the basis of the needs indicated by the risk assessment. This would include an assessment of:

- the nature and quantity of the dangerous goods stored or handled
- the types and likelihood of emergencies
- the fire protection and other emergency equipment provided
- the physical features of the premises
- access to the premises (workplace) by emergency services
- the number of people likely to be on the premises or on adjoining premises.

Relevant emergency contact telephone numbers need to be displayed in prominent locations or provided to workers (eg on an emergency response card).

The following matters should be considered when planning to deal with emergencies and controlling fires:

- developing a site emergency plan, including procedures for alerting the fire brigade and cooperation with the fire brigade
- the provision of fire fighting equipment, location and access to this
- suitable fire, heat and smoke detection systems
- maintenance of fire fighting equipment
- provision of an adequate water supply
- safe isolation and emergency stop procedures
- control of access to the premises or affected area during the emergency
- extra equipment and measures for entry into a confined space for rescue
- PPE and self-contained breathing apparatus that may be needed.

The above measures need to be included in staff training and instruction (see chapter 17), and developed in consultation with employees.

Additional measures must be considered where the quantity of dangerous goods exceeds the "manifest" level shown in Appendix 2. Details are provided in chapters 12 and 14.

2.5 TRAINING AND INSTRUCTION FOR WORKERS

Employers and self-employed persons must provide suitable training, instruction, information and supervision, to ensure workers' health and safety (OHS Regulation, clauses 13 and 14).

Information can also be provided in training, and is covered in section 2.8. Information and training must be commensurate with the risks. Information and training needs for each worker should be determined in the risk assessment process and through consultation with workers.

Everyone should be trained to follow systems of work and work practices that enable them to perform their work safely. Training should include matters covered in this code of practice where relevant. Make sure that only those who have had adequate training and instruction are permitted to carry out the work.

Relevant training needs to be considered for those workers who carry out specific tasks, such as operating, maintaining or cleaning plant.

Managers and supervisors also need training relevant to the dangerous goods in the areas they supervise. Those with the tasks of assessing risks and implementing control measures may also need appropriate training.

Further guidance is provided in chapter 17 of this code of practice.

2.6 CONTROL AND COORDINATION OF CONTRACTORS AND OTHER PERSONS WORKING AT THE SITE

At some locations, more than one organisation or party may be working. Examples are where a principal engages contractors, labour hire workers or persons working in a partnership.

Controllers of premises, plant or substances (who themselves are not working at the site) also have responsibilities. An example is where a corporation engages a contract packer at a separate site and provides (and retains ownership of) the goods to be packed. Another example is strata title factory units, where the lessor and the lessee both have duties.

2.6.1 Coordination

Coordination of health and safety efforts is also essential. Clause 8 of the OHS Regulation provides that, if more than one person has a responsibility with respect to a particular occupational health and safety matter:

- each person retains responsibility for the matter, and
- the responsibility is to be discharged in a co-ordinated manner.

Providing information in the form of signs, labels and MSDS (see chapter 3) is an important part of this coordination.

2.6.2 Contractors

In order to adequately ensure both the protection of contractors who work at the site (even if only occasionally), and to ensure contractors protect others, it is important to adopt procedures, such as:

- permit to work systems (eg for hazardous areas)
- isolation and tagging procedures to prevent inadvertent starting or energising of plant
- providing adequate information and training about storage containers and associated hazards and risks, and emergency systems established (such as fire alarms).

Health and safety issues should be considered at the time of preparing tender documents and when evaluating tenders. The need for risk assessments and safe work method statements prepared by contractors should be considered at an early stage to ensure that the work is carried out safely.

Supervision or evaluation may be necessary to ensure contractors carry out appropriate procedures, including implementing this code of practice.

2.6.3 Premises where there are several occupiers

At some premises there may be several occupiers and consequently several persons may have duties that must be coordinated. Examples are strata title factory units, partnerships, joint ventures and where a person leases part of a premises.

In such cases the duties must be coordinated as described in section 2.6.1. Owners of premises should check if other persons at the premises are using dangerous goods and whether the premises is suitable in terms of the premises related control measures described in this code of practice.

2.7 REGULAR CLEANING, MAINTENANCE AND INSPECTIONS

Risks can be reduced through regular checks, inspection, maintenance and cleaning programs.

Inspection of plant must be carried out by a competent person (OHS Regulation clause 137(e)). If the operation or condition of plant presents an immediate risk to health or safety, the plant must be withdrawn from operation until the risk is eliminated or, if this is not practicable, controlled (OHS Regulation clause 136(3)(n)).

Arrange for a comprehensive and detailed examination of storage containers and associated plant and pipework by a competent person at intervals recommended by the manufacturer. This may need to be more frequent in harsh environments such as near seawater, or where factors could cause deterioration or damage, such as the nature of the stored material, corrosion, chemical reaction, fatigue, vibration, heat or ultra violet light.

Further advice on maintenance and inspection is provided in section 9.10 *Regular cleaning, maintenance and inspections*.

2.8 INFORMATION AND SIGNAGE

The key information provided to workers includes placards and signs in the work area and premises.

Signage is an important way of providing information. The OHS Regulation requires signage for certain risks. For example, an employer must ensure that all relevant information on emergency procedures relating to plant is displayed in a manner that can be readily observed by persons who may be exposed to risks arising from the operation of plant (OHS Regulation Cl 144(2)).

Lighting should be sufficient for persons to read labels, placards and signs where necessary.

Further information on:

- labels and material safety data sheets (MSDS) is provided in chapter 3.
- signage (such as placarding) is provided in chapter 15.

2.9 DESIGN OF NEW PREMISES OR PLANT

This code of practice should be observed at the design stage when planning a new plant, facility, or premises; or modifying an existing premises, facility or plant.

All premises, structures and plant should be designed and manufactured for use with the specific dangerous goods that will be handled or stored. All safety aspects of the design, commissioning, operation, testing, maintenance, repair and decommissioning should be anticipated and planned at the design stage. This enables control mechanisms to be incorporated into the design. The costs of control measures may well be lower if incorporated into a safe design rather than by adapting inappropriately designed plant or premises.

The design process should follow the principles of the hierarchy of control (see section 2.2 and chapter 8), and specific control measures (see chapters 9 and 10). See section 9.12 for advice on the design of buildings and areas. The designer of plant must identify, assess and control any hazards or risks. Any dangerous goods necessary for the use of the plant should be specified and warnings provided in relation to unsuitable goods.

If a structure or plant that was not designed and built for use with the particular dangerous goods is subsequently introduced, additional care is required to ensure suitability and that risks are controlled.

Take account of any external factors in the layout of the premises, such as whether the location and type of fire protection meets with operational requirements of the fire brigade. If you intend to store substantial quantities of dangerous goods, engaging the advice of the fire brigade will assist in designing a suitable fire protection system. Australian Standards relevant to the goods that will be stored also provide advice on safety precautions and fire protection (see chapter 12).

Further advice on design of premises and storage is provided in chapter 9.

2.10 SECURITY OF THE SITE AND STORAGE AREA

Because of the hazards associated with dangerous goods, access to premises and work areas needs to be controlled and restricted to those persons having a legitimate purpose.

Occupiers of premises have a duty, so far as is reasonably practicable, to prevent

- access to the occupier's premises by unauthorised persons
- unauthorised activities occurring on those premises.

2.10.1 Factors to assess

Security systems and procedures should be developed on the basis of the risk assessment. The following factors should be considered:

- the need to ensure the security of personnel, dangerous goods, processes, equipment, plant, buildings, records and information systems.
- the location of the premises in relation to the access from the surrounding community and roads
- the likelihood of mischief or sabotage
- the integrity and reliability of the security system and possible requirements for backup support for systems and security personnel.

2.10.2 Controlling access

Where it is necessary to control access of people to the premises, the access control system should include the following:

- a means to identify the extent of access to be permitted for each person
- the means to account for everyone on site at any given time
- the issuing of restricted access passes to visitors, or prohibiting unaccompanied access.

Depending on the size of the premises and the risks identified in section 2.10.1 above, security measures where dangerous goods are kept might include the following:

- fencing or enclosing the storage areas (but providing safe access and egress)
- providing locks on doors, windows and other openings to buildings, rooms, compartments or shipping containers
- continuously supervising areas
- performing security checks on vehicles entering or leaving the premises
- limiting access by visitors, customers, contractors or employees to particular areas.

2.11 SERIOUS INCIDENTS AND OTHER INCIDENTS – INVESTIGATION AND REPORTING

2.11.1 Obligation to respond to an incident and investigate the cause

The terms "serious incidents" and "incidents" are described in the definitions in section 1.10. These must be reported to WorkCover.

Important for dangerous goods are those incidents or risks sometimes called "near misses". These include the following:

- an uncontrolled explosion or the risk of an explosion or fire
- an uncontrolled escape of dangerous goods, or the risk of an escape
- damage to any plant, equipment, building or structure or other thing that impedes safe operation.

Even when no person is injured, any uncontrolled escape or risk of escape of dangerous goods, or damage arising from dangerous goods, must be reported to WorkCover (OHS Regulation clause 341).

In relation to dangerous goods, the OHS Regulation (clause 174ZO) provides that:

An occupier must respond to a serious incident or other incident involving dangerous goods at the occupier's premises by ensuring that:

a. immediate action is taken to assess and control any risk associated with the serious incident or other incident and the surrounding area so far is reasonably practicable

b. only persons essential to carrying out the action referred to in paragraph (a) remain in the vicinity of the serious incident or other incident

c. the risk to each person engaged by the occupier at the premises to carry out the action referred to in (a) is reduced so far as is reasonably practicable.

This clause does not apply to an emergency service responding to the serious incident or other incident.

The OHS Regulation (clause 174ZP) provides that:

An occupier must ensure that:

- any serious incident or other incident occurring at the premises is investigated and that the investigation, so far as is possible, determines the cause or likely cause of the serious incident or other incident
- a record of the investigation is:
  - made
  - kept for at least five years, or the life of the facility or premises
  - readily available, on request, to WorkCover.

If a serious incident has occurred, the plant involved and an area of the place within four metres must not be disturbed for 36 hours or a period specified by an inspector in an investigation notice (OHS Act section 87).

2.11.2 Setting up a system

The immediate response to an incident should be provided for in the emergency plan. Advice on emergency plans is provided in chapter 14.

A system developed for investigating incidents (including serious incidents) on the premises should include the following:

- procedures for staff to report incidents
- means of recording incidents
- the allocation of responsibility for investigation of incidents to a responsible person
- provision for the investigation of the causes of incidents, and keeping records of these investigations
- follow up action to address the causes of incidents and the introduction of control measures to prevent a recurrence
- reporting arrangements to WorkCover NSW and your workers compensation insurance agent (see details on the WorkCover web site: www.workcover.nsw.gov.au).

The site or plant must not be disturbed for at least 36 hours (unless varied by an inspector's notice) in the event of a serious incident (OHS Act section 87).

2.12 REPORTING INCIDENTS INTERNALLY

2.12.1 Principles

A system for workers to report incidents should be established within the workplace and organisation.

Each incident should be investigated to determine its cause or likely cause. The risk assessment should be reviewed, having regard to the results of the investigation, and risk control measures revised accordingly.

The system for reporting should be:

- prepared in consultation with employees (or their representatives)
- documented so that it is readily understood by people who may be affected
- able to inform supervisors, employees, representatives and other relevant persons of the results of the investigation.

2.12.2 Records of incident investigations

Consider including the following matters when recording a serious incident:

- Were on-site or off-site emergency plans activated?
- Did the leak or spill have the potential to cause fire, explosion or release of toxic or corrosive materials?
- Did the leak or spill have the potential to cause any of the following effects:
  - acute or chronic human health effects?
  - environmental harm?
  - damage to plant or equipment?

- Would the leak or spill affect the quantity or quality of effluent discharged into the sewers?
- Did the leak or spill need to be reported to WorkCover and/or the Department of Environment and Conservation?

2.13 ACCESS AND EGRESS (EMERGENCY EXITS)

Safe access to and egress from premises, or part of the premises including plant, is always required for all persons who may come to the premises or work there (OHS Regulation, clause 174ZF). This may include the need for emergency exits, and provisions for exit from work areas, including storage locations and the inside of bunded areas.

Do not store dangerous goods where they could hinder escape from the building, work area or premises in the event of a leak, spill or fire. Clear access should be readily available to emergency services and for emergency equipment (eg for fire fighting and clean-up of spills).

Ensure access by observing the following:

- keeping internal routes clear at all times
- keeping external routes clear for vehicular access (including emergency vehicles)
- keeping doors and gates unlocked when they may be required as exit points
- having doors and gates opening outwards where appropriate
- providing easy egress from work areas including bunded areas
- keeping areas clear where fire brigade connections are necessary for fire fighting, such as water, foam or gas inlets or outlets.

2.14 SUPERVISION

Supervision is an important way of ensuring workers adhere to the safe working procedures laid down. The OHS Regulation (clause 14) requires that employees be supervised by a competent person.

It is important to observe and consult with employees to find out how the job is actually done. People do not always work "by the book" and may devise their own methods of work. Also, find out what happens during cleaning, maintenance and breakdowns, and during staff absences or shortages. Where a difference is detected between the system of work set out and the way it is implemented, it is important to examine the reason and amend the procedures if necessary to ensure safety.

Supervision is also a way of ensuring that persons who are rendered incapable by drugs or intoxication do not increase risks by working with dangerous goods. All sites should have a drugs and alcohol policy.

Young persons may need close supervision due to their possible immaturity and lack of experience.

2.15 ITEMS YOU DO NOT NEED TO INCLUDE WHEN IMPLEMENTING THIS CODE OF PRACTICE

Some items containing dangerous goods are not covered by this code of practice. In general this includes dangerous goods installed for use in some items of plant where covered by legislation other than the OHS legislation. It also includes some applications of a minor nature.

Examples are:

- fuel in the fuel tank of a vehicle or self-propelled plant
- acid in a lead-acid battery that is in use in an item of plant or a vehicle
- portable medical oxygen cylinders when deployed for use
- air in a tyre
- domestic size fridges and air-conditioning units.

However, work with such items still needs to be evaluated in terms of health and safety. Actions such as refuelling a vehicle or charging a battery have intrinsic risks that need to be assessed, and are covered by the handling aspects of this code of practice.

CHAPTER 3 – IDENTIFYING DANGEROUS GOODS, OBTAINING INFORMATION AND PROVIDING INFORMATION

It is essential that relevant OHS information is obtained and passed on to relevant persons. Key information is in the form of labels on containers, placards on storage areas and material safety data sheets (MSDS). Where there is no such information available – eg goods created and used within the workplace or emissions – then equivalent information needs to be obtained.

3.1 STEPS TO FOLLOW

To identify hazards it is important to identify all the substances and goods that are classified as dangerous goods at the premises and make a list.

Step 1 – Identification of containers of dangerous goods and emissions

The first step is to identify where the dangerous goods are located and the forms they take. Substances and goods can appear in a variety of forms. Look through your premises and include an examination of:

- containers or packages such as cans, bottles or packets
- large tanks
- gas cylinders
- contents of process vessels or vats
- stockpiles
- emissions such as vapours, mists, dusts, fumes, gases
- by products (including stockpiles)
- wastes.

In each case, identify the substances, products or emissions involved.

Look at each job or task separately. As examples, consider:

- handling containers in the storage area
- mixing, diluting and measuring – eg when decanted for use
- use such as spraying – where the substance may become airborne
- handling and loading or unloading vehicles
- the form of storage – eg is it in a tank, packages on pallets, bags?
- using dangerous goods with or in plant – eg process vessels, vats
- generation of dusts or fumes by the work.

Step 2 – Check the classification – are they dangerous goods and/or hazardous substances

Identify which of the substances and goods you use, handle, store or emit are classified as either or both:

- dangerous goods
- hazardous substances.

For substances supplied to your premises, identify the type from:

- labels on packages or signs (eg placards) on bulk containers
- Material Safety Data Sheets (MSDS) you have obtained from the supplier.

Some articles will also be classified as dangerous goods – eg some types of batteries.

It is the duty of the supplier to provide information in the form of correct labels on packages or containers. Dangerous goods have a "diamond" label. If the dangerous goods also have a Subsidiary Risk then there is also a second "diamond" symbol on the label or placard. For help in identifying dangerous goods from the characteristic "diamond" labels consult the WorkCover publication: *Reading Labels and Material Safety Data Sheets*.

Records in the form of stock lists and inventories could be useful, particularly if inventory is marked with the category of hazardous substance or dangerous good at the time of purchase.

The hazards of dusts and other emissions from items not covered by a label should also be considered. When diluted for use, the classification of some goods may change. However, this does not necessarily mean that the hazards or risks have been eliminated – spraying a dilute solution may still cause hazards. For example, acids that are dangerous goods of Class 8 may no longer be classified as dangerous goods when very dilute, but may be classified as hazardous substances due to the potential to damage skin.

Step 3 – Make a list

Having identified the dangerous goods (and hazardous substances), then write these down in a list. This will help to form a register in step 4. The register is the list (inventory) plus the relevant MSDS (for substance supplied). For further details see section 3.5.

Include any additional dangerous goods or hazardous substances created on the premises, such as dusts and fumes, on the register (even if these goods or substances are not manufactured with the intent of them leaving the premises).

Step 4 – Obtain MSDS or equivalent information

It is the duty of the supplier to provide you with information in the form of a Material Safety Data Sheet (MSDS) for each type of dangerous goods or hazardous substance supplied for use at work. MSDS for any new dangerous goods or hazardous substances supplied to you in the future will also need to be placed in the Register when you obtain them.

Retailers of consumer packages are not obliged to provide MSDS – however MSDS may be available from the manufacturer or importer for the dangerous goods obtained through retail outlets.

Step 5 – Obtain health and safety information

Step 5 is a review of the information on the label, MSDS or from other sources (such as the supplier of plant). For each chemical, goods or substance find out:

- the type of hazard
- recommended control measures
- any relevant control conditions necessary to maintain stability
- any risks arising from incompatibility with other goods.

The type and degree of the hazard is indicated on the label and in the MSDS for substances supplied to your premises. If the substance is an emission, by-product or waste then you will need to classify it, using the appropriate criteria.

You may also need information on any control conditions specified in the MSDS, which should include information and specifications such as temperatures and proportions and limits for every ingredient that stabilizes the dangerous goods. These include: phlegmatizers; diluents; solvents; wetting agents; stabilizers; and inhibitors.

3.2 PLANT USED WITH DANGEROUS GOODS

If the dangerous goods are to be used with plant, check the plant manufacturer's instructions provided by the supplier of the item of plant. If the plant is leased, the hirer or lessor also has obligations – see division 3 of chapter 5 of the OHS Regulation. Occupiers should not vary the type of goods used with the plant without an assessment by a competent person.

Suppliers of plant must provide you with the following information relating to safe use (OHS Regulation, Clause 105):

a. the purpose for which the plant was designed

b. testing or inspection to be carried out

c. knowledge, training or skill necessary for persons undertaking testing and inspection of the plant

d. commissioning and use (see details below)

e. systems of work necessary for the safe use of the plant

f. emergency procedures

g. any documents relating to testing and inspection.

The information to be provided in item (d) above (commissioning and use) includes all of the following:

- installation
- commissioning
- operation
- maintenance
- inspection
- cleaning
- transport
- storage
- dismantling of the plant, if the plant is capable of being dismantled.

Further advice on specific aspects is provided in chapters 9, 10 and 11 on control measures.

3.3 PROVIDING INFORMATION TO WORKERS

3.3.1 Legal requirement

Information must be provided to workers in the form of the following:

- labels on containers, including those when substances are decanted into another container
- ready access to relevant MSDS
- placards on bulk storage locations
- other signs where relevant.

For non-workplaces, this obligation for dangerous goods falls on the occupier (ie the controller of the premises). The labelling and MSDS obligations are in clauses 162, 163, 174ZH and 174ZI of the OHS Regulation. Placards are required by clauses 174ZJ to ZM of the OHS Regulation and are explained in chapter 15.

3.3.2 Labelling goods within workplaces and other premises

Labelling is a key element of establishing a safe method of work. The objective is to allow substances to be used safely and without risks to health.

The identification of all dangerous goods and hazardous substances being handled or stored is the first step in hazard identification for the risk assessment (see chapters 6 and 7), and an opportunity to ensure all are properly labelled.

All containers of dangerous goods or hazardous substances supplied to, used in, or handled on the premises must be appropriately labelled. This includes wastes. The employer must ensure that the label is not removed, defaced or altered.

As a minimum, the OHS Regulation specifies that the label clearly identifies the substance and provides basic health and safety information including the relevant risk and safety phrases. This should be in accordance with the ADG Code, with the exception of C1 combustible liquids and Goods Too Dangerous To Be Transported.

Guidance for the labelling of packages (containers of a size less than bulk) is provided in the national *Code of practice for the labelling of workplace substances* (see this on the web site – www.nohsc.gov.au). Normally the containers supplied to the premises will be correctly labelled and additional labelling will not be necessary. However, substances transferred to another container and substances produced and used within the premises must be labelled – see advice in 3.3.3 below.

Consumer products used occasionally in the workplace should not require additional labelling, if they are labelled according to the SUSDP (*Standard for the Uniform Scheduling of Drugs and Poisons*) by the supplier (in addition to the dangerous goods label). However, if consumer products are frequently used then the employer should examine the need for additional OHS information.

Labelling (called placarding) of bulk containers is covered in chapter 15.

3.3.3 Labelling of containers and of transferred substances

Where a substance is transferred to another container (eg decanted), the type of labelling required will depend on whether the substance is consumed immediately or over a longer period of time, and on the size of the container. Even when no labelling or minimal labelling is required, it is important to consider ways of ensuring that workers cannot make mistakes by mis-identifying substances.

The time periods to consider are:

- a container into which a dangerous goods is transferred for immediate use need not be labelled, providing it is cleaned immediately after it has been emptied (see 3.3.4).
- a container into which a dangerous goods is transferred for use within the next 12 hours needs only to be labelled with the product name and any relevant risk and safety phrases. A symbol in the form of the relevant dangerous goods "diamond" can serve as a risk phrase.
- where not consumed immediately or within the next 12 hours, the container into which the dangerous goods is transferred must be labelled to clearly identify the dangerous goods and carries basic health and safety information about the substance, including any relevant risk and safety phrases.
- where labelling is required but the container into which the substance is transferred is very small (eg a laboratory test tube), a practical method for labelling should be established. For example, the label may be attached to supporting apparatus, such as a test tube rack. Alternatively, a tag may be used to provide the information. A fixed or moveable sign could be placed adjacent to the work area. This could include a key or code to indicate the contents of the small container.

3.3.4 Cleaning

The objective of cleaning is to ensure that there is no residue that could still present a risk to health or safety. The container must be free from dangerous goods, which means if the container immediately before it was empty held:

- a gas or volatile liquid – the concentration of gas or vapour in the atmosphere of the container is now less than the concentration listed in the *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* [NOHSC: 1003]
- dangerous goods of Class 2.1, Class 3, or Subsidiary Risk 2.1 or 3 – the concentration of those goods or their vapours in the atmosphere of the container is now less than 5 per cent of the LEL for the goods when sampled at ambient temperature
- a non-volatile liquid or solid – the container has been thoroughly cleaned.

LEL means the lower explosive limit, which means the concentration of flammable gas or vapour in air below which the gas atmosphere is not explosive.

For gases of Class 2.2 in cylinders, when at atmospheric pressure the container can be regarded as "free from dangerous goods" since any risk is minimal.

The risk of a flammable atmosphere inside the container should be determined. Methods of cleaning include chemical neutralisation, curing or deactivation to the extent necessary to ensure there is no risk to health or safety.

The National *Code of practice for the labelling of workplace substances (hazardous substances and dangerous goods)* provides further detailed guidance on how to do this labelling. The risk and safety phrases are provided in the *List of Designated Hazardous Substances* and the *Approved Criteria Classifying Hazardous Substances.* The dangerous goods "diamond" labels also count as risk phrases (ie you can have a symbol instead of a word).

When diluted, some substances will no longer be classified as hazardous or dangerous. However, labelling should still be maintained in case of hazards that may arise during the use of the substance. For example, if a spray is released, exposure standards could be exceeded and/or a flammable atmosphere created.

3.3.5 Unlabelled containers

If a container does not have a label or is improperly labelled, action should be taken to correctly label the container as outlined above.

If the contents of the container are not known, this should be clearly marked on the container, for example, 'Caution do not use: unknown substance'. Such a container should be stored in isolation until its contents can be identified and properly labelled if dangerous or hazardous. If the contents cannot be identified, they should be disposed of in an acceptable manner in consultation with the relevant waste management authority.

If an employee finds a container that does not have a proper label, the employer should be advised immediately.

3.4 MATERIAL SAFETY DATA SHEETS (MSDS)

MSDS are a key source of information and are important for the task of risk assessment.

3.4.1 Worker access to MSDS

At each premises, workers (including employees) must have ready access to copies of MSDS for the dangerous goods and hazardous substances used. Practical ways of making MSDS accessible should be discussed in consultation with employees (see chapter 2, section 2.2.2). The OHS Regulation (Clause 162(1)(b)) requires that copies of MSDS must be readily accessible to employees who are required to use or handle the hazardous substance or dangerous goods. Employees who are supervising others working with the hazardous substance or dangerous goods should also have ready access to MSDS.

Access to MSDS may be provided in a number of ways including:

- paper copy collections of MSDS
- microfiche copy collections of MSDS with microfiche readers open to use by all employees
- computerised MSDS databases (eg cd rom or on line).

In each case, the employer should ensure that:

- the current MSDS are available
- any storage or retrieval equipment is kept in good working order
- employees are trained in how to access the information
- where information is displayed on a screen, there are means of obtaining a paper copy of that information.

For dangerous goods at non-workplaces, these obligations extend to the occupier of the premises.

3.4.2 Alteration of MSDS

An MSDS obtained from a supplier must not be altered, except where the MSDS is provided from overseas and does not provide adequate information. If an employer wishes to add additional information to the supplier's MSDS, it should be appended to the MSDS. However, it should be clearly marked to indicate that the appended information is not part of the original MSDS. Specific workplace information may be added in this manner and is not considered to be an alteration to the MSDS.

3.4.3 MSDS requirements in laboratories and pharmacies

MSDS must be provided by suppliers of laboratory reagents and pharmaceuticals. MSDS are not required for subsequent preparations, laboratory samples or reaction intermediates, or for retail pharmacies (see 3.4.4 below).

MSDS are required where a laboratory or pharmacy manufactures a dangerous good or a hazardous substance and supplies this for use at work (eg in a hospital).

3.4.4 Retailers and retail warehouse operators

Retailers and retail warehouse operators are exempt from the requirement to hold MSDS outlined above, for goods intended for retail sale. The exemption applies to consumer packages held on their premises, which hold less than 30 kilograms or 30 litres and which are handled in an unopened state.

Retailers are also exempt for dangerous goods supplied:

- in a container provided by the purchaser (eg a jerry can for dispensed kerosene or a propane when refilling a portable gas cylinder)
- fuel for a vehicle.

However, if the container is opened (for example for repacking) then an MSDS must be obtained and made available to employees and other workers.

3.4.5 Transit

MSDS are not required for dangerous goods in transit. The *Emergency Procedure Guide* provides sufficient information.

3.5 REGISTERS OF SUBSTANCES AT THE PREMISES

3.5.1 Requirement

Employers must keep a register providing a listing of all dangerous goods and hazardous substances that are used or produced in the premises – see step 3 in section 3.1 (OHS Regulation, clauses 167 and 174ZW). The register is useful as a source of information and as a management tool. This is not the same as the manifest (see chapter 16), although in some situations the manifest could be used to perform the same role. A register or manifest is not required for dangerous goods in transit since the shipping documents are sufficient for this function.

On construction sites (where the value of the work is over $250,000, or where a demolition or asbestos removal licence is required), the principal contractor must keep a register of all dangerous goods and hazardous substances on the site (OHS Regulation, clause 228). Sub-contractors on construction sites must provide the principal contractor with relevant information held by each sub-contractor. The Principal contractor must also keep records of risk assessments.

3.5.2 Minimum information needed in a register

The Regulation requires that the minimum information that must be included in a register is a list of all dangerous goods present, together with the MSDS for all dangerous goods for which an MSDS is required under the Regulation (ie the supplied substances and goods). The same document may also contain a list of hazardous substances together with the MSDS for all hazardous substances that have been supplied.

Include all substances, even those such as emissions and dusts generated, since the risks arising from these must be assessed.

The completion of simple and obvious assessments should also be noted in the register (see advice on small quantities in chapter 4 and retail in chapter 5 of this code of practice).

3.5.3 Keeping the register up to date

The register must contain entries for all dangerous goods (and hazardous substances) currently used or produced in the premises. Make sure that the current MSDS is also in the register. MSDS expire after five years, so check that they are up to date.

The register should be updated as new dangerous goods or hazardous substances are introduced to the premises and the use or production of existing dangerous goods is discontinued.

3.5.4 Access to the register

Employers must ensure that employees who handle or store dangerous goods have ready access to the Register (OHS Regulation clause 174ZW(3)). Those employees who could be exposed to a hazardous substance must also have access to the Register (OHS Regulation clauses 167(3)).

Employee representatives and relevant public authorities should also have ready access. Practical ways of doing this should be discussed in consultation with employees. The register can either be located centrally or kept in the premises to which it pertains. It may be in electronic form, but this must be accessible to relevant employees. For example, screen based equipment must be accessible or paper printouts made available.

3.5.5 Retailers and retail warehouse operators

Retailers and retail warehouse operators are exempt from the register and MSDS provisions of the Regulation for goods in consumer packages intended for retail sale (OHS Regulation, sub-clauses 174M and 167(4)). The exemption applies to consumer packages held on their premises, which hold and which are handled in an unopened state, or a container provided by the purchaser of less than 30 kilograms or 30 litres.

3.5.6 Transit

A register is not required for dangerous goods in transit. The shipping documents provide sufficient information.

3.6 IDENTIFICATION OF DANGEROUS GOODS AND HAZARDOUS SUBSTANCES IN VESSELS AND IN ENCLOSED SYSTEMS

Hazardous substances and dangerous goods in a workplace contained in an enclosed system, such as a pipe or piping system, or a process or reactor vessel, must be identified to persons who may be exposed to the contents (OHS Regulation, clauses 173 and 174H(4)). Bulk storages or processes containing dangerous goods must be signed and placarded – see chapter 15. Pipes containing dangerous goods should be identified and distinguished.

Suitable means of identification include colour coding in accordance with Australian Standard AS 1319 *Safety Signs for the Occupational Environment,* or Australian Standard AS 1345 *Identification of the Contents of Piping, Conduits and Ducts*. Identification such as this should be used in conjunction with suitable work practices such as permit to work systems.

Where the contents of a reaction vessel undergo chemical changes during the manufacturing process it is not possible to accurately label or placard the vessel. In such cases a system for providing relevant information should be established. This could be in the form of batch sheets or written instructions. These should outline the feedstock ingredients and any information regarding the reaction intermediates that arise, in order to provide information about the hazards and risks that may arise during the process.

When process vessels are used as bulk storage vessels and contain dangerous goods, they must be placarded to indicate the hazards arising from the contents.

In addition, vessels used in electroplating must be labelled with the name of the substance in the vessel, even if the substance is not a dangerous good or hazardous substance (OHS Regulation, Clause 193).

3.7 ADDITIONAL INFORMATION ABOUT DANGEROUS GOODS OR HAZARDOUS SUBSTANCES AND ASSOCIATED PLANT AND EQUIPMENT

Employers should make other relevant information available to employees and employee OHS representatives. This will be necessary for dangerous goods or hazardous substances produced in the workplace for which a MSDS is not required. Information should be obtained about health effects, precautions for use and safe handling.

Employers should also provide relevant information to employees and employee OHS representatives on plant and equipment used with a dangerous good or hazardous substance, such as exhaust ventilation systems. The employer should make available information about the use for which the equipment is designed and the conditions necessary for its safe use. Health and safety information provided by the supplier of plant must be passed on to employees.

3.8 NICNAS SUMMARY REPORTS

Where they have been produced and are applicable, summary reports produced under the *Industrial Chemicals (Notification and Assessment) Act 1989* (Cwlth) should be made available on request to employees and employee representatives. Suppliers must provide these reports (OHS Regulation, Clause 157).

Note: The reports produced under this program are for chemicals developed since 1989 or for what are known as "priority existing chemicals". For other chemicals they will not be available.

3.9 ENCLOSED AND CONFINED SPACES, UNSAFE ATMOSPHERE

Any area where there is a risk of exposure to atmospheric contaminants or an unsafe level of oxygen must be isolated and appropriate warning signs must be provided (OHS Regulation, Clause 54). Confined spaces must be identified and entry of unauthorised persons prevented (Clause 75).

Many dangerous goods are hazardous substances and have personal exposure standards that must not be exceeded (OHS Regulation, Clause 51). For further advice see the *Code of practice for the control of workplace hazardous substances*, and the NOHSC Standard: *Adopted Exposure Standards for Atmospheric Contaminants in the Occupational Environment*.

3.10 INFORMATION AVAILABLE TO THE PUBLIC

Providing information, eg in signs, to members of the public is an important control measure and mandatory in some situations.

Where there is a risk to a visitor (eg a customer), or where the presence of a visitor may increase risk, visitors should be informed about:

- the hazards to which they may be exposed while on the premises
- appropriate safety measures to be applied while on the premises
- actions to take in any emergency, such as when the emergency procedure or plan is activated while they are on the premises.

The need for a formal system of providing safety information will depend on factors such as:

- the nature and severity of the hazards and risks
- the degree of access to areas of risk
- the extent of supervision that will be provided.

Methods of providing safety information to visitors or customers, at relevant parts of the premises, may include:

- appropriately placed signs
- giving verbal instructions
- providing written information such as a safety card
- showing a video.

MSDS are not required for retail sales – see section 3.5.5.

An alternative control measure is to prevent the public accessing areas of risk (see security in section 2.10).

3.11 GOODS TOO DANGEROUS TO BE TRANSPORTED

Goods too dangerous to be transported are not classified and assigned Class numbers, etc, under the ADG Code. They are listed in Appendix 5 of the ADG Code. Since they cannot be transported they cannot be supplied. They include very self-reactive substances including some organic peroxides, explosives and explosive related material.

More common substances in this category include aluminium dross when wet or hot; charcoal when wet; and coal briquettes or coke when hot. When stored or handled in open atmosphere, they do not normally show the properties of goods too dangerous to be transported.

When mixed with stabilizers or diluents some of the substances in this category are classified in either the ADG code or the Explosives Code, and may be transported under suitable conditions. However, if the goods have lost the stabilizer or diluent they may become goods too dangerous to be transported.

3.12 PROVIDING INFORMATION TO OTHER WORKPLACES

If you supply dangerous goods or hazardous substances to other workplaces then you must provide information in the form of labels and MSDS. A summary of advice on supplier duties is provided in the WorkCover Guide: *Suppliers of chemicals and substances to workplaces: Guide to the legal obligations of suppliers including the supply of hazardous substances and dangerous goods* (catalogue WC00453). Dangerous goods must be supplied in packages or containers meeting the requirements of the relevant transport code.

Suppliers of plant used with dangerous goods must pass on information relating to safe use.

Retailers are exempt from the requirement to pass on MSDS for consumer packages. However, this exemption does not apply to trade sales (ie sales where the goods are clearly intended for use at work).

CHAPTER 4 – STORAGE AND HANDLING OF SMALL QUANTITIES

This chapter applies to premises, and areas of premises, where relatively small quantities of dangerous goods are stored and handled. The term "handling" includes all aspects of use.

As an alternative, the "minor storage" conditions of the Australian Standard relevant to the Class or Classes of dangerous goods stored or handled can be used as guidance. Those listed in section 1.7 have equivalent status as an approved industry code of practice.

4.1 QUANTITIES TO WHICH THIS CHAPTER APPLIES

This chapter covers the handling and storage of dangerous goods on the premises:

- in packages in aggregate quantities below the "placarding quantity" (see Appendix 2)
- to "manufactured product" in packages under the quantities shown in section 4.15
- not in "bulk".

If only relatively small quantities of dangerous goods are stored or handled on the premises, this chapter will help simplify the task of assessing risks and determining controls. Essentially, having a relatively small quantity is a key control measure reducing risk. However, this principle does not necessarily apply to personal exposure risks or risks resulting from emissions.

Employers should consult with employees about implementing the recommended control measures.

Advice on the storage of less than one tonne of agricultural chemicals on farms and other agricultural premises is provided in the *Code of practice for the safe use and storage of chemicals (including pesticides and herbicides) in agriculture*.

Advice for users of pesticides on storing and handling small quantities is provided in the *Code of practice for the safe use of pesticides including herbicides in non-agricultural workplaces*.

4.2 STEPS TO TAKE

Storage of dangerous goods should be in a designated area, location or cabinet within the premises. In some cases, dispersal of goods around the premises could reduce the fire load.

Step 1 – Prepare a list of all the dangerous goods in each storage area that includes for each of the dangerous goods:

- the name
- the Class, Subsidiary Risk and Packing Group
- a summary of the hazards identified in the MSDS.

This could be based on the register you are required to keep (see section 3.5).

Step 2 – Assess risks by reviewing the MSDS for each of the dangerous goods for information on the following risks (based on Class and/or Subsidiary risk):

- fire and explosion risks of flammable gases (Class or Subsidiary Risk 2.1) or liquids (Class or Subsidiary Risk 3), flammable or combustible solids (Class or Subsidiary Risk 4) or combustible liquids (C1)
- fire risks of oxidizing agents (Class or Subsidiary Risk 5)
- toxic risks (Class or Subsidiary Risk 2.3 or 6)
- corrosive risks (Class or Subsidiary Risk 8).

If you have flammable goods, identify any potential ignition sources – see section 4.7.

Step 3 – To control risk, implement the following measures:

- minimise quantities kept at any one time
- substitute the dangerous goods with other goods of a lower risk
- follow the MSDS and label instructions on handling and storage
- ensure the plant you are using is suitable for the purpose (eg examine the plant manufacturer's instructions or information provided on plant safety)
- train workers to follow the procedures in this chapter
- observe the recommendations in this chapter.

Step 4 – Document your control measures – this could be a notation on the register or on the MSDS.

4.3 STORAGE AND HANDLING OF PACKAGES

A package is any type of container of a size or capacity less than bulk. Often goods used, handled or stored are in the packages delivered following transport and delivery to the premises and so meet the ADG Code requirements.

Observe the following control measures:

- keep packages closed when not in immediate use
- store on surfaces resistant to attack by spilt contents (eg if storing acid, the shelving should be acid resistant)
- stow packages in a manner that minimises the risk of falling or being dislodged
- ensure that leakages from packages cannot adversely affect other dangerous goods or other substances in the storage area. Liquid dangerous goods should not be stored above solid dangerous goods that are in paper or absorbent packaging. Store glass containers at lower levels to minimise the risk of breakages
- ensure any special control conditions are observed to ensure stability (eg maintain stabilizers or refrigeration, keep packages dry)
- where an aggregate volume of 100 L or more (or 50 kg or more) of aerosols or other types of small disposable cylinders are stored together, enclose the storage area (for example with mesh) to reduce the risk of projectiles in the event of a fire
- contain or repackage any leaking package.

4.4 TRANSFER OF DANGEROUS GOODS FOR USE

Where dangerous goods are transferred, for example by pumping, decanting or dispensing to fill other containers or moved from place to place, reduce the risks from spills and other risks by observing the following:

- The place where the transfer is carried out should be: set aside for the purpose; not within the storage area but adjacent to it; free of obstructions with sufficient room to allow the transfer to be carried out and to hold the containers and associated equipment.
- Provide spill containment with the capacity to hold the contents of the largest container.
- The transfer should be done in a manner that minimises the generation of any vapours or dusts, and avoids splashing or spillage.
- If flammable vapours or dust may escape, ensure no ignition sources are nearby. If generation of static electricity is possible, provide electrical bonding for containers and transfer equipment. Avoid the use of non-conducting plastic or rubber funnels or hoses.
- Keep equipment for clean up and any necessary decontamination materials close by.
- The intended container should be suitable – eg it cannot be damaged by the dangerous goods. Some plastics containers are unsuitable because they can be softened or made brittle by the dangerous goods. Vapour pressure is an important issue, especially for plastics drums.
- The container may need to be labelled – see section 3.3.3 in chapter 3.
- If flammable goods are transferred or used, the area should be free of combustible waste.
- Consider fire risks from other storage areas of combustible materials – such as packaging, wood, plastics or pallets.
- Keep packages closed when not in use.
- Do not use plastic taps on containers for transferring flammable liquids since they can melt in a fire. Self-closing metal taps or hand-operated dispensing pumps are preferable.
- Dispensing equipment should be suitable for the task.
- Plastics containers should not be used for flammable liquids unless of an approved type and suitable. Use of plastics should be limited since plastics containers can melt in a fire and increase risks.

Transfer of liquids by gas or air pressure should be avoided where reasonably practicable. If unavoidable, prevent over pressure of any component by suitable pressure control. It should be impossible to detach any component or the container while under pressure.

4.5 SEGREGATION

Dangerous goods that are incompatible with other substances (including dangerous goods) should be segregated to prevent risks arising from contact or mixing. Segregation may be achieved by use of an impervious barrier or a suitable distance to prevent contamination – 1.5 m should be sufficient for solids or liquids, or 3 m for gases in most cases. This will depend on the height of the storage and the nature of the goods (a barrier may not be sufficient for gases). The barrier should be sufficiently high and extend far enough to prevent any leakage or spillage reaching the other goods.

MSDS give advice on compatibility. A compatibility chart is provided in Appendix 8. However, some substances within the same Class may be incompatible, for example acids (Class 8) have a reaction hazard with alkali (Class 8).

Other examples of compatibility risks are:

- Class 5.1 oxidizing agents with Class 3 flammable liquids, combustible liquids or Class 4.1 flammable solids have a fire and explosion hazard
- cyanide salts react with acids to produce a toxic gas
- different types of solid pool chlorine, eg calcium hypochlorite and isocyanurate products have a reaction and area fire hazard.

Segregation from food, food packaging and personal hygiene products is essential in order to avoid contamination.

4.6 SEPARATION

Dangerous goods should be kept separate from people or property at or beyond the boundaries of the premises, either by distance or a barrier. Barriers need to be impervious to the dangerous goods and prevent travel over the barrier or around the ends. If flammable goods are stored, the barrier needs to have a suitable level of fire resistance (fire rating).

4.7 SOURCES OF HEAT OR IGNITION

Typical ignition sources include the following:

- electrical equipment, including: power points, switches, electric motors, battery chargers, transformers, fuse boards, fans, air conditioners, fridges and other equipment with thermostats, computers, and telephones unless they have appropriate explosion protection
- direct fired heaters (and pilot flames) – eg running on gas, liquid or solid fuel
- naked flames or fires (matches, blow torches, barbecues, radiant gas heaters, incinerators)
- sparks from grinders
- heat or flame from welding
- ignition system and electrical components of machines including internal combustion engines such as lawn mowers, pumps and generators
- hot surfaces such as heaters, exhausts and soot particle emissions.

External lights above 3 m from ground level are not usually a risk.

Include maintenance operations in your consideration of possible risks from ignition sources.

Keep ignition sources away from flammable or combustible dangerous goods (ie goods of Class or Subsidiary risk of 2.1, 3, 4, or C1). Naked flames should be kept at least 5 m from any such goods. Store dangerous goods away from sources of heat (eg heating appliances), since this may increase vapour pressure or deteriorate packaging. For flammable or combustible goods, heat can increase the risks. If flammable or combustible liquids are heated, the auto-ignition temperature should be considered in order to avoid spontaneous combustion.

If the dangerous goods can generate flammable or explosive atmospheres, any electrical equipment used (eg stirrers) should have appropriate explosion protection (eg rated as intrinsically safe or flameproof).

4.8 SPILL CONTROL AND CLEAN-UP

Identify and prevent any potential flow of spilt or escaping solid or liquid dangerous goods to other parts of the premises that could create a risk, or go beyond the boundaries of the premises. Possible means include bunding, or the provision of channels and utilising the slope of the land. Containment should have sufficient capacity to contain any potential spillage – at least the capacity of the largest container kept.

Keep equipment and materials for clean up at the premises to deal with spills or leaks, including absorbent material, neutralising or decontaminating material.

Any spills or leaks should be cleaned up immediately. Contaminated or spilt dangerous goods should not be returned to their original packaging, except for the purposes of disposal or where this will not increase the risk.

Waste generated during clean up needs to be: handled, stored, labelled, and disposed of in a safe manner in accordance with this code and environmental legislation.

4.9 VENTILATION

Provide the storage area with adequate natural or mechanical ventilation sufficient to prevent the generation of a flammable or harmful atmosphere. The use of unventilated shipping containers as permanent storage is not appropriate. The storage area for gas cylinders needs ventilation, even though valves are kept closed, as a precaution against leaking valves.

The level and type of ventilation necessary depends on the nature of the goods and how they are being stored or used. Ventilation is not necessary where an assessment of the risks indicates that the likelihood of the generation of a flammable or harmful atmosphere in the storage or work area is negligible (eg it is always open to the outside air). With gases, asphyxiation due to the displacement of oxygen is a risk – see section 4.14 for advice on storing gas cylinders.

If you intend to rely on natural ventilation, to ensure that airflow will be sufficient to maintain a safe atmosphere, vents should meet the following criteria:

- Vents should be positioned near floor level and near ceiling level. Most dangerous gases and vapours are denser than air and will vent through the floor level vents, with the high level vents allowing fresh air to circulate.
- The ventilation should be directly to the outside and not into another room.
- The minimum vent area (including the spacing of vents) needs to ensure effective airflow. Allow at least 1 square metre of vent area for each 50 square metres of floor area.
- Ensure vents are not obstructed, either inside or outside the store, by packages or other material (eg provide guards).

4.10 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Ensure suitable personal protective equipment (PPE) is used when people handle dangerous goods (use the MSDS as a guide). Maintenance and cleaning of PPE is necessary. PPE must be provided by the employer and replaced when necessary.

See section 8.10 for further advice on selection of PPE.

4.11 FIRE PREVENTION AND PROTECTION

Keep storage and handling areas free of combustible material, waste and refuse. In the case of storage or work outdoors, the surrounding area should be free of combustible vegetation for a distance of at least 3 metres.

A supply of water should be readily available for emergency use to fight fires where necessary.

A portable fire extinguisher should be provided, appropriate to the type and quantity of dangerous goods, near the place where the dangerous goods are being stored or handled. This is in addition to normal building fire protection required by the Building Code of Australia.

4.12 DECOMMISSIONING

Ensure that any container or plant that has been used to store or handle dangerous goods, and that is no longer required for that purpose, is cleaned free of dangerous goods or otherwise made safe.

4.13 USE AND TRANSPORT OF SMALL GAS CYLINDERS

Small gas cylinders are widely used and often carried in vehicles such as vans to work sites. The greatest risks involve flammable gases, but risks can also arise with other types of gas.

4.13.1 Small gas cylinders defined

"Small" in this sub-section generally means a cylinder or receptacle of less than 25 Litres internal water capacity. Examples are:

- barbecue, heating and camping cylinders (eg 4.5 and 9 kg of LP Gas), sometimes used with torches (eg for vinyl laying)
- other cylinders for trade use (eg from 0.34 kg up to E size acetylene and oxygen cylinders, which have a water capacity of 23 L) often used with detachable fittings such as torches
- cartridges and aerosols designed for use with attached equipment (which can be very small, such as 170 g or 306 mL).

4.13.2 Hazards of gas cylinders in enclosed spaces such as vehicles

Explosions and fires have occurred when flammable gas has leaked from cylinders and has ignited inside enclosed areas or vehicles. The build up of gas in an enclosed space can reach an explosive mixture with the oxygen in the air.

Leaks may occur from the main valve, connections, from equipment used with the cylinder (eg a torch) or from a relief valve following normal expansion of liquid gas due to changes in temperature.

Gases that are denser than air (ie heavier) can easily accumulate inside a vehicle, especially when the windows are wound up.

Risks arise in enclosed spaces for the following reasons:

- Since all gases in cylinders are under pressure, any damage to the cylinder may result in injury from a sudden discharge of gas, or from fragments of metal if the cylinder disintegrates.
- Gas leaks may also cause asphyxiation if oxygen in the air is displaced. Be aware that the early effects are drowsiness and tiredness, which may cause you to have a driving accident. This could occur even with small amounts of some gas, such as cryogenic gas or "dry ice".
- Toxic (poisonous) gases (Class 2.3) (such as pesticides or ammonia) can cause health risks.
- Leaks from oxygen cylinders may support a fire or an explosion in enclosed spaces such as inside a vehicle.

4.13.3 Transport precautions – provide ventilation

A number of serious accidents have occurred when cylinders and associated equipment have been transported or kept inside cars or vans.

Possible ignition sources inside a vehicle include the electrical system such as electric motors for wipers and aerials, the engine ignition system, remote locking, cigarette lighters, radio cassettes and CD players. Matches and butane lighters can also be ignition sources. Explosions can occur when activating the remote locking system from outside the vehicle, particularly when the cylinder has been kept inside the vehicle for some time, such as overnight.

Cylinders of flammable gas, such as LP Gas (LPG or propane) or acetylene, should never be left in the boot of a car, or in an unventilated van (unless a suitable vented compartment is used, see 4.13.4). If transported in the passenger compartment of a car, the car windows should be kept open to provide cross flow and through flow ventilation.

Cylinders should be restrained to prevent movement, and kept upright if containing a flammable gas, except if other factors such as the restraint method, small size or design allow the cylinder to be horizontal (eg those for forklifts or permanent gases). The restraint should be strong enough to prevent the cylinder moving in the event of a vehicle collision. Cylinders should be unloaded immediately on arrival at the destination (unless a purpose built ventilated compartment or cabinet is used inside the vehicle).

Vehicles, such as vans, should not be used for the permanent storage of cylinders, unless suitable ventilation is always provided. Tradespeople who regularly use a variety of gases and associated equipment, should install and use a purpose built compartment or cabinet. Such a compartment will allow any leaking gas to be released out of the vehicle (see advice in 4.13.4 below), reducing risks.

An open vehicle such as a utility provides the best ventilation and avoids the risks of gas accumulation. However, the gas cylinder must be secured from theft and movement during transport. A closed toolbox is not suitable if gas can accumulate inside it. A compartment with its own door opening from the outside, mounted along or under the vehicle's tray is suitable, providing the cylinder remains correctly positioned (upright or appropriately positioned, see above).

Note that carrying a cylinder by mounting it on the vehicle body (external to the profile) is not a solution, due to the need to protect the cylinder and valve from collision damage.

If the vehicle carrying the cylinder is parked in an enclosed garage, the garage may not provide adequate ventilation of leaking gas.

4.13.4 Compartments (cabinets) suitable for use in vehicles

Various designs of storage compartments are available for use in vehicles. A key feature is ventilating any escaping gas to outside the vehicle and away from any potential ignition source, such as ducting pipework. It is important to ensure that any venting is not obstructed and any piping used for drainage or ventilation remains intact and is not damaged during use. The cylinders must be secured upright. The method of restraint (of both the cylinder and the cabinet itself) must be capable of securing the cylinder in the event of a vehicle accident (that is, it must be able to resist sudden deceleration). If access to the compartment is from inside the vehicle, the door to the compartment must provide a gas tight seal.

4.13.5 Using the gas

When assembling or attaching equipment to be used with the gas, make sure all connections are gas tight. For example, check that all seals are clean and in good order. You can check for leaks from connections and valves by brushing on soapy water and looking for bubbles.

Some of these portable appliances and heaters (such as patio heaters) are designed only for outdoor use and should not be used indoors due to gas emissions.

4.13.6 Returning cylinders to the vehicle, refilling or exchange

Close the main cylinder valve (if it has one) and deactivate the pressure regulator (if fitted). Disconnect any equipment, appliance or attachments from the cylinder or cartridge. Some designs rely on the removal of the attachments to close the main valve. Do not rely on the valves on torches or other equipment to prevent the leak of gas.

You should have a supply of spare seals, so you can renew the seal when re-connecting attachments next time you use the gas.

Check for leaks from valves and connections by applying soapy water and looking for bubbles. Check areas such as valve openings, screw threads (including where the valve attaches to the cylinder body) and bleeder valves. Smell alone is not a reliable test (even though LP Gas is odorized). Replace any removable valve protection cap, valve outlet cap or plug, and keep this in place on the cylinder at all times when the cylinder is not in use or being filled.

Similar care is also needed when returning the "empty" cylinder to the gas supplier such as a service station for refilling or exchange. Do not leave valves open on empty cylinders – contamination by oxygen entering the cylinder can create additional risks.

Every time you obtain gas, the supplier should test each cylinder for leaks following filling. You should ask for this to be done if you have not observed the testing.

4.14 STORAGE AND USE OF GAS CYLINDERS

Gas cylinders require periodic testing – at least every 10 years for dry gases and more frequently for damp or corrosive gases – check with the gas supplier if you need advice. The last test date is stamped on the cylinder near the valve, on the "collar", or on the footring of some small cylinders (eg LP Gas cylinders). If outside the "test period", it must not be refilled before it is re-tested (and receives a new date stamp). However, it is permissible to use up the cylinder's contents after its test period has expired, prior to testing. Alternatively it could be replaced with a new cylinder. Testing stations can give advice on disposal of a used cylinder if you wish to replace it. Owners of cylinders should keep records of testing and test dates.

4.14.1 Storing gas cylinders

The following precautions should be observed when storing gas cylinders:

- Ensure the storage area is well ventilated. Gas cylinders should not be stored in an unventilated enclosed space. For example, an unventilated garage or shed is not suitable. Cylinders connected to portable gas equipment such as outdoor heaters (eg patio heaters) or mobile barbecues should not be stored inside a building, unless adequate ventilation is assured. Where possible keep gas cylinders outdoors.
- Do not keep cylinders of flammable gas near an ignition source.
- Keep main valves closed when the cylinder is not in use or connected for use. This is in addition to turning off the valve on any pressure regulator used with the cylinder. Replace any removable valve protection cap, valve outlet cap or plug, and keep this in place on the cylinder at all times when the cylinder is not in use.
- For cylinders containing liquefied gas, keep the cylinder in a position so that the pressure-relief valve is in contact with the vapour (not the liquid) inside the cylinder. Usually this means keeping the cylinder upright.
- Protect the cylinder from falling, damage and excessive temperature rise.
- Do not allow combustible material or waste to accumulate in or around areas where the cylinder is kept.
- Do not store the cylinder in a location that could jeopardise the escape of people from the building in the event of a fire (eg keep the cylinder away from doors and passages).
- If an oxidizing gas is stored (eg oxygen), keep at least three metres away from a flammable gas cylinder (unless part of a set).

Consider the use of piped gas as a control measure to avoid the need to move and store gas cylinders, if the gas is used in a fixed location.

4.14.2 Using gas cylinders with appliances and pipework

If arranging for a fixed installation, observe the following:

- the installation work should be carried out by a certified installer if LP Gas, CNG or natural gas, otherwise by a competent person
- check that is has been done in a workman like manner (eg keep a certificate of compliance provided by the installer)
- obtain a certificate of completion signed by the installer and keep this in a safe place
- train workers in the use of the appliance.

4.15 PAINT AND GLUE (MANUFACTURED PRODUCT) OF CLASS 3 IN PACKAGES

The precautions in this chapter apply to "manufactured product" of Class 3 (ie flammable liquids) such as paint or glue, in packages under the following quantities and situations, providing they are not opened (except for the tinting of paint):

- in a factory, PG II and PG III under 2,000 L in total
- in a warehouse or shop, PG II under 2,000 L
- in a warehouse or shop, PG II and PG III under 10,000 L in total.

"Manufactured product" refers to a mixture of flammable liquid and solid material, with high viscosity and minimal solvent separation. The full definition is provided in the ADG code. Examples are polishes, adhesives, surface coatings (paint, lacquers and varnishes) and roofing sealants (such as "liquid bitumen"). Certain products, such as stains, are not classified as "manufactured product" since the viscosity is too low.

However, these quantities do not apply to any associated flammable solvent unless additional suitable precautions are taken. Over these quantities, or for solvent, additional features are needed (see chapters 9 and 10) – these are fully explained in AS 1940.

4.16 POOL CHLORINE

Apply the advice in section 5.6 for the storage and handling of pool chlorine.

4.17 ORGANIC PEROXIDES (CLASS 5.2)

The following advice applies to less than 20 L (or 20 kg) in packages of less than 5 L or 5 kg. Above these quantities consult AS 4326 and chapter 10.

Organic peroxides are very reactive chemicals. They may need specialised handling and storage conditions and should be kept at recommended storage temperatures. Check the MSDS or supplier for information. While usually liquids, some organic peroxides are mixed as pastes (phlegmatized).

4.17.1 Storage conditions

Observe the following conditions for storage of organic peroxides:

- temperature control is important (see 4.17.2 below)
- keep all packages on sealed or laminated hardwood or coated metal shelves, free from rust or corrosion
- if stored in a cabinet or refrigerator, the door must be free to open to release any pressure build-up (eg use magnetic or friction door catches)
- do not keep with food or drinks
- do not store within 3 m of any other dangerous goods, metal fillings, dust or combustible material
- when handling open containers, wear a face shield or goggles, gloves and apron
- have an eye wash kit ready for immediate use.

4.17.2 Temperature control

The following conditions should be observed in order to control temperature:

- keep the storage area below 35 degrees Celsius
- keep out of full sunlight
- do not allow any room heaters or anything too warm to touch either inside or near the storage
- check the storage temperatures required (eg consult the MSDS) and keep all packages within the temperature range specified for all of the organic peroxides kept (eg by refrigeration).

Ordinary refrigerators and room air conditioners may be ignition sources. If stored in a refrigerator or another cooling device is used, consideration should be given to the likelihood of a spill. If a spill could result in flammable vapours, then the refrigerator or other cooling device may need to be suitable for hazardous areas.

The likelihood of a spill and the adverse consequence can be minimised by the following:

- store on a solid shelf
- keep container size small
- ensure lids are replaced tightly.

4.18 LABORATORIES

AS 2243 *Safety in laboratories* (all parts) offers further advice on safe storage and handling of dangerous goods and other substances in laboratories.

4.19 CARBON DISULPHIDE

Carbon disulphide is very volatile, highly flammable, and also has a low ignition temperature that makes it readily combustible. Consequently, special precautions are necessary. Vapours are easily ignited by surfaces such as a light bulb, a warm steam pipe or a hot exhaust pipe and such heat sources should be avoided. Surface temperatures of plant and other equipment should not exceed 80 degrees Celsius – check the auto-ignition temperature in the MSDS. Special explosion protection is needed if any electrical equipment is used near the carbon disulphide, such as ceiling lights, exhaust fans, or forklifts.

Store in a well ventilated area or in a flammable liquids cabinet conforming to AS 1940.

CHAPTER 5 – RETAIL STORAGE AND RETAIL SALES

5.1 APPLICATION OF THIS CHAPTER – RETAIL DEFINED

This chapter applies only to retail outlets, including sales of consumer packages and situations where customers provide a container for refilling. Typically this involves the display of consumer packages for sale and temporary storage of deliveries of packages unloaded from vehicles.

"Retail" means the sale of goods in consumer packages to members of the public who are themselves not engaged in any further resale of those goods. A consumer package is a container intended for retail display and sale, holding less than 30 kg or 30 L, which is not intended to be opened on the retail premises.

This chapter does not apply to any of the following:

- a retail warehouse
- trade sales – ie the sale of goods intended for workplaces that are not part of normal retail sales
- dangerous goods in bulk containers at retail outlets
- retail outlets where individual storage areas contain packages exceeding the total quantities at the level requiring placarding (see Appendix 2), apart from paint and glue (for advice see section 4.15)
- bottled potable flammable liquids, such as spirits or flavourings at the retail premises
- fuel dispensing, which is covered in chapter 11 (see section 11.5 for flammable liquids such as petrol and section 11.7 for gas dispensing, and 11.6 for self-service operation, 11.8 for LP Gas decanting) – however this chapter covers some other aspects of dangerous goods at service stations (eg see 5.7 for pool chlorine).

Employers should consult with employees about applying the control measures outlined in this chapter. The control measures should be included in training for workers.

5.2 PROVIDING INFORMATION – MSDS AND LABELS

There are exceptions for retailers to the general rules about material safety data sheets (MSDS) – see the advice provide in section 3.5.5.

Retailers need not pass on MSDS to customers for the following dangerous goods:

- unopened consumer packages if less than 30 kg or L capacity
- fuel dispensing (eg into a vehicle)
- when purchasers provide their own container (including a gas cylinder) – see section 5.5.

Workers in the retail area need sufficient information to deal with emergencies, such as signage and training (see sections 2.5 and 2.6).

Retailers do not need to apply labels to packages provided for refilling by a purchaser of the dangerous goods (see section 5.5. below).

5.3 RISK ASSESSMENT

The starting point is making a list of dangerous goods (and the register if you have employees), and the information obtained when observing the advice in chapter 3 (*Identifying dangerous goods, obtaining information and providing information*).

Identify and document the broad risks associated with the storage and handling of dangerous goods and hazardous substances at the particular retail premises. The documentation could be a notation in the register.

If you do not have MSDS, then you need sufficient health and safety information – eg from the label or other information from the manufacturer or supplier, to deal with emergencies, for example should a package burst open, or another risk such as a fire occurs. It is the duty of suppliers to provide packages correctly labelled so that dangerous goods can be identified.

If you open containers on the premises, or decant or dispense dangerous goods, this increases the risks.

Hazards are indicated by the Class or Subsidiary Risks shown on the label or MSDS for each type of dangerous goods.

5.3.1 Typical risks in retail

Typical risks in retail are:

- fire and explosion risks associated with flammable gases (Class 2.1 or Subsidiary risk 2.1), flammable liquids (Class 3 or Subsidiary risk 3) and Class or Subsidiary risks 4.1, 4.2 or 4.3
- fire risks from combustible liquids (these will not be labelled with an indication of this risk)
- fire risks resulting from oxidizing agents of Class (or Subsidiary risk) of 5.1 or 5.2
- toxic risks from Class or Subsidiary Risk 6.1 (all of these are also hazardous substances)
- corrosion risks from Class or Subsidiary Risk 8 (all of these are also hazardous substances).

When documenting the risks, describe how the risk might arise during all stages of the retail operation. For example, the risk assessment may identify a fire risk from spilled methylated spirits if ignition occurs after a 1 L bottle falls from a shelf and breaks open.

5.3.2 Identify ignition sources

If flammable goods are stored or handled, identify any potential ignition sources. Typical ignition sources include the following:

- electrical equipment (unless protected or intrinsically safe) – such as: switches, electric motors, transformers, fuse boards, fans, air conditioners, fridges and other equipment with thermostats, power tools, fans, air conditioners, battery chargers, computers, telephones, electric heaters and internal combustion engines such as mowers, pumps and generators

- naked flames – such as: torches for brazing or shrink wrapping, pilot flames in heaters, heaters using gas, liquid or solid fuels, incinerators and barbeques.

Consider exceptional or infrequent circumstances such as maintenance and repairs at the premises, for example these may involve additional ignition sources such as when welding. Extra precautions may be needed at such times.

External lights above 3 m from ground level are not usually a risk.

5.4 CONTROLLING RISKS FOR GOODS ON DISPLAY IN CONSUMER PACKAGES

This does not include the storage of goods immediately following the unloading of a delivery – see chapter 13 (temporary storage).

Follow the procedures in chapter 4 (small quantities), such as minimising quantities kept on the premises. Additional controls to observe include the following.

- Keep dangerous goods away from other goods that could become contaminated in the event of a spill or leak. This is particularly important with goods such as personal products or food (including animal feed). Consider using an impervious barrier or a suitable separation distance (usually 1.5 m would be sufficient).
- Keep dangerous goods away from incompatible substances or products.
- Do not store packages of liquid dangerous goods above solid dangerous goods in paper or absorbent packaging.
- Stow packages in such a way that will prevent the packages from falling or being dislodged and being damaged.
- Packages should not be opened on the premises (with the exceptions of the tinting of paint). If the customer provides a package for refilling, see section 5.5 below.
- Keep equipment and sufficient materials for clean up at the premises to deal with spills or leaks. Absorbent, neutralising or decontaminating material may be necessary. The quantities of clean-up material should be based on the size of the largest packages kept at the premises (ie the volume and spread of the potential spill).
- Any spills or leaks should be cleaned up immediately. Contaminated or spilt dangerous goods should not be returned to their original packaging except for the purposes of disposal or where this will not increase the risk. Waste generated during clean-up needs to be disposed of in a safe manner and in accordance with environmental legislation.
- Keep ignition sources (eg flames, heaters) away from the areas where flammable or combustible dangerous goods are kept. Naked flames from direct fired heaters and any flames associated with maintenance work (eg oxy-acetylene torches) should be kept at least five metres from the goods.
- Additional fire extinguishers (additional to the normal premises requirements of the *Building Code of Australia*) may need to be kept near the dangerous goods storage area or area where decanting takes place.
- If containers are not opened, ventilation will not be required as a control measure, except for gases (Class 2) – see 4.14 for advice.

- Spillage containment would not usually be required in retail unless the quantities of potential spills could spread to other parts of the premises or outside the premises and create a risk.

5.5 DECANTING OR DISPENSING INTO A CUSTOMER'S PACKAGE

Examples are dispensing or decanting of flammable liquids such as kerosene or mineral turpentine into a package provided by the customer.

Ignition sources are a potential hazard. Further guidance for flammable liquids is provided in Australian Standard AS 1940 (see section 1.7 of this code of practice).

Procedures for gas dispensing are covered in chapter 11, section 11.8, of this code of practice.

The retailer is not required to apply a label to the package provided by a customer for refilling.

5.6 POOL CHLORINE

5.6.1 Types of pool chlorine

Dry Pool Chlorine is a dangerous goods of Class 5.1 (oxidizing substances), Packaging Group II (medium hazard rating). The term dry pool chlorine includes calcium hypochlorite, sodium dichloroisocyanurate, sodium trichloroisocyanurate, potassium dichloroisocyanurate, trichloroisocyanuric acid, dichloroisocyanuric acid and other oxidizing agents, in solid form, used for chlorinating swimming pool water, or other chlorinating uses.

A significant hazard of dry pool chlorine is that it will burst into flame on contact with oil, a flammable liquid or small amounts of water. It may cause combustible materials to burn more vigorously than normal. Consequently, dry pool chlorine should be kept away from flammable (eg fuels) and combustible liquids (eg oils), corrosives, and powdered metal. It should not come into contact with any source of heat. If sold at a service station the precautions in section 5.7 should be observed.

Liquid Pool Chlorine is a dangerous goods of Class 8 (corrosive). The Packing Group depends on available chlorine – PG II if between 5 per cent and up to 16 per cent and PG II if 16 per cent or over. A significant hazard of liquid pool chlorine is that on contact with acid it releases the poisonous gas chlorine.

5.6.2 Dry pool chlorine storage indoors

Some types of dry pool chlorine are incompatible with each other. Calcium hypochlorite must not be permitted to come in contact with other dry pool chlorines such as dichloroisocyanuric acid, trichloroisocyanuric acid, sodium dichloroisocyanurate and trichloroisocyanurate. If incompatible pool chemicals are allowed to come into contact, they may dangerously interact to produce heat, explode, or release toxic gas. However, separation distances are not necessary between different types of dry pool chlorine or from dry acid (sodium hydrogen sulfate).

The storage area should be cool, dry and well ventilated, since protection from the sun and moisture is essential. Liquids such as liquid pool chlorine, clarifiers, acids, paints and algaecides should not be kept vertically above containers of dry pool chlorine (ie do not put these on shelves above the dry pool chlorine).

If more than 250 kg of solid pool chlorine is kept on the premises observe the advice in section 10.13.3.

5.6.3 Storage outdoors

Dry pool chlorine stored in the open air should be kept in weatherproof packages and protected from the weather, by waterproof sheeting or other means, on a paved area.

5.6.4 Repacking solid pool chlorine

Should you repack or dispense dry pool chlorine, observe the following additional precautions:

- provide additional separation distances or barriers from the repacking area to the retail sales area and to the storage area
- use dangerous goods approved packages of a capacity not exceeding 20 kg complying with the ADG Code
- ensure packages are labelled in accordance with the ADG Code
- electrical wiring and electrical equipment in the repacking area must be suitable – all electric wiring and equipment in the area should conform to AS 2236 – *Dust-excluding ignition-proof enclosure of electrical equipment*
- do not use flame guns or heat for shrink-wrapping.

5.6.5 Liquid pool chlorine

Keep containers of liquid pool chlorine away from other classes of dangerous goods with which they might react (eg acids). Reaction with other types of pool chlorine is covered under dry pool chlorine, above.

If you have more than 1,000 L in packages refer to section 10.18.2.

5.7 POOL CHLORINE AT SERVICE STATIONS – ADDITIONAL PRECAUTIONS

Pool chlorine is sometimes sold at a service station in proximity to selling fuel for motor vehicles. The hazards and types of pool chlorine are described in section 5.6 above. However, because of the proximity of fuel and other dangerous goods, observe the additional precautions in 5.7.1 and 5.7.2 below.

5.7.1 How to keep dry pool chlorine at a service station

To avoid the additional risks associated with fuel and other goods sold at a service station, dry pool chlorine should be kept in accordance with the following conditions:

- no more than 100 kg kept on display at any time
- the pool chlorine should not be displayed in a driveway for vehicles such as the forecourt
- keep packages under cover, and in a cool dry place, out of the sun
- the pool chlorine should be kept separated from all combustible material by at least a distance of 5 metres or a liquid-tight wall. It must not be stored next to or underneath any liquids, paint, grease, car batteries or anything that burns easily (eg fire lighters)
- the pool chlorine must be in approved packages of no more than 5 kg each
- packages should not be opened on the premises
- no repacking of pool chlorine is appropriate on the premises unless additional precautions are taken (see 5.6.4)
- at least one 9 kg fire extinguisher must be kept near the storage. You should already have extinguishers if you sell petrol
- a sign 'DANGER – NO SMOKING' in letters at least 50 mm high and the Class 5.1 Oxidizing Agent symbol (black on yellow background 'diamond') should be displayed near the storage area. The length of the side of the Class symbol must be at least 100 mm.

5.7.2 Separation distances for dry pool chlorine at a service station

Observe all of the following separation distances with Dry pool chlorine:

- 3 m from any source of ignition
- 3 m from an above ground storage of Class 3 dangerous goods of up to 5,000 L and 5 m if more than 5,000 L
- 5 m from LP Gas storage (eg a decanting cylinder)
- 3 m from dangerous goods of any other Class (eg car batteries)
- 3 m from combustible materials
- 3 m from a public place
- 3 m from a vent or fill pipe for an underground tank containing Class 3 or combustible dangerous goods (eg petrol, diesel).

It may be convenient to use empty containers for display and store the dry pool chlorine in a separate area.

Where more than 100 kg of dry pool chlorine is kept at a service station, a storage area should be set up separate from the display area and separate from other dangerous goods or combustible liquids (eg fuel, oil) – see section 10.13.2.

5.8 LP GAS DISPENSING AND DECANTING

LP Gas dispensing (eg autogas) and decanting from a cylinder into a customer's gas cylinder is covered in chapter 11, sections 11.6 and 11.8.

Aboveground LP Gas tanks require placarding (see chapter 15).

Note that autogas must not be decanted into small gas cylinders in place of propane because it is a blend of different LP Gas components – autogas contains a greater proportion of butane and is unsuitable with equipment, such as burners, that are not designed for its use. However, burners on hot air balloons and some road resurfacing equipment may be especially designed for use with autogas.

5.9 FUEL DISPENSING – EG PETROL

Dispensing of flammable liquid fuels is covered in chapter 11, sections 11.5 and 11.7.

Notices are required to notify customers of procedures and requirements – see chapter 11.

5.10 TEMPORARY STORAGE

If goods are kept in a storage area after being unloaded from a transport vehicle and before being placed in the display area, refer to the guidance in chapter 13 of this code of practice.

Goods should not be kept in temporary storage for a long period since this will increase risks at the premises.

5.11 PLACARDING

If the total quantity (aggregate) of the dangerous goods on the premises exceeds the "Placarding Quantity" in schedule 5 of the Regulation (see Appendix 2) then you must have further signage in the form of placards (see chapter 15). Placarding is not required for underground tanks at service stations (OHS Regulation clause 174ZK).

5.12 MANIFESTS, EMERGENCY PLANS AND INVESTIGATING INCIDENTS

A system of investigating incidents involving dangerous goods must be established.

If the total quantity (aggregate) of the dangerous goods on the premises exceeds the "Manifest Quantity" in schedule 5 of the Regulation (see Appendix 2) there are additional requirements to carry out the following:

- prepare a manifest
- prepare a written emergency plan
- notify WorkCover (most underground tanks at service stations must be notified).

Further advice is provided in chapters 14, 15 and 16.

CHAPTER 6 – IDENTIFYING HAZARDS ASSOCIATED WITH THE STORAGE AND HANDLING OF DANGEROUS GOODS

This chapter applies to premises where the dangerous goods stored or handled are above the "placard quantities" shown in Appendix 2 of this code of practice.

6.1 PROPERTIES OF THE DANGEROUS GOODS OTHER THAN THE CLASSIFICATION

Having identified the principal classifications (Class) and any "Subsidiary Risk" of the substances on the premises (see chapter 3), the next step is to identify other relevant hazards, including physical and chemical properties of the goods. These depend on the nature of the substance and on other hazards present in the premises. The Material Safety Data Sheet (MSDS) will provide additional information for dangerous goods supplied to your premises, however, for dangerous goods created and used on the premises, comparable information will need to be sought.

Examples of additional properties that may need to be taken into account include the following:

- the physical state of the goods (eg a gas, liquid or powdered solid?)
- relevant physical properties and possibility of hazardous atmospheres or atmospheric contaminants – (is it likely to melt or vaporise at normal temperatures; what is the vapour pressure?)
- flashpoint and fire point
- chemical properties such as reactivity, chemical energy, solubility and combustion products
- concentration
- presence of contaminants
- physical characteristics such as particle size, electrical conductivity.

As examples, some metals in the form of a solid block do not present a hazard, but in the form of a finely divided powder can be readily ignited or react strongly with a common substance such as water. A liquid spill may spread further than a spill of a solid, so if you have flammable liquids then any source of ignition nearby is a hazard.

6.2 CONTROL CONDITIONS NECESSARY TO MAINTAIN STABILITY

An occupier must ensure that the stability of dangerous goods is maintained, to avoid inadvertently creating any new hazards or increase risks, such as becoming unstable, decomposing or changing specification (OHS Regulation clause 174R).

Identify and apply any control conditions specified by the manufacturer needed to ensure stability of the dangerous goods, such as the following:

- maintaining the levels of stabilisers such as phlegmatizers, diluents, solvents, wetting agents, desensitisers, inhibitors and/or other adulterants that are necessary
- controlling temperature levels if required so that the goods are stored within any control temperature range specified by the manufacturer

- keeping the dangerous goods and the packaging dry, unless the packages themselves are impervious to moisture.

This does not apply where the dangerous goods are about to be used in a manufacturing process.

6.3 HAZARDS EXTERNAL TO THE GOODS

Having identified the hazards intrinsic to the dangerous goods, the next step is to identify hazards that are external to the goods.

This includes all other substances, structures, plant, systems of work and activities:

- used in the storage and handling of dangerous goods
- not directly involved with the dangerous goods but that could impinge on safety.

"Plant" is defined broadly and includes any machinery, equipment or appliance. This includes tanks, pressure vessels or packages used to contain the goods and associated plant such as pipework or pumps.

For example, a high boiling point oil may create a fire hazard if sprayed (eg a fine leak from a high pressure oil pipeline of piping).

Examples include the identification of all:

- physical components or characteristics that have the potential to cause harm
- hazardous chemicals and physical effects created in a manufacturing or handling process (see section 6.5 below)
- systems of work, including normal operating procedures and the possibility of unusual operating conditions
- correct procedures and operating parameters, and checking that they are being adhered to, including checking that the type of dangerous goods used is appropriate to the item of plant
- possibilities of operator error.

Consider the following hazard sources:

- plant used or moved on the premises (eg ignition sources from engines)
- vehicle movements on the premises
- deliveries of dangerous goods
- transfer of dangerous goods between containers on the premises
- visitor access
- personnel movements in normal and emergency situations
- fire hazards including buildings, concentrations of combustible material and uncontrolled vegetation
- weather conditions such as temperature extremes, wind, lightning, or rainfall including the potential for flooding.

Employees are often aware of these hazards and employers should consult with employees during the identification process.

6.4 OTHER PREMISES AND PUBLIC PLACES

Risks may arise from hazards external to the premises. For example, an adjacent timber yard with stacks of wood is an external fire risk – in the event of the timber catching fire, this hazard could impinge on the dangerous goods.

External hazards include the following:

- any dangerous goods or incompatible substances stored at other adjacent premises or public places
- activities, facilities or installations on neighbouring premises that could create a hazard (eg an ignition source)
- the effects of infrastructure such as a road, rail line, airport, pipeline, power line, radio transmitter or telephone tower
- fire hazards (including concentrations of combustible material or uncontrolled vegetation on neighbouring premises or public areas).

6.5 CHEMICAL AND PHYSICAL REACTIONS WITH OTHER SUBSTANCES

Physical reactions include dilution, dissolution, abrasion, phase change, leaching and absorption. Chemical reactions are those that result in a chemical change in one or more of the goods when they come into contact.

Consider the following hazards:

- physical reaction from incompatible substance coming into contact (eg rapid heating generated by acid mixing with water, causing a steam explosion)
- chemical reaction resulting from contact with other substances (eg an oxidizing agent such as pool chlorine coming into contact with an oil such as brake fluid).

6.6 PAST INCIDENTS – TYPE AND CHARACTERISTICS

Incident information, such as past accidents or spills, contributes to knowledge about the risks.

Find out:

- the type of incidents that have occurred when storing and handling dangerous goods at your premises, or other similar premises storing and handling similar types of dangerous goods
- knowledge about the cause of these incidents
- any information that is available about the effectiveness of controls and about how controls could be improved.

6.7 TOXICITY, HEALTH HAZARDS AND CONTROLLING EXPOSURE

If you have identified toxicity or other health hazards and risks, further advice on the control of individual exposure to hazardous substances is also provided in the NSW *Code of Practice for the Control of Workplace Hazardous Substances*.

Many dangerous goods have personal exposure standards that must not be exceeded (OHS Regulation, Clause 51) – see the *Code of practice for the control of workplace hazardous substances*, and the NOHSC Standard: *Exposure Standards for Atmospheric Contaminants in the Occupational Environment*.

See chapters 10 and 11 for advice on containment of atmospheric risks.

6.8 FOOD AND PERSONAL USE PRODUCTS

Occupiers must ensure that dangerous goods cannot contaminate food, food packaging or personal use products on the premises. "Occupiers must ensure that dangerous goods cannot contaminate food, food packaging or personal use products on the premises (OHS Regulation clause 174W)."

The risk assessment should include the location of the storage of such products. Spill protection (see section 9.7) should ensure that contamination is not possible.

CHAPTER 7 – RISK ASSESSMENT

This chapter applies to premises where the dangerous goods stored or handled are above the "placard quantities" shown in Appendix 2 of this code of practice. In general, risks will be proportional to the overall quantity of dangerous goods stored or handled.

The legal obligations for risk assessment are in clause 174Q of the OHS Regulation. At premises where there are several occupiers, each must ensure the responsibilities are discharged in a coordinated manner. To achieve this, the occupiers will need to discuss with each other their risk assessments and the determination of control measures applying to the premises as a whole.

7.1 ASSESSING DANGEROUS GOODS RISKS

7.1.1 The nature of "risk"

The next step in the risk management process is to assess the risks associated with the hazards that have been identified in chapters 3 and 6. Risks often arise from the unintended escape of dangerous goods or unintended consequences during handling.

Section 7 of the OHS Act provides that risks include those attributable to the following:

- the manner of conducting an undertaking
- the plant or substances used for the purposes of an undertaking
- the condition of the premises, or any part of the premises used for the purposes of an undertaking.

Risk is a combination of the likelihood of an injury or illness occurring and the likely severity of this. Put another way, it is the likelihood that a hazard will result in an incident, and how serious that incident will be.

The risk assessment should include the following:

- the extent of the risk to people (both workers and the public) both at the premises and beyond
- the extent of the risk to other dangerous goods, other substances, plant or buildings both at the premises and beyond
- identification of the factors contributing to the risk (see section 7.1.5)
- determination of the extent and type of controls necessary – controls should be commensurate with risk
- the priorities for implementing control measures
- identification of records that need to be kept.

When assessing risks to buildings, the consequences for the health and safety of persons in buildings, or as a result of danger arising from buildings (eg the spread of a fire or a building collapse) must be considered.

Employers must consult with all relevant employees during this risk assessment process and share information. Employers and self-employed persons must keep records of the risk assessment and review the risk assessment at least every five years, or when indicated by other factors (see section 7.4 below).

7.1.2 Goods and applications for which a detailed risk assessment is not required

Certain goods and articles are not covered by the dangerous goods chapter of the OHS Regulation where they are used in common items such as an item of plant or vehicle. This is because the hazards and risks were taken into account in the design of the plant or vehicle and additional measures are not required. However, the general provisions of other chapters of the OHS Regulation may still apply.

As examples, a detailed risk assessment is not required for the following:

- dangerous goods that are in a battery or fuel tank fitted to plant or a vehicle (or vessel or aircraft) where necessary for the propulsion or operation of the vehicle (up to 250 litres)
- up to 20 litres or kg of dangerous goods in equipment or accessories in fixed plant (eg a battery)
- dangerous goods in a refrigeration system of a freight container
- compressed gas in pneumatic tyres
- potable liquids in consumer packages at a retail premises.

So you do not need to include a single battery in use, but if a battery is being re-charged, or a bank of batteries is used for power, this needs to be included.

The above items are also not included in the calculation of the quantities of dangerous goods to which the various schedules of the Regulation apply.

However, these items may also need to be considered when identifying ignition sources.

7.1.3 Consequences to assess

In assessing the consequences of a possible incident, consider the potential for the following:

- injury and illness to people at the premises
- "knock-on" effects involving increased risks to (or from) other dangerous goods or substances at the premises
- injury and illness to people outside the premises – eg could "protected works" be affected, including nearby facilities such as factories, schools, child and aged care facilities, theatres, shopping centres or residences?
- risks to dangerous goods stored or handled at the premises from hazards outside the premises.

The control of the risk of injury will also help to control risks to property and the environment.

In estimating risk it may be useful to review historical information (ie past incidents – see section 6.6) at the premises or other similar premises. It may also be necessary to estimate the frequency with which some tasks are carried out. Include vehicles carrying dangerous goods that are frequently parked at the premises (eg overnight) in the risk assessment and determination of control measures.

7.1.4 Quantitative risk assessment

Risk assessments may be qualitative or quantitative or a mixture of both. The choice will depend on the hazards, the risk, the complexity of the processes being evaluated, the availability and reliability of data and the ability to develop acceptable risk criteria.

In simpler cases a qualitative assessment may be sufficient, particularly if the guidance in Australian Standards is used.

Quantitative risk assessment may be used where there is reliable data, for example where failure rates are well known. Quantitative risk assessment may be the technique of choice when trying to make a determination between two control measures.

In many cases semi-quantitative techniques may be used. This means that the assessment has qualitative and quantitative components.

In some cases it may be effective to use a highly structured risk assessment such as a Hazard and Operability Study (HAZOP).

7.1.5 Key risk factors

Factors contributing to the risk need to be identified.

Central to risk assessment is an analysis of the following factors:

- failure of containment leading to spillage or leakage of goods (eg failure of plant containing the goods, including pipe connections during transfer)
- fires and explosions resulting from the nature of the dangerous goods
- fire load of other substances, including storages of combustible liquids and other combustible materials
- incompatibility of goods (ie they may react with each other or other substances)
- plant used with or near the goods (eg heat or ignition sources), including the materials the plant is made from (see also section 9.3 for controls on associated plant)
- the buildings near or in which the dangerous goods are stored or handled, including the materials the buildings are constructed from and the potential fire load
- the generation of hazardous atmospheres (eg flammable atmospheres and the risk of explosions) or atmospheric contamination (eg risk of toxicity)

- manufacturing processes, including the temperatures and pressures the goods are subjected to, physical processes such as separation, mixing, absorption, changes of state and chemical reaction
- confined or enclosed spaces increasing risks
- occasional work such as repairs and maintenance should be included in the risk assessment since this may introduce new hazards and increase risks.

These risk factors should be considered with regard to industry knowledge and practice, such as that reflected in relevant Australian Standards.

The site plan that accompanies the manifest (see chapter 16) is also a useful tool when assessing risks and deciding on controls, particularly in relation to matters such as separation distances and spillage containment (bunding).

7.2 GENERIC RISK ASSESSMENT

If the same dangerous goods and similar work processes are used in a number of different locations then it may be possible to develop a generic risk assessment applying to all locations, providing all relevant factors and variables are taken into account. By doing this, the number of assessments can be minimised and unnecessary duplication of effort avoided. For example, in a factory where Class 3 flammable liquids are packaged in three identical packaging lines, the one assessment can apply to all three.

However, you need to ensure that the generic assessment is valid in each situation or area to which it is intended to apply.

Similarly, a generic assessment undertaken by a trade association as a model to be used by members at a number of sites could be applied, providing all factors are taken into account by the occupier of each site.

The application of the relevant Australian Standard listed in section 1.7 for the storage and handling of the dangerous goods in question is a generic assessment. In many instances, the risk controls identified in Australian Standards have been formulated following analysis of particular hazards and their risks and will be sufficient, providing the control measures stated in the Standards are implemented. These need to be directly applicable to the storage and handling situation, and you need to ensure no other hazards impinge (eg there are sufficient separation distances from other dangerous goods).

However, if the situations are not similar, and persons in different premises or areas may be subjected to different risks, a generic assessment may not apply, or may need to be supplemented by a further risk assessment.

7.3 RECORDING THE OUTCOMES OF THE RISK ASSESSMENT

If no specific measures are necessary to control risks, make a notation in the register (eg on the MSDS). However, if specific control measures are necessary, the risk assessment must be documented, and a copy kept while the risk assessment is being reviewed.

The risk assessment records should include the following:

- date of the assessment
- name(s) of the assessor(s)
- name(s) of people who provided specialist advice
- the premises, storage location, area or process to which the record relates
- the dangerous goods involved in the storage or handling work activity and the particular hazards
- the sources of information reviewed or used to make decisions (eg relevant MSDS, Australian Standards)
- identified risks (including the likelihood of possible consequences)
- controls necessary to reduce risks to an acceptable level and how decisions about the control were made, such as a determination of what was reasonably practicable
- the existing controls in place (and if they are sufficiently effective)
- any controls that need to be introduced.

Separate records may be needed for each storage location or process. For simple risk assessments, the record may be a notation in the register accompanying the relevant MSDS.

The risk assessment should include the reasons for determining controls (see chapter 8) and a determination of what was reasonably practicable in the circumstances. The record of the risk assessment will be useful when subsequently reviewing the assessment, or when changes could result in the need for a new assessment (see below). A site plan is a helpful part of the record since key aspects such as separation distances are shown. This could be the same plan accompanying the manifest (see chapter 16).

The record of the result of the assessment must be accessible to any person engaged to work at the premises who could be exposed to the risk, and to any relevant OHS representative (including the consultative process).

7.4 REVIEWING AND REVISING THE RISK ASSESSMENTS

There are circumstances when a risk assessment may no longer adequately apply and needs to be reviewed, and revised when necessary. New controls may be required. Consult with relevant employees during the review process.

7.4.1 Legal requirement

Clauses 12, 37 and 174Q of the OHS Regulation requires that a risk assessment and control measures be reviewed when either:

- there is evidence that the assessment is no longer valid
- injury or illness results from exposure to a hazard to which the risk assessment relates
- a significant change is proposed in the place of work or in work practices or procedures to which the risk assessment relates
- five years has elapsed.

The review must take into account the results of any investigation into a serious incident or incident at the premises.

The review is an opportunity to check that control measures conform to accepted industry standards. If the review identifies any deficiencies in any control measures, the measures must be altered or new measures implemented to ensure effective control.

7.4.2 Changes triggering a review of the risk assessment

The risk assessment should be reviewed when any of the following occurs:

- a new dangerous goods is introduced
- the quantities of dangerous goods at the site change
- the goods are moved to a different location at the site
- a process or plant is modified (eg a different type of dangerous goods is used)
- new information on the hazards or risks becomes available – eg revised information from the supplier, workers identify new hazards
- monitoring indicates inadequate control – eg escape of goods is detected
- incidents have occurred
- new or improved control measures become available or reasonably practicable
- changes in dangerous goods on a neighbouring property – eg affecting a change to separation distances
- changes to the premises, structures or buildings such as:
  - putting openings into firewalls or screen walls (eg for windows, doors, ducts, or vents) that may allow vapours to escape and increase the need for separation distances
  - changes that will reduce the fire containment rating or fire resistance level
  - placing roofs over open storage areas or loading docks (fire may plume and spread under a roof and fire fighting becomes more difficult)
  - changes that affect spillage containment.

If it is known in advance that circumstances may change, the risk assessment should take the projected change into account. This will help ensure that the assessment will still be applicable after the changes take place. You also need to consider this if purchasing new products or plant, moving to new premises or changing production schedules (eg increase in quantities used).

Changes may also need to be reflected in changes to the manifest (see section 16.2) and the notification to Workcover (including the site plan – see section 16.2.5).

7.5 COMPETENCY OF THE PERSONS CARRYING OUT THE RISK ASSESSMENT

The process of assessing risks and determining control measures (see chapter 8) should be carried out by a competent person. If the occupier lacks the necessary expertise, they should engage a person with suitable demonstrated competence to carry out this task. The occupier should provide that person with all the necessary information and access to the premises, so that the nature and extent of existing or proposed storage and handling of dangerous goods can be determined.

A competent person for a task is defined as a person who "has acquired through training, qualifications or experience, or a combination of them, the knowledge and skills to carry out that task" (OHS Regulation, clause 3).

The competency required will vary with the complexity of the task, which depends on the goods present in each actual circumstance.

In the simpler situations, such as the small quantities in chapter 4 or retail in chapter 5, a person capable of interpreting an MSDS, such as a supervisor, should be able to assess risks and determine control measures, using this code of practice.

In cases where the quantity of dangerous goods exceeds the placard level, but remains below the "manifest" level, a greater degree of experience and knowledge may be required, such as knowledge of the relevant Australian Standard and experience in risk assessment would be appropriate.

Where the goods are above the "manifest" level, or where incompatible goods are kept in the same location, or where processing occurs additional knowledge and experience in areas such as hazardous areas classification and the protection of associated electrical equipment may be needed.

In cases where technical knowledge and skills are required, a competent person would be a member of a recognised body, for example the *Australian Institute of Dangerous Goods Consultants*, or a chemical engineer (especially if a qualitative method will be used). Where the dangerous goods are used with plant, the risk assessor should also be competent in relation to the hazards and risks associated with each item of plant.

CHAPTER 8 – DETERMINING CONTROL MEASURES AND APPLYING THE HIERARCHY OF CONTROL

This chapter applies to workplaces and to non-workplaces where the dangerous goods stored or handled are above the placarding quantities shown in schedule 4 of the OHS Regulation (see Appendix 2 of this Code of Practice).

8.1 PRINCIPLES OF CONTROL

Having assessed the risks, the next step is to determine appropriate control measures.

The objective of control is to achieve the requirement that all persons (including members of the public) are not exposed to risks to their health and safety arising from dangerous goods at the occupier's premises (OHS Regulation clause 1740).

The "hierarchy of control" must be applied (OHS Regulation, clauses 11(2) and 5). This was briefly described in section 2.3. The determination of appropriate measures depends on an assessment of what is "reasonably practicable" in the circumstances (see advice in section 8.2 below).

The controls for dangerous goods occur on three levels:

1. containment of the goods to prevent spills or leaks
2. spill containment and measures to mitigate risks resulting from spills or leaks
3. emergency response including fire fighting when other controls have failed.

While the first level is the most important, control measures need to be selected for each of these levels, should the controls at the level above fail.

Employers must consult with all relevant employees when deciding on controls and share information relating to choosing controls.

8.2 DETERMINING THE CONTROLS TO BE USED – WHAT IS REASONABLY PRACTICABLE?

When determining the control that is "reasonably practicable" the following factors should be taken into account:

- *The likelihood and severity of the hazard or risk in question*

This is based on the risk assessment – how likely is it that the storage and handling of dangerous goods will result in injury to people or the likelihood of property damage that could impact on people? How serious are the injuries or damage likely to be and how many people could be affected?

- *State of knowledge about the hazard or risk and ways of removing or mitigating the hazard or risk*

Take into account what is known about the hazards or risks and the methods of control. What do manufacturers and suppliers know about the hazards and risks? What do other workplaces with similar dangerous goods and processes do to control risks (ie what are the usual controls used in the industry or in engineering practice)? What information can industry professionals and organisations, and other sources provide?

- *The availability and suitability of ways to remove or mitigate the hazard or risk*

Are the control measures you have identified available? Are they suitable for the premises and the workers involved?

- *Cost of implementing control measures*

Are the costs of the control measures commensurate with the benefits gained? Time and money invested in selecting and implementing control measures should result in the elimination or significant reduction of risks.

The assessment and weighing of the above factors is an objective test of what is reasonably practicable in the circumstances of the case under consideration. For example, the determination of control measures should be undertaken with regard to industry practice, such as that shown in relevant Australian Standards or other established industry practices. Relevant Australian Standards include those listed in section 1.7 of this code of practice.

8.3 ELIMINATING OR CONTROLLING RISK THROUGH DESIGN

Elimination must be considered first and other controls subsequently determined if elimination is not reasonably practicable. This should be done at the design stage. Reducing the quantities held is also a way of reducing risk (see section 8.4).

Controllers of premises have an obligation to ensure that hazards are identified during the design of the premises and before the premises are provided for use as a place of work (OHS Regulation, clause 34).

8.3.1 Applying design principles

Premises, plant, processes, systems of work and activities should be designed to eliminate any risks associated with the dangerous goods, or if this is not reasonably practicable, reduce the risk.

Isolation and engineering controls should be incorporated into plant and structures at the design stage.

Good design is the most effective way to reduce risks. Consideration at the design stage helps to reduce costs, particularly high operational costs caused by poorly set-out premises and costs created by complex systems of work to cope with the constraints of poorly designed premises. An effective design process means that potential problems can be anticipated and solved before they become real "bricks and mortar" problems.

When laying out premises, any external factors such as the risks to and from adjacent premises should be taken into account. If you intend to establish a fire protection system, the advice of the Fire Brigade should be requested to determine whether the location and type of fire protection system meets with operational requirements of the Fire Brigade – see chapter 12.

8.3.2 Designing a process with low risk

One of the factors determining the level of risk is the decision on the actual physical or chemical process to be used. Chemical reactions usually involve raw materials, intermediates and finished products. Where there is a choice of chemical reactions available, each possible reaction pathway will have inherent hazards and risks associated with it. Other factors include the complexity of the process, the plant used, efficiency, by products, cost, reliability, and energy demand.

Similarly, there may be a choice in relation to the physical processes that are available to achieve the same end product. Some processes involve high temperatures and pressures while alternatives may involve lower temperatures and pressures (eg evaporation compared to freeze drying). For each of the options, the process hazards should be identified and their relative risks assessed. The processes resulting in the lowest overall risk should be selected (subject to practicability).

8.3.3 Location of storage and handling areas

Dangerous goods should be kept only in a designated storage location observing the separation and segregation principles described in section 8.7.

One of the most effective design factors is locating the dangerous goods in such a way as to minimise risk factors. Factors include the following:

- a location well away from other hazards and other sensitive facilities (such as "protected works")
- sufficient area to allow for the isolation of incompatible dangerous goods, and for spill and firewater retention
- ease of access such that transfer and transport risks are minimised
- located above potential flood levels.

When determining if more than one type or class of dangerous goods can be kept or used in the storage or handling area, risk factors relating to compatibility need to be considered (see section 8.7.8).

8.3.4 Design of buildings and storage areas

Buildings should be designed, selected and maintained in a manner that recognises the risks associated with any dangerous goods stored or handled in or near the buildings. Fire risks are of particular importance in building design and suitability.

Generally structures such as buildings should have the following characteristics:

- be constructed of non-combustible materials
- not have spaces where dangerous goods could unintentionally accumulate
- protect dangerous goods from direct sunlight
- if gases are stored, have roofs designed so that gases cannot accumulate beneath roofs or in roof voids
- have adequate ventilation to prevent the build-up of a hazardous atmosphere (see section 9.9).

The *Building Code of Australia* requirements for design may not be sufficient and the relevant dangerous goods Class or type specific Australian Standard should be consulted.

Storage areas should be paved and vegetation should be kept clear.

Shipping containers are not suitable unless especially adapted for the storage of dangerous goods. Many containers have wooden floors that may absorb substances and create hazards and not retain spills or leaks. Shipping containers need to be adapted to provide the features of suitable storage areas, including ventilation and spillage containment.

8.3.5 Design and selection of plant used with dangerous goods

When selecting plant ensure that it is suitable for use with dangerous goods. Plant must only be used in accordance with the plant manufacturer's instructions. If these instructions are not available, suitable instructions must be developed by a competent person (OHS Regulation clause 135(a)).

8.4 QUANTITY REDUCTION

Occupiers should consider reducing risks by reducing the quantity of dangerous goods stored or handled on the premises. Reducing the levels of inventories of dangerous goods held usually leads to an overall reduction of risk.

Examples include the following:

- careful attention to inventory levels through effective stock control, such as the use of just-in-time ordering and supply arrangements
- prompt disposal of dangerous goods not needed, including waste
- using a continuous handling or manufacturing process rather than a batch process
- selecting chemical conversion processes that have a high conversion rate and result in less recycling or stockpiling of materials
- using just-in-time manufacturing – ie handling only those dangerous goods necessary for the production shift rather than stock piling the supply for several shifts in the manufacturing area
- ordering a smaller package size. This will also reduce manual handling risks.

However, you need to ensure that other risks are not increased. For example, ensure that increased vehicle movements or any increased handling does not create further risks.

In some circumstances reduction may not be practicable, such as in warehousing and contract storage.

8.5 ELIMINATION

The most effective method of risk control is the elimination of the hazard at the source. Consider this when compiling or checking your register or manifest of dangerous goods (see chapter 16). Elimination must be considered first, and controls determined (in the order of 8.6 to 8.10) only if elimination is not reasonably practicable.

Examples of elimination include using the following:

- a physical process rather than a chemical process to clean an object – eg cleaning by the use of ultra-sound, steam or high pressure water rather than using a solvent
- water based paints or glues rather than flammable solvent based material
- clips, clamping, bolts or rivets instead of an adhesive
- electrolysis to produce a gas in-situ rather than supply from a cylinder.

8.6 SUBSTITUTION

8.6.1 Lesser hazard

Occupiers of premises must consider controlling risks by substituting dangerous goods of a high hazard with goods of a lower hazard.

Examples include the following substitutions:

- a substance not classified as a dangerous goods – eg degreasing with detergent instead of a chlorinated or volatile solvent
- a combustible liquid instead of a Class 3 flammable liquid – eg using dieseline rather than petrol or kerosene
- a substance with a higher numerical Packing Group number, such as substituting PG III for PG II goods (PG refers to Packing Group)
- a less hazardous propellant in an aerosol, such as carbon dioxide (Class 2.2) instead of LP Gas (Class 2.1)
- a Class 2.2 (non-flammable, non-toxic gas) as a refrigerant rather than Class 2.3 (toxic gas, such as ammonia) or Class 2.1 (flammable gas such as LP Gas)
- a dangerous goods of a single hazard rather than goods with a subsidiary hazard – ie a single Class without a Subsidiary risk rather than the same Class with a Subsidiary risk.

8.6.2 Work methods with lesser risk

Using a work method that has a lesser risk is another method of substitution.

Examples include the following:

- wrapping palletised goods by stretch wrapping rather than flame heat shrink where there is a fire or combustion risk
- using a pallet cage rather than stretch wrap where the static electricity generated during the wrapping or unwrapping of the plastics film may be a hazard
- using a solid substance in a paste or pellet form rather than a dusty powder
- applying paint by brush or roller rather than from an aerosol can
- transferring packages by conveyor rather than forklift in hazardous areas
- using non-sparking tools in a hazardous area.

8.7 SEPARATION

An occupier must ensure that risks are reduced by separation, where it is not reasonably practicable to eliminate the risks (OHS Regulation clause 174S).

Separation means the physical separation of the dangerous goods from a person, property or thing by either distance or a physical barrier. Include vehicles carrying dangerous goods that are frequently parked at the premises (eg overnight) in the separation distances.

8.7.1 Principles of separation

Physical separation is the principal method of controlling risks by separating one hazard from another. This achieves both the purpose of protecting other areas from the dangerous goods and the dangerous goods from hazards arising in these other areas. Many Australian Standards refer to "protected works" and define this in terms of different types of "occupancies", buildings or structures.

Distances, or the use of effective barriers (such as fire rated walls or vapour barriers), or a combination of these, may achieve separation. The types of barriers used will depend on the nature of the risks to be isolated.

Examples of separation include the following:

- distancing the dangerous goods from people, other dangerous goods or protected works, pipelines, and other property, such that interaction is not possible
- decanting in a fume cupboard to control emissions
- storing incompatible dangerous goods in separate buildings; separated by a sufficient distance so that interaction is impossible and a serious incident in one area will not involve the other
- installing a screen wall that is a vapour barrier and has an appropriate fire resistance level (FRL).

8.7.2 Determining separation distances

When determining suitable separation distances consider the following factors:

- the hazards of the dangerous goods (ie Class and Subsidiary Risk) and the risks posed to other storage areas
- the quantity of dangerous goods in each location
- any other activities in the work area that may increase the risk
- any other existing control measures that will reduce the risk.

Separation distances are measured around barriers, which may be vapour barriers, screen walls or fire walls (see section 8.7.5).

8.7.3 Separation from property on adjoining premises (including "protected works").

For most dangerous goods, recommended minimum separation distances are specified in the relevant Australian Standard listed in section 1.7 of this code of practice. Some of these will apply only to storage and not to areas where the dangerous goods are used. These standards apply a variety of distances, depending on Class, Packing Group, quantity, and other factors.

Consider applying the following alternatives for deciding distances:

- the appropriate Class standard (eg AS 1940 for Class 3)
- AS/NZS 3833 for mixed classes
- a risk assessment and the application of other control measures.

8.7.4 Separation distances from on-site facilities

The determination of separation distances from on-site facilities (eg plant) is similar to that in 8.7.3 for off-site facilities, except that where the occupier can apply other control measures to the facilities, a risk assessment may indicate lesser distances.

8.7.5 Applying barriers

Separation distances between incompatible goods may be measured around screen walls and vapour barriers, provided they give equivalent protection as the separation distance.

To determine if barriers are effective, instead of or in conjunction with separation distances, consider the following factors:

- the types of hazards exhibited by the dangerous goods and the risks they pose to the barrier
- the length and height of the vapour barrier required and its effectiveness in varied climatic conditions
- appropriate fire resistance levels (FRL), especially for flammable goods, including the potential heat load from internal or external fires
- structural strength necessary to withstand weather
- structural strength or weakness necessary to minimise the consequences of any overpressure resulting from a serious incident (such as an explosion, unless weakness is a control measure).

8.7.6 Separation from ignition sources

An occupier must ensure that ignition sources in any hazardous area within the premises are eliminated, or if that is not reasonably practicable, the risk arising from an ignition source is controlled (OHS Regulation clause 174U).

Where flammable goods are handled or stored, identify any potential ignition sources.

Typical ignition sources include the following:

- sparks from electrical equipment (unless protected or intrinsically safe) – such as: switches, electric motors, transformers, fuse boards, fans, air conditioners, fridges and other equipment with thermostats, power tools, fans, air conditioners, battery chargers, computers, telephones, electric heaters and internal combustion engines (eg mowers, pumps and generators)

- naked flames – such as: torches for brazing or shrink wrapping, pilot flames in heaters, heaters using gas, liquid or solid fuels, incinerators and barbeques
- incandescent or heated material, hot surfaces or other sources of radiant heat
- heat from friction
- sparks from a mechanical source
- sparks from static electricity.

External lights above 3 m from ground level are not usually a risk.

For dangerous goods with a flammability or explosion hazard, distances determined from AS 2430.3 should be regarded as a minimum. Further advice is found in the Class or type specific Australian Standards listed in section 1.7.

For all other dangerous goods, ignition sources should be kept away as far as reasonably practicable even from those without a flammability hazard, due to the potential adverse impact of fires.

8.7.8 Segregation within a storage area

An occupier must ensure that dangerous goods are stored and handled separately from other incompatible substances and dangerous goods, so that loss of containment cannot cause a serious incident (OHS Regulation clause 174T).

Segregation means separation from other substances (including dangerous goods) so that a loss of containment cannot cause a serious incident.

If several types of dangerous goods are to be held in the one storage location, incompatibility is an important risk to be considered. Incompatible goods should be segregated. Signage of locations with the appropriate dangerous goods symbol ("diamond") and marking (eg lines painted on the ground) helps to maintain this. Normally the location should be used for one Class only. Other goods or items (apart from safety equipment) should not be kept in the location.

Advice on the segregation of packages of incompatible dangerous goods is provided in AS 3833 *The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers* (an approved industry code of practice).

Administrative controls in the form of systems and procedures are needed to ensure segregation is always maintained.

8.8 ENGINEERING CONTROLS

8.8.1 Principles

Engineering controls are measures that change the physical characteristics of structures, plant and processes to reduce the risk associated with the dangerous goods.

Effective containment of dangerous goods is an important control, specified in the OHS Regulation (clause 174Y). Occupiers are required to provide spill containment that will eliminate the risk of any spill or leak. If that is not reasonably practicable, control measures must reduce the risk so far as is reasonably practicable. Any dangerous goods that have spilled or leaked, and any effluent arising from an incident, must be safely contained within the premises so far as is reasonably practicable. It may not be reasonably practicable to contain gases that have leaked.

Engineering controls include ensuring the effectiveness and integrity of the following:

- valves
- pipework and connections
- tanks and pressure vessels
- packages
- containment of firewater.

Consider using engineering controls to achieve the following:

- minimising the generation of dangerous goods or release to the atmosphere
- containing or suppressing dangerous goods, including controlling vapours or dusts
- eliminating, confining or controlling hazardous processes or plant that may pose a risk to the dangerous goods
- protecting the dangerous goods from external hazards and environmental factors such as rain and sunshine
- limiting the area of contamination in the event of spills or leaks.

8.8.2 Types of engineering controls

Types of engineering controls include the following:

- totally or partly enclosing the dangerous goods, or external hazard
- adequate ventilation to eliminate flammable or toxic atmospheres (see further advice in section 9.9)
- blanketing exposed liquid surfaces with an inert atmosphere or sparging (bubbling gas through the liquid from below)
- automating processes to eliminate human error
- fitting sensors and controls for liquid levels, pressure and temperature – for example to reduce the risk of overflow, uncontrolled reaction, to minimise loss or the formation of hazardous atmospheres

- fitting control devices, alarms or shut down devices
- installing appropriately rated (protected) electrical plant and circuitry to minimise ignition hazards
- providing spill control to contain the largest foreseeable spill and to confine spills to avoid risks such as contact with incompatible goods or to limit spread in order to assist fire control (see further advice in section 9.7)
- constructing effective barriers between incompatible goods
- installing detection systems and alarms for hazardous atmospheres and fires
- installing suitable devices to protect installations from external hazards – such as a crash barrier to protect a storage tank from damage by moving vehicles
- installing suitable fire control systems, including fire suppression devices such as monitors (see chapter 12).

8.9 ADMINISTRATIVE CONTROLS

Administrative controls are systems of work or safe work practices that eliminate or reduce risk. They consist of properly designed and implemented work practices and procedures.

Administrative controls rely on people to implement them and diligently follow all the agreed work practices and procedures. To assist implementation, the complexity of such controls should be minimised. Workers are more likely to follow procedures if they have been fully consulted when developing and establishing them.

The controls should be matched to the skills and capabilities of the workers who will implement them. Training is an important component of ensuring workers have full knowledge of the correct procedures.

Supervision must be sufficient to ensure that workers follow these procedures. Supervision must be by a competent person.

Examples of administrative controls include the following:

- safe work procedures that describe the correct methods for performing all work activities, documenting these procedures, and training workers to use them
- operating procedures that ensure that the integrity of structures and plant is maintained at all times
- establishing inspection, maintenance, repair, testing and cleaning procedures to ensure other controls are maintained, and to ensure these procedures do not create risks
- controlling access to the storage and handling areas, for example preventing the use of the area as a thoroughfare
- where there is a fire or explosion risk, prohibiting the carriage and use of matches, lighters or spark producing tools
- regular housekeeping, including cleaning of contamination from walls and surfaces, dust and drip removal from work areas
- keeping lids on containers when not in immediate use
- procedures for spill clean up and decontamination

- procedures for waste disposal (including disposal of clean-up waste and contamination)
- developing and rehearsing emergency procedures
- procedures to ensure the provision and use of appropriate PPE
- procedures for "hot work" in or around the storage or handling area, such as welding or grinding (including work by contractors), such as using "permit to work" systems.

8.10 PERSONAL PROTECTIVE CLOTHING AND EQUIPMENT (PPE)

8.10.1 Principles of using PPE

Personal protective equipment (PPE) includes items such as overalls, aprons, gloves, dust masks, respirators, self-contained breathing apparatus, footwear, goggles or face shields, hard hats, and fully encapsulated suits.

The use of PPE relies on the users following instructions and procedures correctly. Consequently, a greater level of supervision may be required than for other procedures.

Even where not adopted as a regular control measure, PPE may still need to be readily accessible in the event of a failure of containment or an emergency (eg a serious incident).

PPE may be necessary in any of the following circumstances:

- where it is not reasonably practicable to achieve adequate control by other means
- where other controls could fail (eg where urgent action is required because of plant failure)
- during infrequent maintenance operations where the short duration of exposure to risk makes other control measures impracticable.

Employers must consult with employees about establishing the PPE program and the selection and use of appropriate PPE.

8.10.2 Sources of information to help selection

Check that the protective equipment used has the appropriate Australian Standard number on the label. Various standards not only provide specifications but also indicate the type to be selected.

Use labels and MSDS (material safety data sheets) as a guide. If in doubt as to suitability ask the supplier of the dangerous goods for a recommendation suitable for the intended use and circumstances. Also check the specifications provided by the supplier of the PPE. Preferably obtain this advice in writing.

8.10.3 Eye protection

The eyes are the most vulnerable parts of the body to chemical or physical damage, and the most difficult to repair surgically. In any area where there is the possibility of flying objects or where chemicals might splash, appropriate eye protection should be worn. This could be in the form of safety glasses, goggles, a face shield, or full-face respirator. Splashes are most likely when mixing, pouring and transferring and under eye protection may be necessary. If a worker normally wears ordinary spectacles it may be necessary to wear coverall safety glasses or a face shield over the top.

Australian Standard AS1336 *Recommended Practices for Eye Protection in the Industrial Environment* gives the requirements for the selection of the correct type of eye protection, which should conform to AS 1337 (*Eye Protection for Industrial Application)*, or where radiation protection is required, AS 1338 (*Filters for Eye Protection*)

8.10.4 Gloves, aprons and other equipment

Gloves may be necessary when decanting or preparing chemicals, or during maintenance and cleaning. Gauntlet gloves are usually appropriate to protect the lower arms and prevent splashes entering the glove. Check the MSDS, or the supplier for glove type. Rubber gloves are usually not sufficient. PVC, chloroprene rubber or nitrile rubber will be appropriate for certain chemicals, but confirm with the glove supplier on suitability of the glove for the dangerous goods used.

Select gloves that conform to Australian Standard AS 2161 *Protective Gloves and Mittens.*

Aprons, coats or overalls should be worn when there is a chance of a spill or splash, for example, during decanting or cleaning. Hairnets to control long hair may be appropriate in certain situations, such as when using naked flames or rotating machinery.

8.10.5 Respiratory protection

In some situations, respiratory protection will be necessary. An example is the use of a volatile solvent, where the solvent label specifies the use of a respirator or protective equipment. Sometimes the labels will use phrases such as avoid inhalation of vapour or dusts. Consult MSDS for information.

Select respirators that conform to Australian Standard AS/NZS 1716 *Respiratory Protective Devices* (which is an approved industry code of practice).

Respirators should be used, stored and maintained in accordance with the Australian Standard AS/NZS 1715 *Selection, Use and Maintenance of Respiratory Protective Equipment*. A respiratory program conforming to section 7 of AS 1715 would ensure maximum efficiency of the respirators.

Combined filters may be necessary (eg for both particles and vapour) depending on the type of dangerous goods used.

8.10.6 Footwear

Footwear is an important safety item. Good soles provide a sound grip reducing injuries from slipping. Footwear can also protect your feet from mechanical or chemical damage, especially where splashes are possible. Open footwear such as sandals is not appropriate.

Where impacts, cuts or chemical spills are possible, the footwear should conform to AS 2210 *Occupational Protective Footwear Part 2 Specification,* which provides information on the suitability of footwear, sole designs and materials for different types of surfaces (Part 1 provides information on selection, care and use).

8.10.7 Hearing protection

Select hearing protectors that conform to AS/NZS 1270 *Acoustics – hearing protectors*, which is an approved industry code of practice.

8.10.8 Suitability of PPE

Consult the MSDS (material safety data sheet) for advice on appropriate PPE.

When choosing PPE ensure that all of the following points are observed:

- the specification provides the required level of protection from the risks associated with the particular work task (see selection in 8.11 below)
- it meets an appropriate Australian Standard (or other recognised Standard) – look for the standard on the label or supplier's information
- it is suitable for the individual's size and build
- the wearer's need for mobility, dexterity, clear vision, communication and comfort are all considered, including factors such as heat stress
- it is used in accordance with the manufacturer's directions
- it is readily available, clean and in fully operational condition
- employees are trained in the use of the PPE, including the selection, maintenance and when to discard disposable PPE
- the employees wear the PPE as intended
- any necessary maintenance, such as cleaning, is carried out
- the likelihood of a secondary injury risk due to wearing PPE, such as skin rash or heat stress or dehydration caused by unsuitable clothing in hot conditions, has been assessed.

8.11 SAFETY SHOWERS AND EYE WASH FACILITIES

The need for safety showers, eyewashes or other washing facilities will depend on the actual risk. This may be necessary in addition to appropriate PPE.

For example, the requirements where packages are opened and substances handled with a risk of spills and splashes will be different from those in stores where the closed packages are handled – however, the risk could still be accidental breakage or puncture by forklift tines.

Corrosives and toxic substances will need to be removed immediately following accidental contact with clothing or areas of the body.

Where the packages are opened, consider the need for the following facilities:

- a safety shower conforming to ANZSI Z 358.1 or a plunge bath – however, where risk is lower, such as in a service station where batteries are handled, a domestic shower may be adequate (eg as part of the usual facilities)
- eye wash facilities conforming to ANZSI Z 358.1
- water for hand washing.

The facilities should be reasonably accessible – eg less than 10 m away, but not within 2 m from the store or work area to avoid possible contamination of the facility itself.

In work areas where the packages are always closed, water for hand washing should at least be conveniently provided.

Wash facilities should also be considered in areas where tankers are connected via hoses, pipes or valves, or other transfer from bulk storage is undertaken, at a suitable distance – eg between 2 and 7 m distance from the transfer point.

General hygiene is also necessary and you should check if other facilities such as toilets and showers are adequate for workers to decontaminate.

8.12 MAINTAINING AND REVIEWING CONTROLS

An employer must ensure that all measures (including procedures and equipment) that are adopted to eliminate or control risks to health and safety are properly used and maintained (OHS Regulation sub-clause 11(3)).

When incidents are reported, controls should be reviewed (see section 2.11).

Once control measures are in place, you should check that they have been implemented correctly and monitor their effectiveness. Regular reviews of effectiveness may be necessary.

Maintenance of control measures should include the following:

- frequent inspections
- visual checks to ensure that the controls are being applied
- testing and preventive maintenance of engineering controls and PPE.

CHAPTER 9 – CONTROL MEASURES GENERALLY APPLYING TO DANGEROUS GOODS

9.1 SCOPE OF THIS CHAPTER

In general, this chapter applies to the storage or handling of quantities above the placard quantity in Appendix 2 of this Code of Practice, or in bulk.

This chapter provides general examples of risks and typical controls, which may or may not be applicable for the dangerous goods handled or stored at a particular premises. The need for these controls should be indicated by the risk assessment. These controls are in addition to any specific measures indicated in subsequent chapters.

9.2 MAINTAINING CONTROL CONDITIONS TO ENSURE STABILITY

Some dangerous goods are highly reactive, self-reactive or unstable except when kept under controlled conditions. Information about the required level of stabilisers and/or other control temperatures is provided in the MSDS (material safety data sheet) or other information from the manufacturer or supplier. These control conditions should have been identified at the hazard identification stage – see section 6.2.

Dangerous goods must be stored or handled within the particular temperature range specified by the manufacturer (OHS Regulation clause 174R(2)(b)).

Maintain any recommended control conditions, including temperature and any specifications such as proportions and limits for ingredients that stabilize the dangerous goods.

Sufficient stocks of stabilizers should be on hand, allowing for potential supply shortages. Check containers for accidental loss of phlegmatizers or stabilizers from damaged packages.

If it is necessary to maintain a control temperature, ensure sufficient back up or contingency plans in the event of a failure of the cooling plant (eg failure of the refrigeration system).

If the dangerous goods react with water it is essential that the goods be kept dry.

Emergency plans should take into account procedures when control conditions are not maintained or fail – see chapter 14.

9.3 CONTROLS FOR ASSOCIATED PLANT

Examples of plant used with dangerous goods include:

- storage tanks
- pipework, and associated valves and pumps
- mixing vats
- dryers
- filters
- pressure vessels such as tanks
- gas cylinders.

The hazards and risks associated with the plant itself that could impinge on safety with dangerous goods must be controlled. When planning to use or commission plant, all the hazards and risks associated with the installation must be identified so that appropriate control measures can be incorporated. Employer duties for installation, erection and commissioning are described in clause 135 of the OHS Regulation.

Plant should be:

- commissioned only after it has undergone appropriate testing and procedures developed, with regard to the designer's or manufacturer's instructions, to ensure it can be operated safely
- operated only by personnel who have received appropriate training
- maintained and repaired to ensure that no additional hazards or risks arise due to wear and tear or breakdown (see section 9.10).

Portable and mobile appliances powered by LP Gas (apart from engines and vehicles) should conform to AS *2658 Liquefied petroleum (LP) gas portable and mobile appliances*.

Where industrial trucks such as forklifts are used in or near stores of flammable gases or liquids, hazardous areas must be identified. Each forklift used must be suitable for the zone within the hazardous area – see the advice in Appendix 8.

9.4 BULK CONTAINERS

Bulk containers are those containing dangerous goods that are larger than those classified as packages. Bulk containers are those with a capacity of more than 450 L or 400 kg for either liquids or solids, and 500 L for gases (volumes are based on water capacity of the container).

Where dangerous goods are stored in a bulk container, an occupier must ensure all of the following:

- the container and any associated pipework are provided with stable foundations and supports
- any pipework or equipment connected to the container is installed so as to prevent excessive stress on the container, pipework or equipment
- the container and any associated pipework are protected from deterioration (such as corrosion) (OHS Regulation clause 174X).

Deterioration of bulk containers and associated pipework from causes such as chemical reaction, impact, vibration, heat and ultraviolet light should also be considered.

9.5 UNDERGROUND AND MOUNDED TANKS

9.5.1 Risks

Placing tanks underground, or covering with mounds, helps to protect them from some risks, but can pose other risks.

Consider the following risks related to underground, partly underground or mounded tanks:

- failure of the structure, usually from corrosion, allowing the gradual escape of dangerous goods into the water table
- spills from above ground pipework and filling points
- risks arising from abandoned underground tanks when they cease to be used.

Underground seepage of a flammable or toxic liquid can accumulate and penetrate into low lying areas such as telecommunication pits and building basements. These risks may not become evident until after heavy rain has raised the watertable and displaced the dangerous goods accumulated in the soil around the tank.

9.5.2 Controls for underground tanks

Techniques are available to monitor the integrity of underground tanks and to detect leaks. They include inventory monitoring, sampling pits and electronic measures. Corrosion protection often requires specialist advice. Cathodic protection requires approval by the Department of Energy, Utilities and Sustainability under the *Electricity Safety (Corrosion Protection) Regulation 2003*.

Guidance on underground tank installations for petroleum products can be found in Australian Institute of Petroleum CP4 *Code of practice for the Design, Installation and Operation of Underground Petroleum Storage Systems*.

9.6 PROTECTION FROM IMPACT AND OTHER DAMAGE

Occupiers must ensure that containers of dangerous goods, and any pipework, attachments or other equipment, are protected from physical damage arising from activities in or on the premises. This includes the risk of impacts, imposed loads or mechanical stress (OHS Regulation clause 174ZB).

For example, guard against impact by vehicles, mobile plant or boats. Mechanical handling equipment for moving containers, including forklifts or overhead lifting grabs can cause damage to containers, either through mishandling or indirectly by moving the containers into other objects (such as projecting railings, structures or pipes).

The most effective ways to protect containers, their pipework, pumps and attachments from impact is to locate the containers away from trafficable areas or prevent vehicle access. Where vehicles come close to containers or items such as pumps, the need for physical barriers such as railings, bollards or stanchions should be considered.

9.7 SPILL CONTAINMENT

9.7.1 Principles of spill containment

Measures must be put in place to control the risks arising from the spill or leak of dangerous goods (OHS Regulation clause 174Y). See also section 8.8.2 in relation to applying this as an engineering control, in terms of the hierarchy of control.

The dangerous goods that have been spilled or leaked must be contained safely within the premises so far as is reasonably practicable.

Containment should be considered for any location where dangerous goods are stored or handled. All spills or leaks should be contained within a limited area and within the premises – risks to adjacent premises or public places should be eliminated. Any area or receptacle designed to contain goods spilt from a tank must not be shared with spill containment for substances that are not compatible.

In the event of a spill or leak of dangerous goods, the occupier must ensure that the following actions are taken:

- any risk associated with the spill or leak is immediately reduced as far as reasonably practicable
- the dangerous goods and any resulting effluent are cleaned up and disposed of or otherwise made safe, as soon as reasonably possible.

9.7.2 Extent of containment

Factors that will determine the extent of measures needed for spill containment include the following:

- for a liquid, whether it is mobile or viscous
- for a solid, whether it will melt in a fire or dissolve in firewater
- the quantity of the dangerous goods and the need to contain the size of the largest container or largest spill possible
- the consequences of a spill
- the need to contain or manage firewater (or other extinguishing materials) resulting from an incident
- compatibility with other goods that could be spilt
- the need to avoid containing excessive rainwater.

9.7.3 Design

Consider applying the following options for spill containment for liquids:

- providing drains to a purpose built on-site catchment, such as an interceptor or remote impounding basin
- grading the surface so that all spills are contained by the contours
- bunding the area to form a compound (see section 9.7.4 below)
- using double walled containers
- enclosing a tank with a partial or full height bund (in relation to the tank height).

The risks associated with the operation of the containment system should be considered at the design stage and included in the risk assessment. For example, a high bund wall around a package store would usually necessitate long or steep ramps being provided for forklift trucks. Such ramps can cause load instability, so another method of spill control may be more appropriate. For bunded stores, gently sloping floors away from entries may avoid the need for ramps. However, such slopes need to be minimised to avoid instability of materials handling equipment (eg forklifts) when placing loads in high-rise stacking (see also 9.7.5 – Draining into sumps and tanks).

Check the following factors to ensure the effectiveness of the containment method:

- the spill containment system is sufficiently impervious, and can hold the dangerous goods until the spill is cleaned up
- the materials used in construction (or for absorption) are compatible with the dangerous goods and appropriate to avoid contamination of ground water or soil
- spill containment areas are separated where the goods are not compatible or where the spread of the dangerous goods increases risks
- the capacity of any compound is sufficient for the volume of liquid to be contained (including a margin for firewater and rainwater)
- any bund wall or barrier should be high enough to catch all leaks
- absorbent materials, barriers and booms are provided where needed to contain a spill outside the areas where physical containment is provided or to assist clean up
- contaminated firewater can be removed during an incident if needed
- means are available for removing any rainwater that may accumulate in the area or compound when necessary.

If the design and location of the spill containment system may affect emergency services such as the fire brigade, consult with the emergency services authority.

9.7.4 Bunding

A bund is an embankment or wall, which may form part of the perimeter of a compound, designed to contain spills of liquids. Both the bund and the compound floor must be sufficiently impervious to retain spillage or leakage.

Bunding has the advantage that it can be retrofitted to existing buildings and installations.

For package stores and the transfer of dangerous goods, portable (ie self-contained) bunds may be suitable as additional containment. Plastic is an unsuitable material for a portable bund since it can melt in a fire, and may be chemically incompatible.

Bunding is a suitable method for above ground bulk storage installations. Where flammable goods are stored, hazardous areas may need to be determined (see section 9.8).

Suitable material for bund walls include the following:

- concrete kerbing, preferably reinforced and integrally constructed with the flooring. If separate, it must be firmly anchored or adhered, sealed and able to withstand any traffic damage
- brick or concrete block walls are only appropriate where they are protected from damage by material handling operations, such as forklift traffic
- steel angles or other sections firmly anchored to the floor and sealed (usually with a silicone based sealant).

Temporary bund materials include the following alternatives:

- raised earthen walls, preferably with an impervious membrane, unless contingency plans are in place for the recovery or disposal of contaminated earth after a spill
- bags of sand or other compatible material.

Bunds in unroofed areas should be provided with additional capacity to hold rainwater and run off, with a system for the removal of the rainwater. Rainwater should not be allowed to accumulate. Bund valves should not be left open to permanently drain rainwater. If water is to be pumped out, do not use a petrol powered pump inside a bund of a flammable liquid tank – to avoid an ignition source, use a pneumatically driven pump. Electric or engine driven pumps should not be used inside a bund or associated hazardous area without a hot work permit.

The height of the bund wall needs to include allowance for liquid squirting from a tank, or the highest package, not just leaks at ground level. The closer the wall to the tank or packages, the higher the wall needs to be. Spillage deflectors such as shields or double skinned tanks could also be used, if high enough to capture a leak from the top of the tank.

The need for easy egress from the bunded area should be considered, especially in an emergency – eg stairs if the bund is higher than 1 m.

Ensure rubbish does not accumulate inside the bund – eg remove dead trees and shrubs. Brush cutters and lawn mowers are potential ignition sources and should not be used near flammable liquid or gas tanks, especially during transfer. A hot work permit system may be necessary. Bund areas may require individual hazardous area zoning assessment. There may be circumstances where a bunded area may also be a confined space, for example if the bund walls are high or the tank is in a pit, and special procedures are necessary if workers enter this space.

9.7.5 Draining into sumps and tanks

Draining spilled liquids to an underground sump or tank, or to an external pit, avoids the access problems associated with bunds. However, the drain network, pit, tank or sump themselves become a potential source of hazards. Possible incompatibility of goods drained to the sump should be included in the risk assessment. Design needs to be to a suitable standard. Underground or covered sumps or pits should be designed to the standards for underground tanks.

Generally, each such containment system should be exclusively for the effluent from one store or work area, unless all the dangerous goods or combustible liquids are compatible and effective provision is made to prevent flashback through drain pipes.

Since such systems are usually out of sight, controls are needed to ensure they are fully available for use when required. These systems should be prevented from collecting rainwater.

9.7.6 Further advice

Further advice on spill containment is provided in the Australian Standards listed in section 1.7 relevant to the storage and handling of each class.

9.8 IGNITION SOURCES IN HAZARDOUS AREAS

An occupier must ensure that ignition sources in any hazardous areas within the occupier's premises are eliminated or, if that is not practicable, the risks arising from those sources are controlled (OHS Regulation clause 174U). This includes controlling the risk of the hazardous zone originating in the premises extending across boundaries to other premises.

9.8.1 Identifying hazardous areas

Hazardous areas are those areas where flammable or combustible gases, vapours dusts, fumes and mists may be present in a flammable or explosive concentration. Examples are areas where these are generated or evolved. The risk is that an explosive mixture with air can form in certain proportions.

It is important to identify the hazards contributing to the risk, such as the following:

- flammable vapours or gas evolving from dangerous goods
- oxidizing agents that may aggravate the risk of fire or reaction
- ignition sources including static electricity
- accumulation of combustible dust.

Combustible dusts may be "stirred up" by air currents or mechanical action and form an explosive dust/air combination. Undetected dust deposits are often found in ventilation ducts and on top of girders and plant – as little as 30 gm of combustible dust suspended in a cubic metre of air may be flammable. Substances that are not classified as dangerous goods may generate combustible dusts and become an ignition source – for example, coal dust and many food products, such as flour and nut shells. See also section 9.9.1 on "safe atmospheres".

The extent of the hazardous area needs to be determined in all areas where the flammable dangerous goods or those with a dust explosion hazard are stored or handled, or drain into spill control compounds. This includes identifying those dangerous goods in Class or Subsidiary Risk 2.1, 3, 4, or 5.

An occupier should identify hazardous areas by using one or more of the following methods:

- AS/NZS60079.10 Electrical apparatus for explosive gas atmospheres, Classification of hazardous areas, irrespective of the source of ignition
- AS/NZS61241.10 Electrical apparatus for use in the presence of combustible dust, Classification of areas where combustible dusts are or may be present, irrespective of the source of ignition
- AS/NZS 2430.3 2004 parts 1 to 9: Classification of hazardous areas – Examples of area classification
- appropriate modelling and calculations.

Advice on the risk assessment of combustible dusts is provided in AS 4745 *Code of practice for handling combustible dusts*.

The next step is the identification of ignition sources.

9.8.2 Identifying ignition sources

Ignition sources in hazardous areas must be eliminated or if this is not reasonably practicable, controlled (OHS Regulation clause 174U).

An ignition source is any source of energy sufficient to ignite a flammable or combustible atmosphere. Heat sources can increase the evolution of vapour or cause auto ignition (self-ignition).

Examples of ignition sources include the following:

- naked flames, including blow torches, shrink wrapping equipment, stoves, heaters using gas, liquid or solid fuels, pilot lights, dryers, cigarettes, lighters, matches, incinerators or barbecues
- static electricity (see 9.8.5 below)
- heat from appliances or from chemical or biological reactions
- heat from friction
- sparks from moving parts, such as fan blades rubbing nearby surfaces
- sparks from grinding, welding or metal to metal impact from tools or plant
- internal combustion engines, especially the high voltage ignition system – eg lawn mowers, pumps or generators
- heated surfaces including hot exhausts or hot carbon particles from the exhaust
- electrical equipment not rated for the hazardous area, such as power points, switches, lighting, appliances, fans, any equipment with a thermostat such as air conditioners, power tools and battery powered forklift trucks
- radio transmitters and mobile phones
- oily material that may self-ignite, such as seed cake from seed oil extraction, oily rags or waste.

Potential ignition sources outside of the hazardous area should also be considered in relation to spills or leaks. Flammable liquid vapours are heavier than air and tend to flow by gravity along natural channels and drains.

9.8.3 Controlling ignition sources – electrical equipment in hazardous zones

The ignition risks of electrical equipment located within a hazardous area can be controlled by providing wiring, switching and equipment protection suitable for use in the particular hazardous zone.

Guidance on electrical protection systems is provided in AS 1482 *Electrical equipment for explosive atmospheres – Protection by ventilation*.

All electrical installations must comply with AS 3000 *Electrical wiring rules*, which is mandatory under the *Electricity Safety (Electrical Installations) Regulation 1998* (this references AS 1939 *Degrees of protection provided by enclosures for electrical equipment*).

Other relevant Australian Standards relating to electrical equipment include: AS 1826 *Electrical equipment for explosive atmospheres – Special protection – type of protection S*, and AS 2431 *Electrical equipment for explosive atmospheres – Encapsulated apparatus – Type of protection M*.

9.8.4 Restrictions on possession of ignition sources

As an administrative control, procedures should be established to ensure that people do not take any substance or article with the potential to be an ignition source into or near a hazardous area – 3 m is a suitable minimum separation distance.

Where an ignition source is required in an operation in or adjacent to a hazardous area, a formal "hot work permit" system should be used. Some Australian Standards, such as AS 1940, provide detailed guidance on "hot work" in areas where dangerous goods are stored or handled. The work permit should clearly identify the limit of the work area and prohibit entry into the hazardous area.

9.8.5 Static electricity

Static electricity may be generated by movement such as the following:

- pouring, pumping, stirring and high velocity flow, particularly dry powders and liquids of low electrical conductivity, eg most petroleum products
- dry streams of gas, eg air or hydrogen
- personnel, especially when wearing, putting on or removing clothing and footwear of low conductivity – some protective clothing, eg those made of synthetic fibres, may not be static resistant and care should be taken in its selection
- application and removal of plastic wrap
- particulate or aerosol spray, eg spray painting or the rapid discharge of a carbon dioxide extinguisher
- moving plant.

Observe the following to reduce risks from the discharge of static electricity:

- all tanks, pipework, transfer systems (including decanting) and process plant associated with dangerous goods should be electrically bonded to each other and earthed, or otherwise protected (see AS 1020 for advice)
- use anti-static additives in non-conductive liquids
- workers should wear conductive clothing and footwear
- avoid the use of non-conducting plastics or rubber hoses, containers or funnels.

9.9 VENTILATION AND THE CONTROL OF ATMOSPHERES

An occupier must ensure that any atmospheric emissions from dangerous goods that are toxic, corrosive, flammable, explosive or asphyxiant are eliminated or, if that is not reasonably practicable, reduced so far as is reasonably practicable (OHS Regulation clause 174V).

An employer (or self-employed person) must also ensure that for toxic substances that no person at a place of work is exposed to an airborne concentration of an atmospheric contaminant over the limits prescribed in the *Adopted National Exposure Standards for Atmospheric Contaminants in the Occupational Environment* (OHS Regulation clauses 50 to 53).

The above provisions do not necessarily apply to nuisance odours, which may be smelt at levels below those presenting a health or safety risk.

9.9.1 Safe atmospheres

Ventilation is a means of maintaining a safe atmosphere by the introduction or recirculation of air; by natural, forced or mechanical means. Maintaining a safe atmosphere in the storage and handling area is an important control measure. Recirculation should be avoided unless precautions are taken to detect and avoid harmful contamination, and prevent accumulation of contaminants. Recirculation should only be used where temperature control is required.

A safe atmosphere is one in which all of the following conditions are met:

- there is a safe oxygen level for breathing (19.5 per cent to 23.5 per cent by volume at normal atmospheric pressure)
- the concentration of atmospheric contaminants are below the limits set in the relevant exposure standards
- the concentration of flammable or combustible gases, vapours, mists, fumes and dusts is below 5 per cent of the lower explosion limit (LEL)
- the build-up of heat and extremes of temperature is avoided, since this may change risks.

To maintain a safe atmosphere, testing and monitoring may be required, consistent with the risks identified in the risk assessment. See section 9.9.6 in relation to persons working in a confined space.

Advice on the control of worker exposure to atmospheric contaminants is provided in the *Code of practice for the control of workplace hazardous substances*. The *Code of practice: working in hot or cold environments* may also need to be consulted.

9.9.2 Design considerations

A ventilation system should operate exclusively for the particular building, room or space. Where this is not achievable, the system may be linked to another area provided that there is not an increased risk from any incompatible goods, or any other hazard. Ensure that air-conditioning or ventilation does not spread flammable or harmful vapours to other areas or rooms. Separate systems may be required.

Local exhaust ventilation may remove airborne contaminants before they reach the breathing zone of personnel in the area. This is usually more effective than an increase in general ventilation: general dilution ventilation should only be considered for contaminants of low toxicity and where the quantity of contaminants evolved is small.

Ventilation systems should be suitable for the types of dangerous goods on the premises. For example, where there are dangerous goods with vapours denser than air, fumes should be removed from the lowest point (just above any spill containment) and fresh air introduced from above. The exhaust system and ducting should be resistant to attack by the vapours, mists or dusts being exhausted. The risk of fire propagation can be dealt with by self-closing fire dampers, but the risk of spreading flammable but not yet ignited vapours, toxic vapours or dusts must also be considered.

Vents that may exhaust flammable atmospheres should be located away from any potential ignition sources. Fresh air should be drawn from a source uncontaminated by exhaust air or other pollutants.

Exhaust air should be discharged where it will not cause other risks and in compliance with environmental legislation concerning discharges to atmosphere. Environmental standards for airborne contaminants are prescribed in relation to public health by Regulations under the *Protection of the Environment Operations Act 1997*. To protect the environment it may be necessary to fit some mechanism to clean the exhaust of atmospheric contaminants prior to discharge to the atmosphere. Suitable mechanisms may include filtration (for particulates), absorbents, catalysts, scrubbers or burners.

Administrative controls are necessary to ensure that vents remain unobstructed by goods or material.

Most of the Australian Standards covering individual and mixed Class storage and handling provide further advice on ventilation.

9.9.3 Mechanical ventilation

Inlet and outlet vents should usually be located on opposite sides of the storage area at low levels to provide airflow across the floor.

Where both inlet and exhaust are mechanically assisted, capacities and rates should be adjusted to ensure that the pressure inside the store never exceeds that outside, and airflow into any adjoining work areas and offices from the store is prevented.

9.9.4 Local exhaust ventilation

Mechanical extraction of atmospheric contaminants at their source is usually more effective than the provision of general ventilation. This may be necessary to prevent exposures of workers or the public.

Extraction vents should have sufficient capacity under all atmospheric conditions. Discharge points should be located so as to prevent further contamination of the storage or handling areas, or other work areas.

Extraction ducting should not be linked to multiple items of plant if there is any risk of fire spreading through the ducting. Provision against flashback may be necessary.

AS 1482 *Electrical protection for explosive atmospheres – Protection by ventilation* provides further advice.

9.9.5 Natural ventilation

Most vapours from dangerous goods are denser than air and may accumulate near floor level. To prevent build up of hazardous concentrations, vents should be provided at a level immediately above any spill containment, on the opposite sides of a room or space, to provide for airflow across the storage or handling area. High level ventilation may be necessary for temperature control (eg roof vents to allow the escape of warm air).

Vents in a screen wall may negate any fire protection or vapour barrier effects.

9.9.6 Purging and work in confined spaces

Purging is used to displace an atmospheric contaminant from an enclosed space. For example, purging may involve the use of an inert gas such as nitrogen to clear flammable gases or vapours before work commences. The risks associated with the gases removed from the space also need to be considered, or exhausted to a location where they do not present a hazard.

Interiors of bulk containers, such as tanks, that have held dangerous goods will usually be confined spaces and special procedures are required if workers need to enter inside containers or vessels prescribed in the OHS Regulation clauses 66 to 78. Because of the possibility of reduced oxygen levels or residual contamination, safe entry procedures are necessary. Atmospheric sampling, monitoring, or the use of breathing apparatus may be required.

Following purging, the confined space should be adequately ventilated and retested. The reduction in hazard may be temporary, for example flammable gases absorbed into the walls of a steel tank or from deposits may leach out and recreate the flammable atmosphere. Since contaminants may build up again, consider whether it will be necessary to re-purge the space.

Purging should be undertaken in a manner that will not cause rupture or collapse of the container due to pressure differentials. Avoid damage to the container by over-pressure or a vacuum. Pressure relief valves must be operational. Condensing steam may cause a tank collapse if vents are blocked. Note that the use of oxygen or gas mixtures with oxygen in a concentration greater than 21 per cent is prohibited for purging or ventilation of a confined space, due to the risk of fires or explosions (OHS Regulation sub-clause 70(2)).

9.10 REGULAR CLEANING, MAINTENANCE AND INSPECTIONS

9.10.1 Keeping risks low

Regular checks, inspection, maintenance and cleaning programs are essential for maintaining control measures and keeping risks low. All plant must be subject to appropriate checks, tests and inspections necessary to minimise risks to health and safety (OHS Regulation clause 136(3)(m)).

A safety check should be carried out on all containers regularly, or at the beginning or each season or work period, if the container is not in continuous use. Check that maintenance schedules recommended by the manufacturer of plant are kept.

Arrange for a comprehensive and detailed examination of storage containers and associated plant by a competent person at intervals recommended by the manufacturer, or more frequently in harsh environments such as near seawater or where factors such as the nature of the stored material could cause corrosion.

If a container or any other item of plant presents an immediate risk, it must not be used (OHS Regulation clause 136(3)(n)) until the risk is eliminated, or if this is not practicable, controlled.

Maintenance or repair of plant may involve "hot work" processes that generate heat or introduce ignition sources, such as welding or grinding. The risk of fire and explosion must be controlled. A formal "hot work permit" system should be implemented (for examples of a written authority, see appendix H of AS/NZS 2865 *Safe working in a confined space*, and AS 1674.1 *Safety in welding and allied processes – Fire precautions* in relation to welding).

9.10.2 Key areas for inspection and maintenance

Examine containers and associated plant in accordance with the manufacturer's instructions (operator's manual) to ensure they are in a safe operating condition, prior to use and on a regular basis. Where use of a container or plant is seasonal or periodic, an inspection should take place at the beginning of each season or work period. Intervals for comprehensive inspection will be determined by the type of product stored and any external environmental factors.

The following items should be included in a regular inspection and maintenance program, where relevant:

- filling devices, valves and control mechanisms used for transfer
- any safety devices fitted to plant
- air or dust filters, and dust control system for operation, cleanliness and integrity
- pressure relief valves for correct operation
- electrical equipment, including leads and cables
- warning signs and labels for wear and fading
- operation of any warning devices and high level detection systems.

The structural integrity of bulk containers and associated plant should be checked for fatigue and failure. Evidence of structural problems includes visual checks for the following:

- damage to metalwork, bolts or welds such as surface corrosion
- damage to supports of containers or tanks
- settlement, cracking, or damage to concrete; footings, foundations, slabs or exposed plinths
- corrosion of access points such as ladders, stairs, walkways and platforms, including fixing at attachment points
- damage to dust or fluid seals, and the integrity of dust control systems
- any visible bulging or distortion of containers.

Pressure equipment must be inspected in accordance with AS 3788 *Pressure equipment – In service inspection* (OHS Regulation sub-clause 140(1)(a)). AS 3873 *Pressure equipment – operation and maintenance* provides further advice and should be observed (it is an approved industry code of practice – see section 1.8).

Faults that could cause heat or sparks, such as over-heated bearings or slipping drive belts need immediate attention if the stored goods is flammable or combustible.

Arrange for remedial work to be carried out by a competent person if any fault is observed (see below).

9.10.3 Remedial work

All maintenance and repair work should be carried out by a competent person, and in accordance with the designer's or manufacturer's instructions, including the time periods for inspection and maintenance (OHS Regulation clause 137).

Ensure that all electrical work is carried out only by qualified and licensed persons and to appropriate standards. The appropriate protection is especially critical if electrical equipment is used in a hazardous zone.

Repairs carried out must keep plant within its design limits (if modified see section 9.10.6 on page 110).

9.10.4 Cleaning

Regular cleaning is essential to reduce hazards resulting from dusts and combustible materials, especially before starting plant. Some dusts are combustible or can form an explosive atmosphere and these risks should be identified.

A regular cleaning program should include removing dust deposits from any exposed surfaces or accumulated material inside a container (eg by internal cleaning).

Dust hazards, fire risks and explosion risks may arise during cleaning, and any equipment used (eg vacuum systems for dust removal) should be suitable for use in such an atmosphere.

Safe work procedures should be established for cleaning or clearing any plant. When plant and equipment is being cleaned, it should be isolated to prevent operation. A lockout and tagging system should be considered.

9.10.5 Records

Keeping records of maintenance, inspections and repairs will help to confirm that the maintenance program is carried out regularly.

Records must be kept for some types of pressure vessels and boilers (OHS Regulation, clauses 131 and 143).

9.10.6 Modifications to plant

Consult the manufacturer or supplier, or an appropriately qualified engineer, before carrying out structural modifications to plant (including a container).

If contracted out by an employer (or self-employed person), they must ensure that the person engaged to design the plant modification is provided with all the relevant information about the matters relating to the plant that may affect health and safety (OHS Regulation, clause 144(3)).

A person modifying a design takes on the legal obligations of a designer and manufacturer. A number of Australian Standards provide advice in relation to plant or containers used with dangerous goods.

9.10.7 Cleaning of decommissioned containers

Any container that has contained dangerous goods must be cleaned when decommissioned and before it is disposed of.

Specific advice is provided in AS 1940, in other Australian Standards and industry codes for underground tanks – see section 10.8.3 of this code of practice. See also section 10.21 for decommissioning, abandonment and disposal.

When decommissioning containers, consider including the following procedures:

- control risks arising from any mechanical cutting, oxy-acetylene cutting, grinding or any other activities involving heat or friction
- safe storage or disposal of any waste generated
- if persons are required to work inside the container, follow confined space entry procedures (see section 9.9.6).

9.11 WORKING INSIDE BUILDINGS ON PLANT (INCLUDING TANKS AND TANKERS THAT HAVE CONTAINED FLAMMABLE GOODS)

Care is needed in relation to work, such as repair and maintenance work on a tank or tank vehicle (tanker) which has contained flammable goods (Class or Subsidiary Risk 2.1 or 3 of PG I or II), if it is inside a building that is enclosed on more than two sides, due to the risks of hazardous atmospheres.

If the work involves the actual tank or ancillary plant that has contained flammable goods, or "hot work" near the tank or plant, the tank should be gas free. A hot work permit system should be used, including a gas free certificate and possibly continuous monitoring. This usually involves an examination by a competent person to determine it is gas free.

9.12 BUILDINGS

The design and choice of appropriate buildings is an important control measure, especially in relation to fires. Building design is covered in section 8.3.4.

9.13 GAS INSTALLATIONS FOR PLANT

The work of installing gas supply for stationary engines, such as auto gas and CNG, is governed by the *Dangerous Goods (Gas Installations) Regulation 1999* under the *Gas Supply Act 1996*.

CHAPTER 10 – CONTROLS FOR SPECIFIC DANGEROUS GOODS

10.1 USING THIS CHAPTER

This chapter provides advice on specific classes and types of dangerous goods, to be interpreted in addition to the previous more general chapters. Following the identification of dangerous goods in chapter 3, and the advice in chapters 6 to 9, check through this chapter for specific advice on the Class or Subsidiary Risk of the dangerous goods stored or handled at the premises.

Most of the Australian Standards referenced in this chapter have approved code of practice status. When determining control measures conformity with the relevant Australian Standard should be verified.

This chapter applies to storage above the placard quantities (see Appendix 2, this includes all bulk tanks) and to the handling of any quantity where containers are opened.

10.2 MIXED CLASSES OF DANGEROUS GOODS IN PACKAGES

As alternatives to the Class specific Australian Standards indicated in this chapter, the following two Australian Standards provide general advice for the storage of packages applicable to a wide range of situations:

- AS/NZS 3833 *The storage and handling of mixed classes of dangerous goods in packages and intermediate bulk containers*
- AS/NZS 2507 *The storage and handling of agricultural and veterinary chemicals* (applies to dangerous goods broadly described as agricultural, particularly at warehouses, including toxic substances of Class 6).

10.3 GAS CYLINDERS (CLASS 2 DANGEROUS GOODS)

Used or "empty" cylinders should be treated with the same precautions as for "full" cylinders, since residual hazards remain.

10.3.1 Testing and maintenance of gas cylinders

Occupiers must ensure cylinders are inspected and tested in accordance with AS 2030 (OHS Regulation sub-clauses 140(2)). A person who hires or leases gas cylinders must ensure they are inspected and maintained in accordance with AS 2030 (OHS Regulation sub-clause 129(b)).

Gas cylinders require periodic testing – at least every 10 years for dry gases and more frequently for damp or corrosive gases – check with the gas supplier if you need advice. The last test date is stamped on the cylinder near the valve or on the "collar", or on the footring of some small cylinders. If outside the "test period", it must not be refilled before it is re-tested (and receive a new date stamp). However, it is permissible to use up the cylinder's contents after its test date has expired, prior to testing. Alternatively it could be replaced with a new cylinder. Testing stations can give advice on disposal of a used cylinder if you wish to replace it. Owners of cylinders should keep records of testing and test dates.

Gas suppliers can advise on suitable test stations. Test stations should observe AS 2337 (an approved industry code of practice – see section 1.8) for inspections and tests.

10.3.2 Storage and handling of gas cylinders – general

In general, it is good practice to ensure the following:

- any cap provided for use with a cylinder is kept in place on the cylinder at all times when the cylinder is not being filled and not connected for use
- the cylinder valve is kept securely closed when not in use, including when "empty" (unless the cylinder is connected by permanent piping to a consuming device)
- any removable valve protection cap or valve outlet gas tight cap or plug is kept in place on the cylinder at all times (unless the cylinder is being filled or connected for use)
- keep the cylinder secured against unintended movement, such as falling over
- do not lubricate valves or attempt repair of leaks – if the valve is not closing properly, immediately remove the cylinder to a safe area outdoors and call the gas supplier
- have a water hose or fire extinguisher handy to put out any small fire close to the cylinder – a water spray can also be used to keep the cylinder cool in the event of a fire.

A cylinder of Class 2.1 liquefied flammable gas must always be positioned so that the safety relief device communicates directly with the vapour space within the cylinder (OHS Regulation clause 174ZZA). Keep the cylinder upright, unless of a design where other positions are permitted – this depends on the position and operation of the relief device. If in doubt check the manufacturer's or supplier's instructions.

Part 5.2 of AS 4332 *The storage and handling of gases in cylinders* provides additional advice on general precautions.

10.3.3 Gases in cylinders – specific standards

Where Class 2 dangerous goods are stored and handled, observe the relevant Australian Standard, especially in relation to separation distances and ventilation.

The following Australian Standards should be observed for the storage of the following gases in cylinders:

- anhydrous ammonia (Class 2.3) – AS 2022
- cryogenic fluids – AS 1894
- chlorine liquefied – AS 2927
- natural gas liquefied AS 3961
- petroleum gas liquefied (LP Gas) – AS 1596
- where several types of gas are stored observe the relevant parts of AS 4332 *The storage and handling of gases in cylinders*.

AS 4332 does not apply to cylinders connected for use (except for "minor storage"), gases in Dewar flasks or other containers not covered by AS 2030, or part of a fire control system.

Additional advice can be found in the following:

- for portable or mobile oxy-fuel gas systems – AS 4839 *The safe use portable and mobile oxy-fuel gas systems for welding, cutting, heating and allied processes*
- cylinders of oxygen and acetylene that are connected to a reticulation system – AS 4289 *Oxygen and acetylene gas reticulation systems*.

10.4 STORING AEROSOLS AND SMALL DISPOSABLE CYLINDERS

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 Aerosols (non-refillable receptacles with contents under pressure and fitted with a release device)
- UN 2037 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 1,000 kg of aerosols or disposables of Class 2.1 (flammable) or 2.3 (toxic) are kept within an 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).

See section 11.11 for advice on filling small gas cylinders, disposable cylinders and aerosols.

10.5 STORAGE AND HANDLING OF GASES IN BULK (SUCH AS TANKS)

10.5.1 Item registration of vessels such as tanks

Bulk containers of gas (tanks, receivers and other vessels) need to be item registered with WorkCover, renewable annually (OHS Regulation, clauses 113-119). This applies to both storage and use of gas (eg it applies to receivers and heat exchangers fitted to plant). Registration is not required for some low hazard applications – vessels in hazard level D according to AS 4343, vessels not requiring internal inspection under AS/NZS 3788, and serially produced vessels under AS 2971. Automotive LP Gas vessels are item registered as part of the vehicle registration process.

As part of this item registration, you need to know the design registration number. The manufacturer or importer must also register the design with WorkCover or another jurisdiction under a recognised equivalent law. There are mandatory design standards for pressure vessels – see section 1.9.

10.5.2 Standards to observe for gas in tanks

The following Australian Standards should be observed for specific gases in bulk, such as tanks:

- anhydrous ammonia (Class 2.3) – AS 2022
- cryogenic fluids – AS 1894
- chlorine liquefied – AS 2927
- natural gas liquefied – AS 3961
- petroleum gas liquefied (LP Gas) – AS 1596.

These Standards are adopted as approved industry codes of practice in NSW (see section 1.8).

10.5.3 Unodorized liquefied petroleum gas (LP Gas) or dimethyl ether – Class 2.1 (flammable)

Unodorized LP Gas is particularly hazardous due to the absence of any discernable odour. Dimethyl ether (DME) is also often used as a propellant.

The following control measures are recommended:

- keep the storage and handling of un-odorized LP Gas or DME to a minimum, and restrict uses to those for which no less hazardous alternative is available (eg aerosol propellant)
- the area where it is stored and handled should be well ventilated, or in a room designed for that purpose fitted with explosion ventilation, or in the open
- even a small leak, if undetected, may result in the accumulation of any explosive atmosphere. Gas detection equipment should be installed to detect gas where an explosive atmosphere could develop and provide automatic alarm above 25 per cent of the lower explosive limit. The gas detector should emit an audible sound and have a visual display.

See also the advice in section 10.4.2 on filling aerosols and other disposable containers.

10.5.4 Toxic gas in tanks (bulk) – separation distances

Where a type specific standard is available, the conditions and separation distances in the standard should be observed (eg AS 2022 for ammonia and AS 2927 for chlorine, see section 10.5.2).

For some toxic gases there are no relevant Australian Standards. Examples are mixtures of hydrogen and carbon monoxide or other gases, such as those produced by coke ovens. For tanks of such toxic gases (Class or Subsidiary Risk 2.3), the separation distances in the following table should be observed:

Separation distances applying to tanks of toxic gas where a type specific Australian Standard does not apply		
Quantity of toxic gas (Class 2.3 or Subsidiary Risk 2.3) – actual volume (not water capacity)	Up to: 600 cubic metres (STP) if compressed gas, or 2,000 kg or L if liquefied	Over: 600 cubic metres (STP) if compressed gas, or 2,000 kg or L if liquefied
Separation from exposure to:	**Separation distance (metres):**	
Public place	15	30
Protected work	30	60
Another store of dangerous goods (except toxic gas)	15	25

10.6 RETICULATION OF GAS (EG PIPING) WITHIN PREMISES

The following Australian Standards should be observed in relation to gas reticulation through pressure piping within a premises:

- oxygen – AS 4289 (unless medical oxygen)
- medical oxygen – AS 2896 *Medical gas systems – Installation and testing of non-flammable medical gas pipeline systems*
- acetylene – AS 4289.

These Standards are adopted as approved codes of practice in NSW (see section 1.7).

Pipework related to gas fuelled engines such as auto gas and CNG is governed by the *Gas Installations Regulation* under the *Gas Supply Act 1996*.

10.7 FLAMMABLE LIQUIDS IN PACKAGES (CLASS 3 AND SUB-RISK 3 DANGEROUS GOODS)

10.7.1 General

Australian Standard AS 1940 provides useful advice on storage and handling of flammable liquids including aspects such as package stores, tank design, pipework and valves. Advice on safe blending of flammable liquids and package filling is provided in Appendix M of AS 1940.

Sections 10.8.2 to 10.8.5 beginning on page 119 summarise aspects relevant to specific situations.

Since the Packing Group indicates the flammability risk, storage conditions are determined by Packing Group (PG). Typical examples are: diethyl ether is in PGI, ethanol solution above 70 per cent concentration is in PG II, petrol is in PG II and household kerosene is in PG III. Oils are usually combustible liquids – you need to know which are classified as C1 by AS 1940. Check the MSDS for the Packing Group – generic names such as "mineral turpentine", "paint thinners" or "white spirit" may have widely varying specifications and flashpoints.

10.7.2 Packages – up to 850 L of flammable liquids

A flammable liquids cabinet (conforming to AS 1940) is the simplest method for storing small quantities of packages, up to 850 L in total. Dispersal of cabinets around the premises may reduce the potential fire load.

10.7.3 Package stores – up to 4000 L of flammable liquids

The cheapest and simplest way of storing packages is usually in an external store (ie external to the work area and other buildings). It should have all of the following features:

- a concrete floor
- a liquid tight bund of concrete or masonry at least 200 mm high (or higher if necessary)
- ventilation is provided in the building walls above the bund height, by either being:
  - open on all sides, enclosed with mesh (to keep drums from falling out)
  - semi-enclosed with ventilation (either gaps at the top and bottom on three or four sides covered with mesh
  - enclosed with two vents on opposite walls each of an area 0.15 m^2 for each two metres of wall length.
- Appropriate signage is displayed (see chapter 15).

Suitable minimum separation distances for the package store are:

- 8 m from ignition sources, and 15 m from any operation that could produce sparks such as cutting or welding, unless barriers are used
- 5 m from all buildings and fire hazards such as combustible materials on the premises or adjacent premises
- if packages are not opened: 3 m from the boundary of the premises or ignition sources protected by barriers
- if packages are opened, such as for filling or transfer: 5 m from any car park or temporary ignition sources, 8 m from the boundary of the premises and fixed ignition sources protected by barriers.

10.7.4 Ethanol solutions and potable liquids

Ethanol solutions include potable liquids (such as beverages, flavours and fragrances). Solutions above 24 per cent and up to 70 per cent are assigned to Packing Group III even if their flashpoints are below 23°C. Solutions above 70 per cent are in PG II. Solutions below 24 per cent by volume are not classified as dangerous goods.

Because they are readily miscible with water, sufficient dilution with water during fire fighting will remove the flammable danger of the alcohol solution. Consequently, for spillage control, dilution may be preferable to containment (but consider environmental protection and disposal). An adequate sprinkler deluge system should provide effective fire protection.

Adequate ventilation in the storage and handling areas is necessary to avoid flammable or explosive atmospheres, and the personal exposure of workers to alcohol vapour to avoid intoxication.

Potable liquids in consumer packages at a retail outlet are excluded from this code of practice.

10.7.5 Paint, glue and other "manufactured product" in packages

The term "manufactured product" applies to substances containing a flammable solvent. The definition and tests are in the ADG code. This definition is based on three criteria: containing at least 10 per cent non-volatile material, less than 3 per cent solvent separation and of a suitable viscosity. Typical examples are paint and glue. Check with the MSDS or supplier to determine the classification as "manufactured product".

Due to viscosity and low degree of solvent separation, the risks with "manufactured product" are lower than other flammable liquids. AS 1940 provides certain variations depending on the size of the package (where unopened), the Packing Group and the type of premises.

However, solvents are frequently used and kept with the "manufactured product". Unless separated, these variations do not apply and the same storage conditions should be applied to the "manufactured product" as to the solvent (ie as specified in section 10.8 on page 119 or AS 1940).

"Minor storage" rules in AS 1940 apply to manufactured product for:

- Under 2,000 L in a factory
- Under 2,000 L of PG II in a warehouse or shop
- Under 10,000 L of PG III (including up to 2,000 L PG II in the same area) in a warehouse or shop.

Under these quantities no special precautions are recommended apart from the general advice in section 4.3 of chapter 4.

Over those quantities a special store is recommended, conforming to AS 1940, or the advice in section 10.7.3 above.

10.8 BULK FLAMMABLE AND COMBUSTIBLE LIQUIDS (TANKS)

10.8.1 General

Bulk flammable liquids (Class 3 or Subsidiary Risk 3) and combustible liquids should be stored and handled in accordance with AS 1940.

10.8.2 Carbon disulphide

Carbon disulphide is very volatile, highly flammable, and also has a low ignition temperature that makes it readily combustible. Vapours are easily ignited by surfaces such as a light bulb, a warm steam pipe or a hot exhaust pipe and such heat sources should be avoided. Surface temperatures of plant and other equipment should not exceed 80° Celsius – check the auto-ignition temperature in the MSDS. Special explosion protection is needed if any electrical equipment is used near the carbon disulphide, such as ceiling lights, exhaust fans or forklifts.

Packages should be stored in a well ventilated area. Do not store re-opened containers.

Where carbon disulphide is kept in tanks, observe all of the following:

- tanks should be constructed of welded mild steel
- the tank(s) should be within a pit or enclosure, impervious to water and carbon disulphide
- the pit or enclosure should be filled with water to a volume at least equal to that of the tank (or aggregate of all tanks)
- the ullage space in the tank(s) should be filled with water or an inert gas.

Some fire fighting foams may be ineffective. Use dry chemical, carbon dioxide or other inert gas on small fires.

10.8.3 Abandoning or removing underground tanks of flammable and combustible liquids

Dangerous goods must be removed prior to abandoning underground, partially underground or fully mounded tanks (OHS Regulation clause 174ZF). Placards and signs relating to the dangerous goods must also be removed.

If two years have elapsed since dangerous goods were put in or taken from the tank that is mounded, partly underground or underground, then it must be abandoned (after removing the dangerous goods) in accordance with AS 1940 *The storage and handling of flammable liquids*, and WorkCover notified within seven days.

Any work on existing or abandoned underground tanks or associated pipework is potentially dangerous and can cause explosions unless suitable procedures are adopted. Tar like deposits and oily rust and sludge may have accumulated in the tank and pipe work. Flushing with water will not remove them and vapour testing does not detect this. Exposure to the air, sunlight and normal temperatures, or work involving heat (eg use of grinders or oxy-acetylene cutting), is likely to release vapours that can explode.

One of the following options should be adopted:

a. Remove the tank from the ground and transport to a disposal area.

b. Fill the tank with an inert solid material such as concrete or sand.

c. If it is intended that the tank be used again (within two years), fill the tank with water and a corrosion inhibitor.

For options (a) or (b) above, the following work procedures should be observed:

- the work should be carried out only by a competent person, complying with AS 1940, the Australian Institute for Petroleum (AIP) Code of Practice CP 22 *The Removal and Disposal of Underground Petroleum Storage Tanks*, and with the appropriate work permit. Appropriate equipment to handle the vapour hazards is necessary
- equipment that can produce a spark or flame, such as an oxy-acetylene torch, electric welder or an angle grinder should not be used without a strict procedure covered by a permit to work ("hot work" permit)
- empty the tank of all flammable or combustible liquid
- the tank should be "gas freed" (usually by purging – see Appendix L of AS 1940)
- all associated pipework should be disconnected and made safe so that no flammable or combustible liquid remains. The pipes should be removed
- if the tank is to be removed, check to ensure it is in suitable condition to withstand lifting and transport
- dry rust or scale may ignite when dry – keep it wet until disposed of
- gas freeing is a specialist task. Any testing for flammable vapours tests only one part of the tank at any one time. A "gas free" certificate may no longer be valid some time later or if the circumstances change. It is not a substitute for a work permit
- WorkCover must be notified in order to cancel the tank's location on the SCID database.

If a tank will be converted to use with non-dangerous goods, see the procedures in sections 9.10.7 and 10.21 and cleaning in 3.3.4.

A list of appropriate contractors may be obtained from the Petroleum Industry Contractors Association (www.pica.net.au). Contactors are usually listed in the "Yellow Pages" telephone directory under "Petrol pumps and marketing equipment".

10.9 CLASS 4 DANGEROUS GOODS – GENERAL PROVISIONS FOR FLAMMABLE SOLIDS; SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION, AND SUBSTANCES THAT IN CONTACT WITH WATER EMIT FLAMMABLE GASES.

10.9.1 Hazards and risks of Class 4

Class 4 includes flammable solids and liquids (Class 4.1); substances liable to spontaneous combustion (Class 4.2); and substances that in contact with water emit flammable gases (Class 4.3).

Class 4 dangerous goods have a broad range of physical and chemical properties. While most of Class 4 are solids, some can be liquids. Guidance on handling and storage cannot be readily categorised.

When deciding on measures to control the flammability risks, consider all of the following factors:

- non-combustible materials in the construction of buildings and storage areas
- fire protection
- separation distances (or barriers such as fire resistant screen walls)
- ignition and heating sources need to be controlled (eg electrical equipment should be suitable for hazardous zones)
- the need for ventilation.

10.9.2 Packages of Class 4

Areas where packaged dangerous goods of Class 4 are stored or handled should be ventilated. If the goods can generate a flammable gas or vapour, or form combustible dusts, explosion vents or doors should also be considered.

If the dangerous goods are sensitive to light, heat or temperature changes, the packages should be protected from exposure to weather and from direct sunlight.

Where the stability of the dangerous goods is reliant on the dangerous goods being wetted with liquids, such as stabilizers, phlegmatizers or diluents, observe the following measures:

- the packages should be inverted gently as often as necessary to prevent the goods in the upper section of the packages from drying out
- avoid prolonged storage by putting stock control measures in place
- check the concentration of any inhibitor present often enough to ensure that the concentration stays within the recommended levels set by the manufacturer (but do not open sealed packages to do this).

10.9.3 Tanks containing Class 4

Tanks for Class 4 dangerous goods should be designed and operated to ensure the following:

- prevent moisture from entering the tanks
- ensure valves and fittings are readily accessible, easily operated and operate as designed
- provide remote operation for primary shut off valves at the tank.

10.10 CLASS 4.1 FLAMMABLE SOLIDS

10.10.1 Nitrocellulose film and other nitrocellulose products – handling and storage

Nitrocellulose film is in Class 4.1 (UN 2557). Spontaneous combustion is a significant risk.

When working upon or keeping more than 25 kg of nitrocellulose observe all of the following precautions:

- minimise the amount of material introduced into the work area and worked upon at any one time
- the work area should be constructed on non-combustible materials
- the work area should have at least two outward opening doors for easy escape if fires occur
- all furniture and apparatus should be positioned to allow unimpeded egress
- eliminate all ignition sources
- all electrical wiring and equipment must be suitable for use in hazardous areas
- guard or enclose heating elements and other electrical equipment to prevent ignition or decomposition of any nitrocellulose products. Such guards and enclosures should be angled at 45 degrees or more to the horizontal to prevent dust accumulation
- the temperatures of any surfaces and equipment (including enclosures) should not exceed 100 degrees Celsius
- install automatic sprinklers
- waste material should not be allowed to accumulate and should be placed in metal waste bins marked "Flammable waste"
- display signs with suitable warning of hazards and precautions (such as "No smoking").

10.11 CLASS 4.2 SUBSTANCES LIABLE TO SPONTANEOUS COMBUSTION

10.11.1 General

Limiting the possibility of fire is an important control measure for substances liable to spontaneous combustion (Class 4.2).

If the dangerous goods will ignite on exposure to air (eg phosphorus UN 1381 or UN 2447) establish a method to contain any spillage so that air cannot come into contact with the spilt dangerous goods.

10.11.2 Agricultural products in Class 4.2

Some fibrous material containing oil falls into Class 4.2. Typical examples are cotton meal and some types of animal fodder, including by-products of oil extraction such as seed cake.

Examples are:

- UN 1364 oily cotton waste, including cotton hulls and lint from cotton gins
- UN 1363 Copra (dried coconut kernels)
- UN 1373 Fibres, animal or vegetable with oil
- UN 1374 Fish meal (fish scrap) unstabilized (Class 9, UN 2216 if stabilized)
- UN 1386 Seed cake, if more than 1.5 per cent oil and up to 5 per cent, and not more than 11 per cent moisture (classified as UN 1373 if more than 5 per cent oil content)
- UN 2217 Seed cake, if not more than 1.5 per cent oil and not more than 11 per cent moisture
- UN 3088 Self-heating solid, organic, not elsewhere specified.

Recommendations on the bulk storage of the above types of Class 4.2 is covered in the *Code of practice for the safe use of bulk solids containers and flatbed storage including silos, field bins and chaser bins*.

10.12 CLASS 4.3 SUBSTANCES THAT IN CONTACT WITH WATER EMIT FLAMMABLE GASES

Some grain fumigants may be classified as Class 4.3, or may fall into another Class in some forms. For example, the grain fumigant aluminium phosphide in the form of crystals is Class 4.3 (PG I, UN 1397), but in the form of waxed pellets it is Class 6.1 (PG II or III, UN 3048).

Other examples are: sodium metal, some metal powders and calcium carbide (used to produce acetylene gas).

10.12.1 Fire protection for Class 4.3

The hazard of Class 4.3 is that they evolve flammable or toxic gases on contact with water and may ignite spontaneously. This makes fire fighting with water particularly risky and an alternative fire fighting medium must be considered. Fire protection for the storage or handling area should be determined in consultation with the fire brigade.

10.12.2 Lithium aluminium hydride (UN 1411)

Lithium aluminium hydride (ethereal) UN 1411 should be kept as if it were a flammable liquid, but not with other flammable liquids due to its reactivity.

10.13 CLASS 5.1 DANGEROUS GOODS – OXIDIZING AGENTS

10.13.1 Hazards and risks

The hazard with oxidizing agents is that they are reactive and support combustion (while not being classified as flammable). Oxidizing agents may react with a wide range of substances, including flammable or combustible liquids such as petrol, kerosene, vegetable oil, engine oil, brake fluid, paint or grease.

Factors to consider when using or storing oxidizing agents (Class 5.1 or Subsidiary Risk 5.1) include the following:

- oxidizing agents should be kept away from combustible or readily oxidizable materials, sulfur and powdered metal
- store so that they cannot come into contact with a source of heat
- ensure that any heating equipment cannot heat the goods to within 15 degrees Celsius of their decomposition temperature
- the risk of dust explosions and the need for protection of electrical equipment should be assessed.

10.13.2 Storage

When storing packages observe all of the following precautions:

- place on clean pallets, racks or shelves to allow detection of leaks, to prevent contact with other substances, and to make clean up easier. Spillages may ignite on contact with timber. Old and weathered pallets should not be used
- keep packages closed
- protect from heat
- the store should be at least 5 m from any fuel containers, combustible material or incompatible substances
- do not park any vehicles (eg forklifts) nearby – the hot engine, fuel or oil leaks could cause a reaction
- do not store any liquids above oxidizing agents
- do not allow accumulation of dust anywhere – keep surfaces clean
- clean up spillages and dispose of waste, dust, or dried floor washings. Do not mix substances in the waste bin (they might react).

If oxidizing agents are repacked, then the risks arising from any packing plant need to be controlled. For example, any electrical equipment needs to be suitable, such as being dust proof and easily cleaned. Dry powders on electrical equipment may cause overheating and so this equipment should be kept clean to minimise this risk.

Additional requirements for those Class 5.1 that are explosive precursors, such as ammonium nitrate, is provided in the *Explosives Regulation 2004*. A licence from WorkCover is required to handle ammonium nitrate.

Advice on the storage and handling of pool chlorine in retail (including service stations) is provided in chapter 5, section 5.6.

Further class specific advice is provided in AS 4326 (see section 1.7).

10.13.3 Solid (dry) pool chlorine

For less than 250 kg of dry pool chlorine see section 5.6.

If more than 250 kg of solid (dry) pool chlorine is kept on the premises, observe the following conditions:

- The chlorine should be kept at least 5 m away from, or be separated by a liquid tight wall (masonry or concrete) at least 0.5 m higher than the goods on either side, from the following:
  - stored or waste combustible or readily oxidizable materials, including paper, cardboard (eg discarded packaging), or cloth
  - flammable or combustible liquids, corrosives such as acids and caustics, and other dangerous goods of Class 5, and any other substance such as sulfur or powdered metal that could cause decomposition.
- 10 m away from any solid ammonium salt (such as sulphate of ammonia) or separated by a liquid tight wall.
- At least 2 m separation between dry pool chlorine and hydrochloric acid and/or liquid pool chlorine.
- The storage area should be kept clean and combustible waste material must not be allowed to accumulate.

10.14 CLASS 5.2 – ORGANIC PEROXIDES

Organic peroxides are capable of self-reaction and stabilizers are usually necessary. Some are classified as "Goods too dangerous to be transported".

10.14.1 Storage of packages

The following precautions apply to more than 20 L or kg and up to 500 L or kg of organic peroxides in packages:

- keep the packages in a specifically designated and designed cabinet, room or shed
- keep a clear 5 m safety zone opposite the cabinet or storeroom doors and blow out panels
- no other buildings, chemicals or emergency escape exits should be in the storage area. It may be useful to outline the area with yellow paint on the floor or ground
- cabinet doors should have only friction or magnetic catches (to allow any pressure build up to escape)
- do not keep anything else in the organic peroxides store. Do not allow accumulation of waste, dirt, dust or metal filings on the floor (these could react with spillages)
- do not allow ignition sources inside, or outside within 3 m of the storage area or door to the store
- keep packages on sealed or laminated hardwood or coated metal shelves free from rust or corrosion

- a space of at least 100 mm should be kept clear between the packages and the floor, ceiling, or walls (eg fit a guard to prevent contact)
- do not stack packages on any shelf higher than 1.3 m
- have an eyewash kit readily accessible for use in the case of splashes or spills
- if opening packages, take them at least 3 m clear of the store. Reseal all packages before returning them to the store.

10.14.2 Temperature control

Since temperature control is important observe the following precautions:

- keep organic peroxides below 35°C and out of direct sunlight
- do not allow any room heaters or anything warm to touch either inside or near the storage area
- check the MSDS for the recommended temperature
- keep the store within the recommended temperature range for the types of organic peroxides present
- if cooling or refrigeration is required, obtain expert advice – air conditioners and unmodified refrigerators are potential ignition sources.

Further specific advice is provided in AS 2714.

10.15 TOXIC SUBSTANCES – CLASS 6.1 AND SUBSIDIARY RISK 6.1

Observe the Australian Standard most relevant to the circumstances:

- general advice for toxic substances is provided in AS 4452, however AS 1940 should also be observed for goods of Subsidiary Risk Class 3 (flammable)
- agricultural and veterinary chemicals – AS 2507
- liquid and liquefied polyfunctional isocyanates – AS 4081
- in situations of storing packages of several Classes of dangerous goods – AS 3833.

10.16 CLASS 6.2 INFECTIOUS SUBSTANCES – BLOOD BORNE VIRUSES

Advice on handling material that may be contaminated with human blood-borne viruses is provided in the *National Code of Practice for the control of work-related exposure to hepatitis and HIV (blood-borne) viruses*, published by the National Occupational Health and Safety Commission. This is an approved industry code of practice in NSW.

10.17 CLASS 7 RADIOACTIVE MATERIAL

Radioactive material is covered by the *Radiation Control Act 1990*, and the *Radiation Control Regulation 2003*, administered by the Department of Environment and Conservation.

10.18 CLASS 8 DANGEROUS GOODS – CORROSIVES

10.18.1 General

Note that corrosives may be either alkaline or acidic and these two categories are incompatible.

The advice provided in the following Australian Standards should be observed where relevant:

- specific to Class 8 – AS 3780, and for Class 8 with a Subsidiary Risk of Class 3 (flammable) also observe AS 1940
- in situations of storing packages of several classes of dangerous goods – AS 3833 (see section 1.7).

Eyewash and safety showers should be readily accessible where corrosives are handled or transferred (see section 8.12).

10.18.2 Pool chlorine – liquid, Class 8

If you have more than 1,000 L of pool chlorine Class 8 in packages, they should be kept at least 5 m from other dangerous goods with which they might react. An alternative is to have a liquid tight wall separating the goods.

A bund (ie some form of containment) is recommended around the storage area if the amount held adds up to more than 1,000 L. For packages, the bund should hold at least 25 per cent of the total volume of liquid stored. For storage tanks of 1,000 L or more, a bund that will hold 100 per cent of the tank volume is recommended. The Australian Standard *AS 3780 The Storage and Handling of Corrosive Substances* gives more advice on the design of the storage facility and transfer to bulk tanks.

For pool shops, where other hazards are not present (if other dangerous goods are not kept in the shop area), a bund is not essential where not more than 2,000 L is stored if the tank valves are frequently checked to ensure that they are in good order and not leaking.

10.19 CLASS 9 DANGEROUS GOODS – MISCELLANEOUS HAZARDS

10.19.1 General control measures

Advice for Class 9 is provided in the Class specific standard AS 4681. If the goods are environmentally hazardous, spillage containment specified in AS 4452 and the minor storage provisions of AS 4452 should also be observed.

In general, the storage area should be at least 5 m away from any of the following:

- building or office where people may be present
- storage of any other Class of dangerous goods
- accumulation of flammable or combustible material
- any public place.

The need for adequate ventilation should be considered.

10.19.2 Elevated temperature liquids and solids

This section covers:

- UN 3256 Elevated Temperature Liquid, Flammable, N.O.S. with flashpoint above 60.5°C, at or above its flash point
- UN 3257 Elevated Temperature Solid, N.O.S., at or above 240°C.

In the case of liquids that quickly solidify or have a high viscosity at ambient temperature, kerbing or trenches should provide adequate bunding or drainage to ensure containment of spills.

Spillages should be directed away from other dangerous goods, places where persons might be present, wooden structures, accumulations of flammable or combustible material and public places. Contact with water (even if in pipes) may cause a violent steam explosion.

Appropriate signage should warn of the hazards and be visible to emergency services (eg "building contains molten zinc vat", or "hot bitumen – do not use water jets, spray only").

Special consideration should be given to any liquid handled near or above its flashpoint, including hazardous area classification (see section 9.8).

Hot liquids, without a flashpoint or below flashpoint, may also be dangerous goods of Class 9 (UN 3257) and their separation distance from on-site facilities and other "protected works" may need temperature measurement and health flux calculations to be included in the risk assessment.

Many processes use heat transfer oil in a sealed recirculating system. It is quite often above its flashpoint. The supplier's MSDS may not indicate that it is a dangerous goods since it is not transported hot. One of the hazards is fire starting in insulation that has been soaked in the oil either by a small leak or by poor practice.

10.19.3 Polymeric beads (UN 2211) and plastic moulding (UN 3314)

Polymeric beads (UN 2211) and plastic moulding (UN 3314) are likely to release flammable vapours and large quantities should be kept in well-ventilated areas away from ignition sources.

10.19.4 Dry ice (UN 1845)

The carbon dioxide released by evaporating ice is an asphyxiant. Store and use only in well ventilated areas. Do not touch unless wearing insulating gloves.

10.19.5 Ammonium nitrate fertilizer

Ammonium nitrate should be kept away from flammable or combustible material such as petrol, diesel, oil, sulfur, grain or hay dust, charcoal or any type of dry pool chlorine. Once ignited by a spark or friction it may smoulder and eventually burst into flame. Frequently check pallets or stacks of bags, or large quantities, for signs of internal self-heating.

The purchase, transport, storage and handling of nitrate fertilizers with more than 45 per cent ammonium nitrate (excluding solutions) are controlled under the *Explosives Act 2003* and *Explosives Regulation 2005*, and a licence from WorkCover is required. This includes UN numbers: 1942, 2067, 2068, 2069, 2070, 2071, 2072, 3375 and 3379.

10.20 COMBUSTIBLE LIQUIDS

While the flammability hazards of combustible liquids are lower than for flammable liquids, they can add to the total fire load. Combustible liquids may have low autoignition temperatures (possibly lower than some flammable liquids) and fires can result from contact with hot surfaces.

Some combustible liquids have a reactive risk and are incompatible with some dangerous goods – for example brake fluid will catch fire if in contact with granular pool chlorine.

AS 1940 provides further advice that should be observed. Where heated combustible liquids are handled see the advice in section 10.19.2 of this Code of practice.

10.21 DECOMMISSIONING, ABANDONMENT AND DISPOSAL

Risks associated with abandonment and disposal of plant and dangerous goods must be identified and controlled, including environmental risks.

An occupier must ensure that any plant, equipment or container that was used in connection with dangerous goods and that is no longer intended to be used, or is to be disposed of, is made free from dangerous goods or otherwise made safe (OHS Regulation clause 174ZF(1)).

Used containers should be cleaned so they are free of dangerous goods, unless arrangements have been made for refilling, refurbishment, or other procedures to make them safe (see section 3.3.3). Advice on the standards for cleaning is provided in section 3.3.4.

Labelling should be retained on used packages that are not free of dangerous goods to identify the hazard. Labels should be removed or obliterated from containers made free of dangerous goods.

Decommissioned plant may present immediate or future risks (eg from residues) and the following should be carried out:

- identification of possible residual or resultant hazards and risks
- provision of appropriate fire protection where necessary
- ventilation to prevent build up of a hazardous atmosphere
- containment of any effluent.

Advice on the disposal of tanks and packages formerly containing flammable liquids is provided in AS 1940. Abandonment of underground, partly underground and mounded tanks is covered in section 10.8.3.

For an LP Gas tank, if two years have elapsed since any dangerous goods were last put in or taken from the tank, the OHS Regulation (clause 174ZZE) requires that the owner must:

- remove any remaining dangerous goods from, and abandon, the tank in compliance with AS/NZS 1596 – 2002 *The Storage and handling of LP Gas*
- notify WorkCover within seven days in the approved form.

CHAPTER 11 – CONTROLS DURING TRANSFER

This chapter applies to the transfer of any quantity of dangerous goods. This covers all forms of movement of the dangerous goods.

11.1 TRANSFER OF DANGEROUS GOODS

Transfer refers to the movement of dangerous goods from place to place; either within a premises, between premises, or to or from the premises. This may be by any means, such as a container, pipework, pipeline or vehicle such as a tanker. Transfer includes movement into or from a container, package or vehicle, including pumping, dispensing and decanting.

An occupier must ensure that any risk associated with the transfer of dangerous goods is eliminated, or if that is not reasonably practicable, controlled so far as is reasonably practicable (OHS Regulation sub-clause 174Z(1)).

11.1.1 Risks during transfer

Transfer generally poses risks greater than static storage, since the goods are either unconfined at some stage of the transfer process (such as when pouring or pumping from one container to another), or plant failure could occur. Unsuitable facilities or inadequate procedures for filling or unloading tanks or tanker vehicles may cause overfilling with consequent risks, including serious injury to operators.

Consider the following additional risks during transfer:

- increased vapour levels in the area around the transfer
- generation of static electricity in non-conductive flammables
- overflow, leakage or spillage – eg if open vats are being filled
- spillage or leakage away from any spill containment, such as where the transfer is by pipework or pipeline.

The risk assessment should evaluate how the following factors affect the above risks:

- the hazards associated with the particular dangerous goods
- flow or transfer rates and quantities
- external hazards and nearby activities (eg ignition sources).

11.1.2 Transfer control measures

Clause 174Z of the OHS Regulation required occupiers to have regard to the need to:

- control spills and leaks
- minimise static electricity
- control vapour generation
- ensure suitability of pipework, attachments and associated safety systems.

Control measures that should be considered for transfer include the following:

- overflow protection equipment on receiving vessels or containers
- flow and pressure regulators on pipework and pumps
- interlocking of valves and switches
- ensuring the compatibility of connections for hoses, couplings, fittings and vapour recovery
- ensuring the continuity of connections for earthing and electrical or electronic data controls
- systems for detecting losses from pipework and fittings, such as static pressure loss detectors, external sensors or measurement
- control of static electricity in non-conductive flammable or combustible liquids or finely divided combustible powders by using bonding and earthing conductors between tanks, vehicles and pumps
- isolating valves (see section 11.2)
- emergency shut down (see section 11.3)
- control of vapour emissions (see the list below)
- control of ignition sources when flammable goods are transferred (see section 9.8).

Vapour emissions during transfer can be minimised though means such as the following:

- using enclosed systems
- opening lids of containers for the minimum possible period
- minimising the surface area of liquids exposed
- avoiding splash filling of liquids
- minimising the temperature of liquids
- providing extraction ventilation.

When decanting into a container, labelling is required – see chapter 3, section 3.3.3.

For further advice on transfer of goods consult the relevant Class or type specific Australian Standard.

11.1.3 Laws relating to loading and unloading vehicles or wagons

Laws relating to the loading and unloading of transport vehicles or wagons at the premises are contained in the transport legislation and the ADG code, and refer to various Australian Standards. The relevant parts of AS 2809 *Road tank vehicles for dangerous goods* must be complied with.

Transfer operation, as defined in the ADG code, means the process of transferring dangerous goods in bulk into or from a tank vehicle, bulk container or freight container.

Transfer includes all of the following:

- the connection of any hose or other equipment to the tank vehicle, bulk container or freight container
- the connection of any hose or other equipment to a storage container
- the movement of the goods into or from the tank vehicle, bulk container or freight container
- any other activity directly connected with the transfer of the goods.

The procedures for loading and unloading described in chapter 10 of the ADG code are mandatory. This sets standards for items such as hose assemblies. Transfer of flammable liquids (Class 3 or Subsidiary Risk 3 dangerous goods) must be in accordance with AS 1940. The ADG code contains specifications for pumps used. Procedures in AS 1596 for LP Gas are mandatory.

There are some special provisions for the transfer of Class 3 (or Subsidiary Risk 3) at a farm, mine site, or into a tank classified as "minor storage".

11.2 TANK ISOLATING VALVES

It is important that valves have position indicators to indicate the valve position – ie open or closed. The lack of a position indicator on isolating valves has caused spills and accidents. The valve position should be clearly visible from a distance, eg from outside the bunded area (except for cryogenic vessels covered by AS 1894).

Suitable valves include:

- rising spindle (the spindle protruding above the wheel indicates the valve is open)
- quarter turn valves – the status is indicated by the handle position (parallel to the pipe to indicate "open").

Other important points are:

- lockable valves should only be lockable in the closed position
- detachable handles should not be used. If an unavoidable requirement, the handle should only be detachable in the closed position. Reattachment should only be possible in a manner that indicates the correct position
- brass valves are unsuitable on large flammable or combustible liquid tanks since they may melt in a fire.

11.3 PUMP EMERGENCY SHUTDOWN SWITCHES

Quick shut down of pumps is an important safety measure to control spills or fires. Pumps used to transfer dangerous goods into or out of tanks should have emergency shut down switches.

The emergency shutdown switch should be located so that the following can be performed:

- it can be readily and conveniently operated
- it is close to the normal position of the operator (eg the tanker driver)
- the operator can reach it to stop the transfer before a spillage gets out of control in an emergency (eg even if a pump seal failure sprays corrosive or burning liquid or the transfer hose ruptures)
- it is not inside the bunded area, in the pump seal "spray zone" or on the far side of the tank (or tanker) away from the operator and other controls
- access is never obstructed.

Additional control measures for fixed locations include the following:

- it may be useful to mark the area with yellow paint and a "keep clear" sign.
- provide an appropriate sign – eg "Emergency Pump Shutdown" with letters at least 100 mm high
- make sure gloved hands can operate the switch – mushroom type push buttons are usually used
- if several buttons are used (eg start/stop/reset) then make sure the stop button is unmistakable even in poor lighting
- if the operator has to attend to related tasks away from the normal position (eg to manually gauge the tank), transfer should be stopped.

11.4 TANKER LOADING AND UNLOADING PROCEDURES

This applies to filling tanks (ie over 400 L), fixed or removable (demountable), carried on vehicles.

11.4.1 Bottom loading

Bottom loading refers to hoses connected to the tanker compartments' bottom connections. Bottom loading should be protected by an automatic overfill system.

Bottom loading systems should include all of the following controls:

- a preset meter with automatic slow start and slow finish control
- a dry break hose coupling
- automatic overfill cut-off for each compartment
- integrated electrostatic bonding
- vapour discharge with controls accessible from ground level
- drive away prevention interlock.

For flammable or combustible liquids, further technical details are provided in the Australian Institute of Petroleum (AIP) *Code of practice CP 6 – Vehicle Bottom Loading and Vapour Recovery*.

11.4.2 Top loading

Top loading must use either hoses (connected liquid tight), or a hose and spear (in contact with the bottom of the tank) through an open hatch. If loading is controlled manually (ie without a preset meter) a "dead man's handle" should always be used. This is a self-closing valve (usually spring loaded) that has to be pulled continuously to allow the liquid to flow. It is not sufficient to have only the pump stop button to stop the transfer.

Flammable and combustible liquids should never be "splash filled" into a container or tank, due to the risk of ignition by static electrical discharge. These liquids should be loaded through a hose and spear that discharges below the level of the liquid as it fills the tank and allows static electricity to be conducted away.

11.4.3 Pumping flammable fuel from vehicles to above ground tanks

Suitable separation distances between vehicles and above ground tanks should be established to reduce risks in the event of a fire. The tanker must be positioned so it can be promptly driven away in the forward direction should a spill or fire occur.

11.5 FUEL DISPENSING INTO FUEL TANKS OF VEHICLES, VESSELS, AEROPLANES AND POWERED PLANT – GENERAL ADVICE

Dispensing here means fuelling a vehicle, engine or gas container from a dispensing unit, such as a bowser. This includes retail at service stations.

This covers general advice for the dispensing of fuels such as Class 3 liquids or Class 2.1 gases and includes retail sale. Examples of typical liquid fuels are petrol and kerosene, and gaseous fuels include LP Gas and Compressed Natural Gas (CNG). Additional advice specific to LP Gas and CNG is provided in the next section (11.6).

Potential sources of ignition during dispensing should be eliminated by the following procedures:

- any vehicle engine should be stopped while the dispensing operation takes place for the vehicle
- all practical steps taken to ensure ignition sources have been eliminated within 3 m of the vehicle (or other engine) fuel tank filling point or dispenser, including the nozzle, apart from the necessary movement of other vehicles
- prominent appropriate signage advising of the above steps, such as "Stop engine – no smoking".

Steps should be taken to prevent unauthorised access to dispensers and to prevent any person under the age of 16 years using a dispenser. See also the advice in section 11.7.3.

11.6 LP GAS AND CNG DISPENSING

Gas cylinders, such as barbeque cylinders, should not be filled from a dispenser. Exceptions to this are cylinders such as forklift cylinders that have been especially designed to be filled from a dispenser (not all cylinders are so designed, and these must be filled by decanting).

Further advice is provided in AS 1425, AS 1596 and AS 3961 (see section 1.7).

For a CNG (compressed natural gas) refuelling station, the ALPGA standard *AG 901 Code of Practice for NGV Refuelling Stations* should be observed (see section 1.7).

11.7 DISPENSING OF FUELS AT SERVICE STATIONS

Flammable fuels (both liquid and gas) are commonly dispensed at service stations. Safety is primarily the responsibility of the occupier of this premises.

11.7.1 Consol operation at self-service stations (OHS Regulation clause 174ZZ)

Fuels are often sold to the public by dispensing through self-service units, controlled from a central consol at a service station.

In addition to the points in 11.5 and 11.6 above, for a self-service dispensing unit (other than at an unstaffed service station) the person who keeps the dangerous goods for sale must comply (or cause compliance) with the following:

- instructions for the operation of the dispensing unit (including those covered in section 11.7.3 below) must be clearly displayed on or immediately adjacent to it
- the unit and the area surrounding it must be adequately illuminated
- a consol operator must be appointed to control and supervise from a control point the operation of the dispensing unit when it is in operation for the sale of fuel
- the consol operator must be a trustworthy person over the age of 18 years
- the consol operator must be fully conversant with the operation of the dispensing unit by the users and the system employed for the sale of fuel.

To be able to respond to emergencies promptly, the occupier should ensure that the operator has an unobstructed view of the dispensing units. For example, the windows overlooking the forecourt should not be obstructed with racks of goods for sale or advertising posters, unless other means are used – such as closed circuit TV or mirrors.

Training of the consol operator should include the manner of operation of the dispensing unit, safety cut-off procedures to prevent the flow of fuel, the location of fire fighting equipment, and other emergency procedures such as fire extinguisher operation.

11.7.2 Duties of consol operator

The consol operator should ensure safety by controlling the activities of all persons dispensing fuel, such as:

- ensuring fuel is not supplied unless the person using the dispenser follow all procedures correctly, including those described in 11.7.3 below
- taking all necessary steps to prevent the flow of fuel through the unit in the event of a spill or other risk such as a fire
- taking all practicable steps to ensure that the self-service dispensing unit is not operated by a person under 16 years of age.

Further advice is provided for liquid fuels in section 6.2.5 of AS 1940, and for LP Gas in section 9.3.3 of AS 1596.

11.7.3 Obligations on drivers and other persons where fuel is dispensed (OHS Regulation clause 174ZZ).

The following obligations are placed on drivers and other persons at the premises where the fuel is dispensed, such as service stations:

- when a vehicle is standing near a self-service fuel dispensing unit, the driver must ensure that its engine is stopped before the fuel tank is opened, and remains stopped while the dangerous goods are being dispensed into the vehicle
- a person must not introduce an ignition source within 3 m of a fuel-dispensing unit (including the nozzle of the hose that is part of the unit) while in operation, apart from the normal movement of vehicles (eg a vehicle moving to the other side of the dispensing unit).

11.8 LP GAS DECANTING

11.8.1 General procedures for decanting LP Gas from a cylinder

Filling cylinders and fuel containers by decanting from a cylinder is a common procedure for both retail sales and on-site use of LP Gas. Decanting means the filling of cylinders without the use of a pump; usually from a larger cylinder.

Small cylinders should never be filled from the autogas dispenser units – adaptors should not be used since autogas (a mixture of butane and propane) is different from the LP Gas, mainly propane, used in small gas cylinders. Note that forklift fuel cylinders may be of one type or the other – use only the gas specified for that forklift.

The procedures described in AS 1596 (see section 1.7) should be observed.

To minimise decanting risks, the following precautions based on AS 1596 are emphasised:

- do not place cylinders on a non-conductive stand, such as a milk crate – metal stand, or placing the cylinder on the ground, will allow static electricity to escape
- do not overfill cylinders. LPG expands considerably when a cylinder gets warmer – an overfilled cylinder could leak or burst, with a consequent explosion
- do not decant fill any portable cylinders over 25 L (10 kg) or fuel tanks (eg forklift cylinders) over 50 L (22 kg)
- do not fill date expired cylinders
- do not fill damaged, dented or corroded cylinders
- do not allow untrained or young persons to fill cylinders
- do not allow self-service by retail customers (ie the general public)

11.8.2 Position of the decanting cylinder

A risk is created during filling since a considerable quantity of gas is released from the cylinder being filled. This gas is denser than air and can accumulate in low areas such as drains or maintenance pits. The characteristic smell may not reach nose level.

Distances from ignition sources is a key risk factor. The position and procedures in AS 1596 (section 7) should be followed. In relation to sources of ignition, the following can be excluded: fuel dispensers, overhead lights, vehicles, and electrical installations more than 0.5 m above the top to the decanting cylinder.

11.9 PIPEWORK

Pipework should be labelled to conform with AS 1345 in order to provide appropriate safety information.

The material used for piping and pipework, whether metal, rubber or plastics, should be compatible for the intended use, the type of dangerous goods, pressure and location.

11.10 HANDLING PACKAGES

Shrink-wrapping of loads using torches is not usually appropriate with dangerous goods due to the fire hazard.

Packages should not be stacked too high to avoid falls, breakages of containers and resultant spills.

Advice on controlling the ignition hazards posed by forklifts and other industrial trucks is provided in Appendix 8.

11.11 FILLING GAS CYLINDERS, DISPOSABLE CONTAINERS AND AEROSOLS

11.11.1 General procedures

AS 2030 should be observed when filling gas cylinders.

The ADG code requirements for gas cylinders, including design and labelling, must be followed when preparing cylinders for transport.

Filling LP gas cylinders and other containers by decanting from another cylinder is covered in section 11.7.

11.11.2 Filling disposable containers and charging aerosols with liquefied flammable gas

Disposable containers are filled once only and are not refilled.

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 Aerosols (non-refillable receptacles with contents under pressure and fitted with a release device)
- UN 2037 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.

In this section, "charging area" means the area within a building where aerosols or disposable cylinders are filled with a liquefied flammable gas (Class 2.1).

The charging area should be separated from any other part of the building by a vapour tight wall, that may have only a doorway, and openings of not more than 0.1 square metre to allow the passage of containers to and from the charging area. The door should open in both directions and be closed as far as reasonably practicable during charging. An explosion blow-out panel should be provided in any unattended charging room.

The charging area (including any pressure vessels and plant) should have mechanical ventilation such that the following are observed:

- it is separated from the ventilation system for any other area and the ducting does not pass through any other area
- the concentration of any escaping gas is kept less than 25 per cent of the lower explosive limit
- escaping gas does not flow through any doorway or opening
- the discharge from the ventilation system is above any roof, or part of a roof measured 10 m laterally.

Gas detectors should be used to detect leaks from the charging plant and pipework. The gas detector should function at above 25 per cent of the lower explosive limit of the gas and produce a sound and visible signal and shut off any gas flow into the area.

The gas piping connected to plant used for charging (charging machine) should have a manual shut-off valve and excess flow valve at the point where the piping enters a flexible connection to the charging plant. The shut-off valve and its purpose should be clearly identified by signage at or near the valve.

Once filled, the aerosol or disposable container must be tested in accordance with section 3.8.2 of the ADG Code: the container is tested immediately for leakage by immersing in water that is at a temperature of 55° Celsius, and safely disposed of if found to be leaking. An alternative method can be used if it is of equivalent effectiveness.

Also see the advice in section 10.5.3 regarding un-odorised LP Gas.

CHAPTER 12 – FIRE PROTECTION

Fire protection is an essential element of the control measures for the risks of flammable or combustible dangerous goods. The need for fire protection and the appropriate fire protection system must be determined from the risk assessment.

The "fire protection system" includes fire detection, fire suppression and fire fighting equipment, which may be fixed or portable.

12.1 PROVISION OF A FIRE PROTECTION SYSTEM

Occupiers must ensure that appropriate fire protection and fire fighting method (including equipment) is provided, installed, and maintained (OHS Regulation clause 174ZC). This is in addition to any fire protection required by the *Building Code of Australia* (BCA). The BCA does not cover the risks involving dangerous goods and does not deal with matters such as tanks or open air storage. A person assessing fire protection should have relevant competencies.

At premises where there are several occupiers, fire protection needs to be coordinated to ensure it is effective for the whole premises.

Fire protection and the fire fighting method must be designed and constructed for the types and quantities of dangerous goods and the conditions under which they are stored and handled. These conditions include the materials that any buildings, plant or structures are made from, such as fire rating and combustibility. The need to use water deluge systems to keep tanks cool should be considered.

Fire fighting equipment, including the media used, must be compatible with the dangerous goods, and effective in the control of incidents involving the types and quantities of dangerous goods (OHS Regulation clause 174ZC(1)(a)(iii)).

The design and construction of the fire protection for each area where dangerous goods are stored and handled, and for the premises as a whole, should take into account the relevant Australian Standard listed in section 1.7 of this code of practice, including any class or type specific Standard. This should also be determined in relation to the emergency plan (chapter 14).

The effectiveness of the system needs to be evaluated if any changes or modifications are made to:

- the building or structures on the premises
- the types or quantities of dangerous goods stored or handled at the premises
- plant or processes associated with the storage or handling of dangerous goods
- the fire protection system itself.

The fire brigade should be consulted when designing or altering the system, including whether to directly link alarm systems for large installations to the fire brigade.

12.2 DESIGNING THE FIRE PROTECTION SYSTEM

The fire protection system design should take into account all of the following risk factors:

- chemical and physical properties of the dangerous goods
- any particular hazards of the dangerous goods
- quantities being stored and handled at each location on the premises
- storage configurations, such as height of shelving and density
- the total fire load of the area being protected
- the location of the storage location or handling area in relation to other storage or handling areas
- design, type of construction and total floor area of the building, storage location or handling area
- the type of operations in each handling area or storage location
- the extent of containment of the dangerous goods
- chemical and physical processes during use or processing
- transfer and transport systems, including the location of transport vehicles
- the impact of hazards external to the storage and handling area, including those beyond the boundaries of the premises
- the personnel available to operate the fire protection system and their capability
- the need to also protect facilities external to the premises
- environmental considerations including the containment of contaminated fire water
- the need for the fire protection system itself to remain operational in the event of a fire.

Fire fighting media (such as water, foam or dry agent) must be suitable and compatible with the dangerous goods. For example, sprinklers and water-based extinguishers should not be used with dangerous goods of Class 4.3 (dangerous when wet).

12.3 WATER SUPPLY

The water supply for fire fighting should be sufficient to supply both fire fighting equipment at the premises and any additional equipment that may need to be used by the fire brigade.

Where water supply is not available (or adequate) from the main water supply, it may be necessary to provide additional water storage and/or pumps, or an alternative source. The adequacy of water supply should be checked with the fire brigade.

Booster systems may be needed to provide sufficient pressure for large-scale fire fighting. This may require either the installation of fixed or portable pumping equipment, or an appropriate number of booster connections and feed hydrants, together with a hard standing area for fire brigade pumping equipment.

Pumps should always have sufficient fuel (eg for six hours) and starter batteries should be regularly checked to ensure they are charged ready for use.

12.4 FIRE ALARM SYSTEMS

Fire alarm systems should be designed and installed to achieve the following:

- automatic systems should be capable of being manually activated at clearly identified manual alarm activation points at convenient and safe locations near work areas
- an alarm signal distinguishable from other signals to allow ready recognition, and be clearly audible throughout the storage location and premises
- where high noise levels or the use of PPE may prevent the recognition of an alarm signal, an effective alternative alarm system is also installed, such as a visual system
- the system remains operable when the main power supply fails.

Further advice is provided in AS 1603 *Automatic fire detection and alarm systems* (all parts), and AS 1670 *Fire detection, warning, control and intercom systems* (all parts).

12.5 FIRE FIGHTING EQUIPMENT

All fire protection and detection equipment should conform to appropriate Australian Standards

12.5.1 Compatibility with equipment used by the fire brigade

Equipment such as couplings, fire fighting media, hose reels, hydrants and monitors should be selected and installed in consultation with the fire brigade to ensure compatibility.

Check the following:

- fire fighting equipment at the premises is capable of being used with the equipment used by the fire brigade, without adaptation or modification (eg all fittings and couplings need to be compatible)
- the pressure ratings of fire mains and ancillary equipment are consistent with the pressures that may be imposed by the connection of the fire brigade's equipment
- fire fighting foam or any special fire protection medium, if used, is compatible with the fire fighting media used by the fire brigade.

12.5.2 Location of fire fighting equipment

Fire fighting equipment should be located to achieve the following:

- all dangerous goods and other items being protected can be directly reached by the fire fighting medium, with particular attention to high rack storage
- it is readily accessible in the event of an incident, preferably adjacent to exit doors or on exit routes
- it is in a conspicuous position.

12.5.3 Identification of fire fighting equipment

All fire fighting equipment should be marked and labelled in conformity with the relevant Australian Standard.

Where necessary to assist with the identification of fire fighting equipment and location, additional signs should be installed, in conformance with *AS 1319 Safety signs for the occupational environment.*

12.6 EQUIPMENT THAT MAY BE NEEDED

12.6.1 Fire hose reels

Fire hose reels should conform to AS 1221 and be installed to AS 2441, and to the requirements of the fire brigade and the *Building Code of Australia*.

Locate sufficient hose reel systems so that:

- there is one on every storey of a building used to store and handle dangerous goods where the total floor area exceeds 300 square metres
- every location in the building can be reached by at least one hose, allowing for all obstacles
- it is possible to reach all installations, including the top of rack storage.

Provide hose reels with the following:

- a sufficient hose length
- conspicuous signage (including the type if foam is used)
- protection by a cabinet or other means, if the hose reel is in an environment where it may be damaged.

12.6.2 Fire hydrants

Fire hydrants can be substituted for the hose reels identified in section 12.6.1 above. However, this is not appropriate in situations where only a single person is available to operate the equipment (including offices, hospitals and one person operations).

The hose connections for fire hydrants must have fittings that allow connection to the fire brigade's mobile appliances without the need for adaptors.

Guidance for the selection, installation and location of fire hydrants can be found in AS 2419 *Fire hydrant installations* (all parts). Where flammable or combustible liquids are stored and handled detailed guidance can be found in AS 1940 (see section 1.7).

Hydrants should be equipped with hose, branch and nozzle, except where it is not appropriate and prudent to do so, such as where susceptible to theft or where there are no personnel properly trained to operate them.

Hydrants external to buildings should provide appropriate coverage and be located convenient to exit doors and easily visible, with appropriate identification signs.

12.6.3 Monitors

Monitors may be appropriate where fire control requires large quantities of fire or cooling water to be directed at a fixed installation, with minimum exposure of fire fighters.

The following factors should be taken into account when specifying and locating monitors:

- the design water flow capacity – an allowance on 50 per cent over any calculated capacity should be provided to take into account potential adverse wind conditions
- the type of nozzle that is required, such as fixed or variable and the need to supply foam as well as water
- the location relative to the installation being protected
- the anticipated heat flux at the monitor location – in situations where the heat flux is likely to exceed 2 kw/m^2 the provision of radiant heat protection for personnel operating the monitor should be considered.

Monitors should be installed in accordance with the manufacturer's specifications and would normally be located 15-30 m from the facility to be protected. If monitors are required to be closer to the facility, or where the expected heat flux is excessive, protection of personnel should be taken into account. This would normally necessitate the provision of remote control.

12.6.4 Automatic sprinkler systems

Where fire sprinkler systems are required, they should be installed in accordance with AS 2118 *Automatic sprinkler systems* (all parts).

Where foam systems are required, the advice of suppliers and the fire brigade, or other guidance, may be necessary.

12.7 PORTABLE FIRE EXTINGUISHERS

12.7.1 Principles

Portable fire extinguishers should be suitable for the fire risks involved, in conformance with appropriate Australian Standards.

Check the following factors for fire extinguishers:

- located in a readily accessible position
- identified so they are clearly visible
- protected (eg from vehicle collision)
- unobstructed and readily available
- not adversely affected by hazardous or climatic conditions
- regularly inspected, serviced, pressure tested and recharged as necessary (see the manufacturer's or supplier's instructions).

12.7.2 Location of fire extinguishers

Extinguishers should be wall mounted on a hook or bracket, or an unlocked cabinet, at a suitable height and with signage. Where the extinguisher could be subject to unauthorised interference, the cabinet may be locked providing it has a glass panel that can be broken to remove the extinguisher in the event of a fire.

All storage areas of dangerous goods need protection, but the number of extinguishers necessary will be greater for fire risk goods.

AS 2444 *Portable fire extinguishers and fire blankets – selection and location* provides further guidance.

12.7.3 Suitability of extinguishers

Foam extinguishers should be suitable for the particular dangerous goods. As examples:

- alcohol compatible foam should be use for alcohols or other water miscible solvents (eg polar solvents)
- carbon dioxide extinguishers may protect electrical equipment, and will minimise clean up and damage to equipment, but have a poor "knock-down", short discharge range, and may be ineffective where there is significant air movement – dry powder or vaporising liquid may be more effective
- carbon dioxide and acidic extinguishers, such as those based on ammonium phosphate, should not be used where cyanides are present
- carbon dioxide should not be used on fires involving magnesium or titanium metals

Where powder type and foam extinguishers are likely to be used together, they should be compatible.

12.8 RESPONDING TO FAILURE OF THE FIRE PROTECTION SYSTEM

Emergency plans should include a consideration of requirements in the event of a failure of fire protection equipment.

In the event that any of the components of the fire protection or fire fighting equipment are rendered inoperative, the occupier must ensure the following:

a. the implications of the inoperability are assessed

b. alternative measures are taken to control, to the same level of effectiveness, those risks that were controlled when the equipment was functioning fully

c. action is taken to return this equipment to full operation. (OHS Regulation sub-clause 174ZC(2)).

In determining the alternatives under item (b) above, the occupier must have regard to the need for all of the following:

- provision of alternative fire protection measures
- reduction of the quantities of dangerous goods

- stopping or limiting the processes used for the storage and handling of dangerous goods
- modifications to systems of work. (OHS Regulation sub-clauses 174ZC (4) and (4)).

Examples of alternative actions that should be considered to control the risks during the inoperable period include the following:

- ceasing all or part of the work or operations in the area affected by the failure if the risk is high
- providing temporary fire protection systems or equipment until repairs are completed
- in a simple case, such as failure of a fire extinguisher or a hose reel, the equipment should be serviced or replaced.

If the effectiveness of the fire protection system has been significantly reduced, the occupier must notify the Fire Brigade of the condition of the system (clause 174ZC(3)). Determination of "significantly reduced" should be based on the risk assessment and emergency plan. For example, one faulty portable fire extinguisher in an area where normally three are provided would not be a "significant reduction". Advice should be obtained from the fire brigade on alternative protection measures.

Prompt steps should be taken to ensure that the faults are corrected and the system brought back into full operation.

12.9 MAINTENANCE

Fire protection systems and equipment should be inspected and tested at regular intervals to ensure that it is always fully operational.

All fire protection equipment should be properly maintained. Various parts of AS 1851 *Maintenance of fire protection equipment* provides further advice on maintenance and inspection.

CHAPTER 13 – TRANSIT AND TEMPORARY STORAGE

Practicable measures need to be adopted to control risks where dangerous goods are kept temporarily. This chapter provides advice on temporary storage and transit storage for any quantity above the placard quantity in Appendix 2 (which includes all bulk containers).

13.1 TEMPORARY STORAGE AREAS

Temporary storage is short-term storage where the dangerous goods are held at a location, outside of the usual storage area, while awaiting further transfer, held in an area waiting for loading onto a vehicle, or following delivery (unloading). This applies to premises where other dangerous goods are permanently stored and handled, other than for the purposes of transport (ie other than transit storage).

Examples of temporary storage include the following:

- awaiting loading for dispatch after removal from the usual storage area (eg being assembled into transport loads)
- being placed into storage after receipt and unloading
- infrequent short-term storage after delivery prior to dilution for use, or consumption during use
- transfer between areas within a premises for a specific purpose such as manufacturing
- loaded onto a vehicle, vessel or aircraft prior to or after transport.

The quantities of dangerous goods in a temporary storage location, and the duration of the storage, should be kept to a minimum.

Control measures should ensure that an incident occurring in a temporary storage location is not likely to adversely affect the permanent storage or process area, or any other operations. Risks to other storage and handling areas should be considered.

Consider the need for the following precautions within the temporary storage area:

- appropriate segregation
- readily available equipment for containment and clean-up of spills and leakages
- emergency response as part of the plan for the premises (chapter 14)
- PPE for personnel in the area
- fire protection as part of the fire protection system for the premises (chapter 12).

13.2 TRANSIT STORAGE AREAS

Transit storage is defined in section 1.10 and refers to temporary storage of dangerous goods during transport where the goods will not be at a premises where dangerous goods are stored or handled, other than as part of the process of transport.

Transit storage refers to loads on vehicles or wagons, where the dangerous goods that comprise the load comply with the relevant transport legislation and code (whether for road, rail, air or sea). Transit storage would include vehicles at ports, rail yards and truck depots.

To apply the transit storage provisions, all of the following conditions at the premises must be met. The dangerous goods:

- are part (or all) of a transport load in compliance with the relevant transport code including the provision of shipping documents
- are loaded on a vehicle, vessel or aircraft, or being transhipped from one to another vehicle, vessel or aircraft
- will not be at the premises for more than five working days (excluding public holidays)
- will not be consumed or processed at the premises
- are not intended for sale at the premises.

Transit storage areas are where dangerous goods are not kept permanently during transport, while awaiting further transport or being re-assembled into transport loads, for example at ports, rail yards, airports or truck depots. This does not apply to premises where dangerous goods are manufactured or stored, since these have additional risks, for example where the goods are unloaded for storage or use.

Examples of transit storage include the following areas.

- inside a building (eg a transport depot) where packages or intermediate bulk containers are transferred
- outdoor, where loaded freight or tank containers are held prior to transport
- where loaded vehicles (including trailers and rail wagons) are held during transit, such as ports, rail yards or truck depots.

13.3 PLACARDING FOR TRANSIT OR TEMPORARY STORAGE

Additional placards are not required for transit storage since the load is placarded.

If dangerous goods are frequently kept temporarily at a location on the premises in quantities above the placard threshold then placarding is required (see chapter 15).

13.4 CONTROL MEASURES FOR TRANSIT AND TEMPORARY STORAGE AREAS

Ensure the following control measures are implemented for transit storage:

- the length of time that dangerous goods are held does not exceed five consecutive working days (apart from public holidays)
- all dangerous goods that are assembled in loads ready for transport are packaged or contained, marked, stowed, secured, placarded, segregated and documented in accordance with the ADG Code
- incompatible dangerous goods are segregated according to the particular transport mode in the ADG Code
- dangerous goods are kept apart from foodstuffs (including stock feed) so as to avoid any potential contamination
- control ignition sources where relevant to fire or explosion risk
- suitable fire protection is provided

- materials for localising, controlling and cleaning up spills or leakages are readily available
- precautions for the transit storage in the relevant Class or type specific Australian Standard should be observed – for example, advice for flammable liquids is provided in section 3.9 of Australian Standard AS 1940.

CHAPTER 14 – EMERGENCY PLANS, PREPAREDNESS AND PROCEDURES

The purpose of the emergency plan is to minimise the effects of any incident or serious incident that may occur and involve the dangerous goods. Typical incidents include a loss of containment of the dangerous goods or when control measures have failed.

In this chapter, the term "incident" includes a "serious incident" (see the definitions in section 1.10). Examples would be a loss of containment of the dangerous goods leading to a spread of liquid or vapour through the premises and possibly into adjacent premises or public places.

14.1 LEGAL OBLIGATIONS

An employer or self-employed person must make arrangements for emergencies (regardless of the size of the premises or quantities of dangerous goods), in relation to the matters over which they have control (clause 17 OHS Regulation).

Where the quantity of dangerous goods at the premises exceeds the "Manifest quantity" in column of schedule 5 of the OHS Regulation (see Appendix 2), then occupiers must prepare a *written* emergency plan and review this at least every five years (OHS Regulation clause 174ZD). At these quantities, a manifest must be prepared and WorkCover must also be notified (see chapter 16).

14.2 DEVELOPING THE EMERGENCY PLAN

The emergency plan for the premises should be developed using the risk assessment as a basis for determining the requirements at the premises, and a consideration of a response to the incidents (including serious incidents) that could occur. It may be appropriate to develop this in conjunction with the plan for fire protection (see chapter 12).

Essential considerations when developing the emergency plan, prior to determining the contents (see section 14.3 below) are as follows:

a. Arrangements must be made for all of the following:

- the safe and rapid evacuation of persons
- emergency communications
- appropriate medical treatment of injured persons.

b. At a fixed place of work, the following must be provided:

- adequate arrangements for shutting down and evacuation in the event of an emergency
- details of the arrangements for evacuation kept on display in appropriate locations
- one or more persons appointed and appropriately trained to oversee any such evacuation and, if appropriate, the use of on-site fire fighting equipment.

c. In making the arrangements in (b) above, the following characteristics of the place of work must be taken into account:

- the nature of the hazards present
- the size and location
- the number, mobility and capability of persons present.

d. The plan should consider all of the following:

- the worst-case credible scenario (ie the most serious incident possible)
- the more likely events (all possible incidents)
- sufficient flexibility so that an emergency response can be varied or graduated according to the severity and type of incident
- an individual plan if necessary for each building or storage location at the premises.

14.3 CONTENTS OF THE EMERGENCY PLAN

The written emergency plan should include the matters described in the following table, based on the considerations in section 14.2.

Contents of the emergency plan

Topic	Details
Site and hazard information	1. Name, location, address and nature of operations. 2. Detailed map of the facility and surrounding area. 3. Inventory of dangerous goods at the site (this could be a copy of the manifest or register). 4. Maximum and minimum number of persons expected at the site. 5. Infrastructure likely to be affected by a serious incident. 6. Emergency planning assumptions. 7. Description of measures to control the consequence of each hazard and major incident.
Command structure and personnel	8. Details of emergency contact personnel. 9. Allocation of personnel for implementing the plan. 10. Arrangements for "mutual aid" between adjacent premises.
Notifications	11. Procedures for providing early warning or alarm of an incident. 12. Details of on-site and off-site warning systems. 13. Contact details for the emergency services. 14. Details of on-site communications systems.
Resources	15. Details of emergency resources on-site. 16. Arrangements for obtaining additional external resources.
Procedures	17. Procedures for safe evacuation and mustering of personnel. 18. Details of control points and procedures for essential services. 19. Procedures for containment of any incident. 20. Procedures for decontamination following an incident.

Australian Standards relevant to the Class of dangerous goods stored also provide guidance on emergency plans (eg Appendix N of AS 1940).

14.4 DEVELOPING THE PLAN (PREMISES ABOVE MANIFEST QUANTITIES)

This section applies if the quantities of the dangerous goods stored and handled on the premises exceed the "Manifest Quantities" shown in Appendix 2.

In developing the emergency plan, the advice of the fire brigade must be sought – a copy must be lodged with the Commissioner of the NSW Fire Brigades (ie at a central point and not with the local fire brigade). Regard must be had to any written advice from any emergency service.

If an emergency may impact beyond the perimeter of the premises, the persons with control of adjacent premises should be consulted about how the plan would be implemented, especially any requirement for the evacuation of persons from the premises.

It may also be necessary to consult with the local counter-disaster organisation and other authorities responsible for environment and planning as well as local government to ensure consistency with emergency planning legislation – eg State Emergency Disaster Plans ('DISPLANS').

14.5 IMPLEMENTING, COMMUNICATING AND MAINTAINING THE PLAN (PREMISES ABOVE MANIFEST QUANTITIES)

This section applies if the quantities of the dangerous goods stored and handled on the premises exceed the "Manifest quantities" shown in Appendix 2.

14.5.1 Communicating the plan

The contents of the emergency plan must be communicated to all people who may be exposed to a risk as a result of a serious incident (emergency), including the following:

- employees
- contractors and sub-contractors who may be present from time to time
- persons in control of adjacent premises to the extent that it is relevant.

The plan should be in a readily accessible and understandable form. It may need separate sections applicable to each group above and made relevant to their circumstances. This could be either a hard copy or in a computer format. The location of the emergency plan should be known to supervisors, contractors and employees, and discussed with emergency services whenever there is a review or update. A copy should be made available to the fire brigade and other relevant emergency services.

14.5.2 Reviewing the plan

The occupier must review the emergency plan:

- if there is a change in circumstances at the premises or adjacent premises so that the plan no longer complies
- at intervals of not more than five years from the date on which the plan was developed or last reviewed.

The emergency plan should be tested once devised and then after each modification and at regular intervals. Simulated emergencies and other exercises should systematically attempt to involve all people likely to be involved in a serious incident or incident. These exercises should include practical drills.

Plans should be updated when any of the following occurs:

- there is a change in circumstances on or off the premises leading to a change in risks
- updated information on risks becomes available
- a deficiency in the plan is identified.

14.6 EMERGENCY PROCEDURES

Emergency procedures should be developed to cover all foreseeable emergencies such as the following:

- fires and explosions
- spillages of dangerous goods
- release of gas or vapour
- uncontrolled reactions
- risks external to the actual dangerous goods (such as a fire on adjacent premises or vehicle collision).

The procedures should be brief and displayed in a sign or made readily available (eg as a pocket card for workers – see Appendix 6).

The procedures required will depend on the nature of the premises. However, as a minimum they should describe procedures for:

- raising the alarm
- contact details of emergency services (eg Fire Brigade and/or Ambulance), and/or local council or Department of Environment and Conservation
- immediate actions to be taken by the worker.

14.7 EMERGENCY EQUIPMENT – ESCAPE OF DANGEROUS GOODS

Equipment required to contain and clean up any escape, spill or leak of dangerous goods must be kept on the premises and be accessible at all times (OHS Regulation clauses 174ZE).

Consider the need for the following items:

- over packs such as oversized drums for containing leaking packages
- absorbent material (suitable for the goods likely to be spilled)
- booms, plates and/or flexible sheeting for preventing spillage from entering drains and waterways
- neutralising agents such as lime or soda ash
- suitable pumps and hoses for removal of spilled liquids
- hand tools such as mops, buckets, squeegees and bins
- suitable PPE for the workers undertaking clean up or other emergency related tasks such as closing valves.

Establish a procedure for the regular checking, maintenance and replenishment of this equipment to ensure it is serviceable.

14.8 RESPONDING TO AN EMERGENCY

Immediate action should be taken to assess and control any risk associated with an emergency, including fire protection.

Only people who are essential to the tasks of assessing and controlling the risk associated with the emergency should be permitted to remain in the vicinity of the emergency. The procedures and plan should specify those essential personnel.

Serious incidents, emergencies and other incidents should be investigated – see advice in chapter 2, sections 2.11 and 2.12, of this code of practice.

CHAPTER 15 – PLACARDING AND SIGNAGE

15.1 APPLICATION

This chapter applies to premises where dangerous goods are stored or handled in quantities in bulk, or in packages above the "Placarding quantity" in Appendix 2. This includes dangerous goods in process vessels. The legal obligations for placarding are contained in clauses 174ZJ to 174ZM of the OHS Regulation.

Transit storage locations do not require placarding since the load or vehicle signs and placards are sufficient.

15.2 PRINCIPLES

Placards provide visual warning of the hazards associated with the storage of dangerous goods at the premises. This is particularly important for emergency services such as the fire brigade.

Placards must be displayed if the dangerous goods are stored in bulk, or in packages over certain quantities – see the "placarding quantity" and rules in Appendix 2. To determine this, the total quantity of dangerous goods on the premises of each class, sub-class and packing group needs to be calculated, as well as the quantities in each storage location. Individual vehicles parked while loaded for transport should be included in the calculations of the quantities, unless the dangerous goods are in transit (see the definition of "transit").

Placards are of three types:

- an "outer" warning placard, known as the "HAZCHEM" placard, on the outside approaches to the premises
- placards at each location of dangerous goods in bulk (eg tanks)
- placards at each location where packages stored and handled.

Placards are not required in the following circumstances:

- in an IBC or bulk container intended for transport and marked in accordance with the ADG code
- C1 combustible liquids in a quantity not exceeding 10,000 litres
- dangerous goods of Class 2.1 or 3, or combustible liquids stored in an underground tank at a retail outlet where the goods are used to refuel vehicles (eg at a service station)
- dangerous goods in transit, since a sufficient placard or marking is provided under the appropriate transport code (C1 does not require a placard for transport).

Placards must be kept legible and unobstructed. Placards need to be visible from all normal approaches to the storage location, and/or the main entrance. This is so that the placards are readily visible to emergency services when approaching the location where the goods are stored or handled.

15.3 TYPES OF PLACARDS

15.3.1 Outer warning placards

The premises must be marked by a "HAZCHEM" Outer Warning Placard if the *total* quantity of dangerous goods stored or handled at the *premises* exceeds the "Placarding Quantity" on the premises for any item shown in Appendix 2. An outer placard may be needed even when no specific storage location in the premises requires a placard.

These Outer Warning Placards must be displayed at all road and rail entrances to the premises where emergency services may gain entry. Usually this will be at the main road entrance. However, if the premises consists of buildings back from the street, such that the placard at the street entrance would be not be effective, the Outer Warning Placard should be displayed at each entrance of the building that may be used by the emergency services. If in doubt, consult with the fire brigade about the location.

15.3.2 Bulk storage

Placards are required for each bulk storage location, even where the quantity does not exceed the "placard quantity" in Appendix 2.

The quantities defining "bulk" are:

- for gases – a container of more than 500 L "water capacity" (usually a tank)
- for liquids – a container of more than 450 L capacity (or a mass of more than 450 kg)
- for solids – more than 450 kg (or more than 450 L container capacity), which includes uncontained solids such as a pile on the ground.

Placards for bulk storage are essentially the same as the full size Emergency Information Panel (EIP) required by the ADG code for bulk transport, with the emergency contact details removed. A bulk container, vehicle or an IBC marked in accordance with the ADG code is acceptable (apart from combustible liquids).

The placard must be located on or adjacent to the bulk container (such as a tank) or storage. Underground tanks and the associated pipework do not require a placard if at a retail service station.

Examples of placards and the dimensions are shown in Appendix 3.

15.3.3 Packaged dangerous goods

Placards must be displayed on or near each storage location for packaged dangerous goods, if the quantity in the storage location exceeds the "placard" quantity specified in Appendix 2. This quantity should be calculated as the maximum likely (rather than as a minimum) and include factors such as a possible extra load delivered to meet peak demand or before a holiday.

The groupings of Classes, Sub-risks and compatibilities of packages in each storage location are dictated by the principles of separation and segregation (see section 8.7 of this code of practice).

For existing stores of packaged dangerous goods, the signs required under the previous regulations for dangerous goods are usually sufficient.

The Class label (and/or mixed Class labels) should be grouped together. Grouping need not be in a horizontal line – it can be vertical or diagonal. If there is regular variation in the type of dangerous goods it may be convenient to use frames for slip-in/slip-out labels (eg the type commonly used on vehicles). Vehicles and loads marked in accordance with the ADG Code placards are acceptable.

CHAPTER 16 – MANIFESTS AND NOTIFICATION OF PREMISES TO WORKCOVER

16.1 APPLICATION

This chapter describes additional requirements for premises where dangerous goods are stored and handled in relatively large quantities, above the "Manifest quantities" in Appendix 2. A written emergency plan in is also required at these levels (see chapter 14).

16.2 PREPARING A MANIFEST AND PLAN OF THE PREMISES

16.2.1 Legal requirement

A manifest must be prepared when the quantity of dangerous goods on the premises exceeds the quantities listed in schedule 7 of the OHS Regulation (see Appendix 2 for quantities, and details of the contents in Appendix 4), as required by clause 174ZN of the OHS Regulation. The manifest covers the whole premises.

This includes goods loaded onto vehicles, except dangerous goods in transit since there are shipping documents.

The manifest must be readily available to the emergency services and an inspector.

16.2.2 Purpose of manifests

The purpose of the manifest is to provide emergency services with information on the quantity, type and location of dangerous goods on the premises, to enable them to respond appropriately in a serious incident.

The manifest could also serve the purpose of the list of dangerous goods for the Register (see section 3.5), and form the basis for notification to Workcover (see section 16.3).

16.2.3 Location of the manifest

The manifest must be kept on the premises in a place easily accessible to the emergency services. It should be located near the Outer Warning Placard at the front of the premises (see chapter 15), unless otherwise agreed with the fire brigade. It should be housed in a holder of substantial waterproof construction. Typically this would be at the main vehicular entrance to the premises.

16.2.4 Contents of the manifest

The manifest is a document that includes the following information:

- general information – the name of the occupier of the premises, the address of the premises, and the date when the manifest was prepared or last amended
- emergency contact information for at least two people who may be contacted in the event of a serious incident

- a summary information about the classes and Packing Groups (if any) of the dangerous goods at the premises
- information about dangerous goods stored in bulk, other than IBCs
- information about packaged goods and IBCs
- information about dangerous goods in processes such as manufacture
- dangerous goods loaded onto vehicles, vessels or aircraft (except when in transit)
- a plan of the premises.

For dangerous goods in transit, items 3, 4 and 5 may be in the form of shipping documents (as provided by the ADG Code).

The manifest must be revised when there is a change in any of the above information.

Details of the contents and a sample manifest are provided in Appendix 4.

16.2.5 Plan of the premises

The purpose of the plan is to identify the places, buildings and structures on the site where the dangerous goods are stored or handled. It should be easy for emergency personnel to read and considered when the emergency plan is being developed (see chapter 14). The plan can also be used as a tool in the risk assessment process. The items included on the plan should be relevant to the risks and include matters significant to the emergency response. For example, the drains included on the plan should be those related to spill control or those along which spilt liquids or gases could travel. Underground sewer pipes, for example, would not be relevant.

The plan should be on a scale that adequately illustrates the details required.

Details of the requirements and an example are provided in Appendix 4.

16.3 NOTIFYING DETAILS OF YOUR PREMISES TO WORKCOVER

Information provided to workCover is kept on an electronic database that enables the fire brigade to access information on sites during emergencies. This includes access to information about the hazards in premises adjacent to or near a fire so that an appropriate response can be quickly developed.

The occupier of premises where dangerous goods are stored and handled in quantities that exceed, or are likely to exceed, the relevant quantities specified in the column headed “Manifest quantities” in the table in Appendix 2 of this code of practice (schedule 5 of the OHS Regulation), must ensure WorkCover is notified.

The quantity is the total quantity on the premises, including that loaded onto vehicles. This does not apply to dangerous goods in transit.

This must be done within 14 days of the obligation arising, with a further notification at least every year.

The information that must be provided to WorkCover includes:

- the name of the occupier
- the address of the premises where the dangerous goods are stored and handled
- the occupier's contact details
- the nature of the principal activities involving the dangerous goods
- the Class and maximum quantity of the dangerous goods stored and handled in bulk or as packaged dangerous goods
- descriptions, details and maximum quantity of any C1 combustible liquids stored and handled in bulk or as packaged dangerous goods
- the product name and the maximum quantity of goods too dangerous to be transported.

Notification forms can be obtained from WorkCover that will guide you through the details of the information required – phone 13 10 50 or look at the WorkCover web site – www.workcover.nsw.gov.au. The form is known as the Dangerous Goods Notification Form DGN 1.

Requirements and procedures for notifying incidents to Workcover are provided in chapter 2, sections 2.11 and 2.12.

CHAPTER 17 – TRAINING

Training programs should be developed and assessed in consultation with employees. Training needs should be identified in the risk assessment process.

17.1 INDUCTION TRAINING

All new employees must receive induction training covering the following elements (OHS Regulation clause 13(1)):

- arrangements for the management of occupational health and safety, including arrangements for reporting hazards to management
- health and safety procedures relevant to the work of the employee, including the use and maintenance of risk control measures
- how to access any health and safety information that the employer is required to make available to each employee
- any other induction training relevant to the place of work, having regard to the competence, experience and age of the new employee.

17.2 TRAINING TOPICS

Consideration should be given to the following topics in training, as a minimum, where relevant to the job:

- the types and quantities of dangerous goods and combustible liquids at the premises, work location, and the correct manner in which they are stored and used
- safe work methods to be used on the job, including matters described in this Code of practice
- the safe use of any tools, plant and associated equipment, and dangerous goods or hazardous substances to be used on the job, such as fire protection measures and eliminating sources of ignition
- administrative procedures for controlling risks, such as ensuring permit to work systems are followed
- the correct use, care and storage of personal protective equipment (PPE) including any relevant hygiene issues
- dust, gas and fire risks that may be present and the controls adopted, including procedures to follow if equipment such as dust extraction fails
- hazardous areas and restrictions on ignition sources, especially vehicles and portable items
- recognition of plant failures or other system failures that could lead to an escape of dangerous goods
- emergency and evacuation procedures (including recognising the fire alarm, fire fighting measures and the location of fire fighting equipment and other emergency equipment), confined spaces entry procedures and rescue of entrapped persons
- how to observe any administrative controls, such as restrictions on entry into areas, and warning signs, including signs attached to containers, controls or valves

- the dangerous goods classification or hazardous substances classification (if any) of substances used, stored or handled; and any other relevant safety, or health risks (eg dusts or emissions) arising from work, handling or storage
- security measures, signs and procedures (see also section 2.12)
- the dangers of the containers of dangerous goods as confined spaces, and the confined spaces entry procedures (if entry is planned, or could be required for emergency rescue)
- how to access health and safety information, such as the register and/or the manifest, reading labels, signs, placards, and material safety data sheets.

The risk assessment process may indicate other training topics that are relevant and necessary.

17.3 OUTCOMES OF TRAINING

The outcomes of training include the ability of workers to demonstrate an understanding of the following matters, where relevant to the particular job:

- an understanding of the dangerous goods classification system
- safe work practices relating to the storage and handling of dangerous goods at the premises
- how to interpret information provided on labels, signs and placards
- how to locate a Material Safety Data Sheet (MSDS) and how to use this information, and where to obtain any other relevant information
- the nature of the hazards and risks associated with the duties being performed
- measures used to control the risks and how to apply these
- proper use, cleaning and replacement of PPE
- emergency procedures
- first aid and incident reporting procedures to be followed in the case of illness, injury, incident or serious incident.

17.4 REVIEWING TRAINING

To ensure training remains effective, it should be reviewed regularly to identify any need for further training. Employees should be consulted so they can help identify training needs.

Training should be reviewed when the risk assessment is reviewed (see chapter 7).

Information, instruction and training should be evaluated to ensure that the content is clearly understood by workers. Evaluation could take the form of on-the-job observation and through consultation. Refresher training should be provided as required.

17.5 TRAINING RECORDS

Records of training must be kept for five years, in a suitable form, for those employees who are likely to store or handle dangerous goods (OHS Regulation, clause 174ZV).

APPENDIX 1 – NON-WORKPLACES – QUANTITIES ABOVE WHICH THIS CODE OF PRACTICE APPLIES

The quantities in the following table are the quantities above which this Code of Practice and the OHS Regulation apply to non-workplaces.

Class and type of dangerous goods	**Threshold quantity above which OHS legislation applies**
Liquefied Petroleum Gas (LP Gas) in cylinders (being dangerous goods of Class 2.1)	500 L water capacity of containers
Class 2.1, other than LP Gas (eg acetylene in cylinders)	200 L water capacity of containers
Class 2.2 (eg oxygen or air in cylinders)	300 L water capacity of containers
Class 2.3 (eg pesticide gas)	any quantity (ie this code of practice applies to a non-workplace where any class 2.3 is stored or handled)
Class 3, not in Packing Group 1 (eg petrol, kerosene)	100 L
Pool chlorine (ie solid pool chlorine of Class 5.1)	100 kg
Sodium hypochlorite designated by UN number 1971 (ie liquid pool chlorine of Class 8)	100 L
Class 9	100 kg
Any Class of dangerous goods in Packing Group 1	5 kg or 5 L
C1 Combustible liquids (eg diesel fuel)	1,000 L
Any other dangerous goods not covered above	100 kg or 100 L

Notes:

- for gases the volume is the water capacity of the container (such as a cylinder) in litres, and not the total volume of gas when released from pressure
- where the quantity is expressed as litres or kilograms, the number of litres or kilograms when added must not exceed the overall threshold for either litres or kilograms.

APPENDIX 2 – QUANTITIES AT WHICH NOTIFICATION, PLACARDS AND MANIFESTS ARE REQUIRED UNDER SCHEDULE 5 OF THE OHS REGULATION.

1. For the purposes of the Table below, the placarding quantity or manifest quantity is equal to the total of the quantities determined in accordance with items 2 and 3.

2. In relation to:

   a. packaged dangerous goods in a container that are:

      i. non-liquid dangerous goods (other than Class 2 dangerous goods) – the quantity is to be determined by the net mass in kilograms of the goods in the container

      ii. liquid dangerous goods (other than Class 2 dangerous goods) – the quantity is to be determined by the net capacity of the container

      iii. Class 2 dangerous goods – the quantity is to be determined by the water capacity of the container

   b. dangerous goods in bulk that are:

      i. non-liquid dangerous goods (other than Class 2 dangerous goods) – the quantity is to be determined by the mass in kilograms that the container is designed to hold

      ii. liquid dangerous goods (other than Class 2 dangerous goods) – the quantity is to be determined by the design capacity of the container in litres

      iii. Class 2 dangerous goods – the quantity is to be determined by the water capacity of the container

      iv. solid dangerous goods not in a container – the quantity is to be determined by the undivided mass in kilograms

   c. dangerous goods that are articles or things – the quantity is to be determined by the net quantity of that part of the article or thing that is in itself dangerous goods.

3. In the table below, kg or L means, where this combination of letters immediately follows numbers, the combined total of:

   a. the number of kilograms of non-liquid dangerous goods (other than Class 2 dangerous goods)

   b. the number of litres of liquid dangerous goods (other than Class 2 dangerous goods)

   c. the water capacity of containers of Class 2 dangerous goods

   in accordance with item 2.

4. For the purposes of the Table below, separately, in relation to the storage or handling of dangerous goods separately from other dangerous goods, means the physical separation of the dangerous goods from other dangerous goods, by either distance or a physical barrier.

Table				
Group	Description of dangerous goods	Packing Group	Placarding quantity	Manifest quantity
1	Class 2			
	Class 2.1	Not Applicable	500 L	5,000 L
	Class 2.2, Subsidiary Risk 5.1	Not Applicable	2,000 L	10,000 L
	Other Class 2.2	Not Applicable	5,000 L	10,000 L
	Class 2.3	Not Applicable	50 L	500 L
	Aerosols	Not Applicable	5,000 L	10,000 L
	Cryogenic fluids	Not Applicable	1,000 L	10,000 L
2	Class 3, 4.1, 4.2, 4.3, 5.1, 5.2, 6.1 or 8	I	50 kg or L	500 kg or L
		II	250 kg or L	2,500 kg or L
		III	1,000 kg or L	10,000 kg or L
		Mixed Packing Groups in a single Class with the quantity of each Packing Group below the specified quantity for the Packing Group.	1,000 kg or L	10,000 kg or L
3	Class 9	II	1,000 kg or L	10,000 kg or L
		III	5,000 kg or L	10,000 kg or L
		Mixed Packing Groups in Class 9 with the quantity of each Packing Group below the specified quantity for the Packing Group.	5,000 kg or L	10,000 kg or L
4	Mixed Classes of dangerous goods where none of the Classes, types or Packing Groups (if any) present exceeds the quantities specified for the relevant quantity in Item 1, 2 or 3 of this Table.	Not Applicable	5,000 kg or L – The quantity applies only if the placarding quantity for an individual Class that is present is 5,000 kg or L. 2,000 kg or L – The quantity applies only if the placarding quantity for all of the Classes present is 2,000 kg or L or less.	10,000 kg or L

5	C1 combustible liquids stored or handled with fire risk dangerous goods where none of the Classes, types or Packing Groups (if any) present exceeds the quantities in Items 1, 2 or 3 of this Table.	Not Applicable	1,000 kg or L	10,000 kg or L
6	Goods to dangerous to be transported that are not kept in a laboratory.	Not Applicable	Any quantity	Any quantity
7	C1 combustible liquids in bulk stored and handled separately from other dangerous goods.	Not Applicable	10,000 L	100,000 L
	C1 combustible liquids stored and handled in packages separately from other dangerous goods.	Not Applicable	50,000 L	100,000 L
	C1 combustible liquids in bulk and in packages stored and handled separately from other dangerous goods provided the quantity in bulk is 10,000 L or less.	Not Applicable	50,000 L	100,000 L

Note. For the purposes of item 3 in the Table, where Class 9 dangerous goods do not have a Packing Group assigned to them, they are deemed to be assigned to Packing Group III.

APPENDIX 3 – REQUIREMENTS FOR PLACARDS UNDER SCHEDULE 6

The purpose of this appendix is to illustrate the form of placards required by the OHS Regulation, schedule 6.

SCHEDULE 6 PLACARDING REQUIREMENTS

(Clauses 174ZJ and 174ZK)

1. OUTER WARNING PLACARD

1. The placard must have:

a. the form shown in Figure 1

b. dimensions not less than those shown in Figure 1.

2. The placard must display the word "HAZCHEM" in red letters not less than 100 mm high and of the style shown in Figure 1, on a white or silver background.

3. For the purposes of subclause (2), ***red*** means the colour Signal Red in accordance with AS 2700S-1996 (R13), *Colour Standards for general purposes-Signal Red.*

Figure 1: Form and dimensions of an outer warning placard

2. PLACARD FOR DANGEROUS GOODS IN BULK OF CLASS 2.1, 2.2, 2.3, 3, 4.1, 4.2, 4.3, 5.1, 5.2, 6.1, 8 OR 9

1. The placard must have:

a. the form shown in Figure 2

b. dimensions not less than those shown in Figure 2.

2. The placard must contain the following information:

a. in space (p) in Figure 2, the proper shipping name

b. in space (q) in Figure 2, the UN Number

c. in space (r) in Figure 2, the Hazchem Code for the dangerous goods specified in the ADG Code

d. in space (s) in Figure 2, the Class label and Subsidiary Risk label, if any.

3. For the purposes of subclause (2) (d):

a. the Class label and the Subsidiary Risk label, if any, must have the form and colouring specified in the ADG Code

b. if there is more than one Subsidiary Risk label, the width of the right hand portion of the placard may be extended.

3. PLACARD FOR DANGEROUS GOODS IN BULK THAT ARE GOODS TOO DANGEROUS TO BE TRANSPORTED

1. The placard must have:

a. the form shown in Figure 2

b. dimensions not less than those shown in Figure 2.

2. The placard must contain the following information:

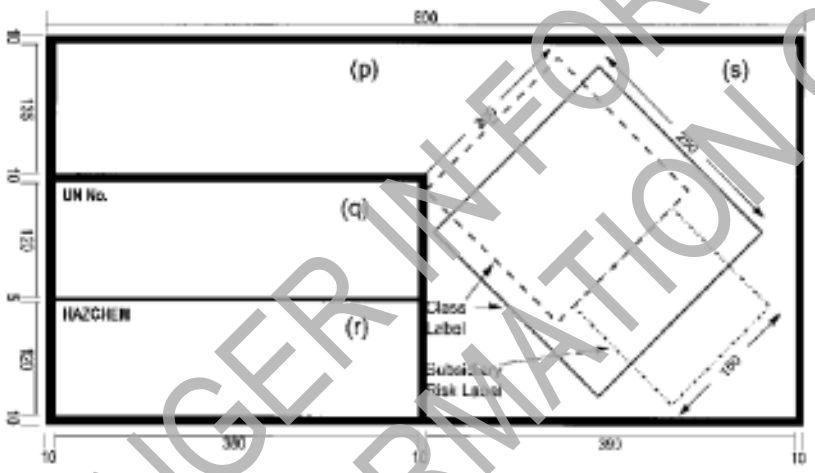
a. in space (p) in Figure 2, the name for the goods specified in Appendix 5 of the ADG Code

b. space (q) in Figure 2 must be left blank

c. space (r) in Figure 2 must be left blank

d. in space (s) in Figure 2, the label specified in Figure 4.

Figure 2: Template for a placard for dangerous goods (other than C1 combustible liquids) in bulk



Note:

1. The numerals and letters used for showing the proper shipping name or name of the goods, UN Number and Hazchem Code must be:

a. black on a white background, except where a letter of the Hazchem Code is white on a black background, and

b. at least 100 mm high, except where the proper shipping name requires 2 lines to be used, in which case the lettering must be at least 50 mm high.

2. An Emergency Information Panel of a size and layout in accordance with the ADG Code for the dangerous goods that contains the information required by clause 2 or 3 may be used as a placard for a storage of dangerous goods in bulk instead of the placards referred to in clause 2 (1) or 3 (1).

4. PLACARD FOR PACKAGED DANGEROUS GOODS

1. The placard must have the form shown in Figure 3 and be of sufficient size to accommodate the labels to be displayed on it.

2. The placard must have a white or silver background.

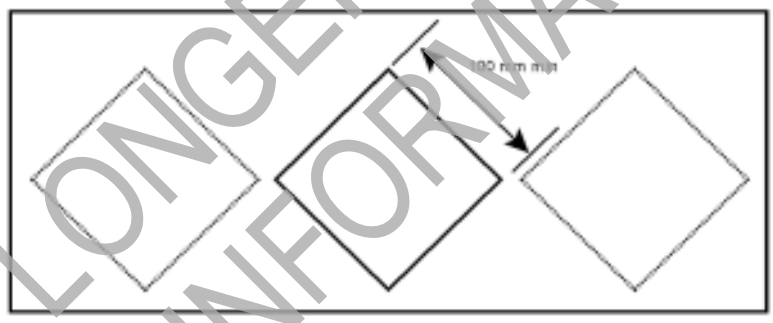
3. The placard must display:

a. for dangerous goods present in the storage location, other than goods too dangerous to be transported:

- the corresponding Class label for each Class of dangerous goods present in a quantity that exceeds the quantity specified in the column headed "Placarding quantity" in the Table to Schedule 5
- if the total quantity of mixed Classes of dangerous goods exceeds the mixed Classes quantity specified in Item 4 of the Table to Schedule 5:
  - a Class label for each Class of dangerous goods present that exceeds 50 per cent of the quantity specified for the Class in Item 1, 2 or 3 of the Table
  - if no other Class label is required, a mixed Class label
- for C1 combustible liquids and fire risk dangerous goods in an aggregate quantity exceeding 1,000 L – a Class 3 Class label

b. for goods too dangerous to be transported present in the storage location, the label specified in Figure 4.

Figure 3: Form and dimensions of a placard for storages of packaged dangerous goods



Note: The Class label, mixed Class label and the label required by clause 4 (3) must have sides at least 100 mm long.

APPENDIX 4 – INFORMATION THAT MUST BE CONTAINED IN A MANIFEST UNDER SCHEDULE 7

These details are taken from schedule 7 of the OHS Regulation, which applies to premises where the quantities are above the "Manifest level" shown in Appendix 2 of this code of practice.

These requirements are illustrated in Appendix 5 by a "Sample Manifest Form" and a "Sample Plan of Premises".

The following information is to be contained in a manifest.

1. GENERAL INFORMATION

1. The name of the occupier of the premises.
2. The address of the premises.
3. The date when the manifest was prepared or last revised.

2. EMERGENCY CONTACTS

Contact information for at least two persons (or for one person if that person is available at all times) who may be contacted in the event of an emergency for information as to the nature and quantity of dangerous goods likely to be on the premises.

3. SUMMARY INFORMATION ABOUT CLASSES OF DANGEROUS GOODS

A summary list that specifies the maximum quantity of:

a. each Packing Group of each Class of dangerous goods that has Packing Groups

b. each Class of dangerous goods that does not have Packing Groups

c. C1 combustible liquids

d. each type of goods too dangerous to be transported

that the premises may store or handle.

4. DANGEROUS GOODS STORED IN BULK OTHER THAN IN IBCS

1. In relation to each container (other than an IBC) and each other form of storage of dangerous goods in bulk at the premises:
   - the identification number or code
   - the type and capacity.
2. In relation to dangerous goods that are:
   - dangerous goods other than C1 combustible liquids or goods too dangerous to be transported – the proper shipping name, the UN Number and Class of the dangerous goods
   - C1 combustible liquids – the product name and the statement "Combustible Liquid"
   - goods too dangerous to be transported – the name of the goods specified in Appendix 5 of the ADG Code and the statement: "Goods too dangerous to be transported".

5. PACKAGED DANGEROUS GOODS

In relation to each storage location that contains packaged dangerous goods or dangerous goods in IBCs, and that is required to be placarded in accordance with Subdivision 6 of Division 3 of Part 6A.3:

a. the identification number or code for the storage location, and

b. for dangerous goods of Packing Group I or Class 2.3 that are likely to be kept in the storage location:

   i. the proper shipping name of the dangerous goods that are assigned to a Class

   ii. the Class

   iii. the maximum quantity of each of the dangerous goods that may be stored or handled in the storage location

c. for goods to dangerous to be transported that are likely to be kept in the storage location:

   i. the name of the dangerous goods specified in Appendix 5 of the ADG Code

   ii. the statement "Goods to dangerous to be transported"

   iii. the maximum quantity of each of the dangerous goods that may be stored or handled in the storage location

d. for other dangerous goods that are likely to be kept in the storage location:

   i. for dangerous goods with an assigned Class – the Class for the dangerous goods

   ii. for C1 combustible liquids – the statement "Combustible Liquid"

   iii. in any case, the of each Class and the maximum quantity of C1 combustible liquids that may be stored or handled in the storage location.

6. DANGEROUS GOODS IN MANUFACTURE

In relation to each location where dangerous goods are manufactured:

a. the identification number or code of the manufacturing location

b. for dangerous goods with an assigned Class – the Class of each type of dangerous goods and the maximum quantity of each Class that can be handled in the location

c. for goods to dangerous to be transported – the statement "Goods to dangerous to be transported", and the maximum quantity of those goods that can be handled in the storage location

d. for C1 combustible liquids – the statement "C1 combustible Liquid", and the maximum quantity of the C1 combustible liquids that may be handled in the location.

7. DANGEROUS GOODS LOADED ONTO VEHICLE, VESSEL OR AIRCRAFT

If, in relation to any dangerous goods loaded onto a vehicle, vessel or aircraft at the premises, there are dangerous goods shipping documents that comply with the ADG Code available for the goods, the information required by clauses 3, 4 and 5 may be provided in the form of a compilation of those shipping documents.

8. PLAN OF PREMISES

A plan of the premises that:

a. shows the location of:

   i. the containers and other forms of storage of dangerous goods in bulk referred to in clause 4

   ii. the storage locations for the packaged dangerous goods and dangerous goods n IBCs referred to in clause 5

   iii. the locations where dangerous goods are manufactured referred to in clause 6

b. includes a description in words of the location of:

   i. the items referred to in paragraph (a)

   ii. areas where dangerous goods loaded onto a vehicle, vessel or aircraft may be located

c. provides the identification number or code for the items referred to in paragraph (b)

d. provides a legend for the identification numbers and codes referred to in paragraph (c)

e. shows the location of:

   i. the main entrance and other points of entry to the premises

   ii. essential site services, including fire services and isolation points for fuel and power

   iii. the manifest

   iv. all drains on the site

f. describes the nature of the occupancy of adjoining sites or premises.

APPENDIX 5 – SAMPLE MANIFEST FORM

DANGEROUS GOODS AND COMBUSTIBLE LIQUIDS MANIFEST

1. GENERAL INFORMATION

Occupier: .....

Address of premises: .....

.....

Date of preparation: .....

Site Plan Number: .....

2. EMERGENCY CONTACTS

NAME	POSITION	TELEPHONE
		B/H A/H
		B/H A/H
		B/H A/H

3. SUMMARY INFORMATION ABOUT CLASSES OF DANGEROUS GOODS

Class	Packing Group	Maximum quantity
2.1	NA	3,000 L
3	II	52,000 L
3	III	36,075 L
4.1	I	50 kg
5.1	II	18,000 L
6.1	III	15,000 kg
8	II	14,100 L
C1	NA	29,000 L

4. BULK STORAGE

Tank Id No.	Dangerous goods					Tank	
	Name	Class	Sub Risk/s	UN No.	PG	Type	Capacity
DG T1	Petrol	3	n/a	1203	II	u/g	30,000 L
DG T2	Combustible liquid	C1	n/a	n/a	n/a	u/g	29,000 L
DG T3	LP Gas	2.1	n/a	1075	n/a	a/g	3,000 L
DG T4	Hydrogen Peroxide	5.1	8	2014	II	a/g	18,000 L

u/g — underground

a/g — aboveground

n/a — not applicable

5. PACKAGE STORAGE LOCATIONS

5.1 Packaged dangerous goods of Packing Group I or Class 2.3

Storage location	Dangerous goods					Quantity	
	Name	Class	Sub Risk	UN No.	PG	Average	Maximum
PS1	Sodium Picramate	4.1		1349	I	20 kg	50 kg

5.2 Other packaged dangerous goods

Storage location	*Class*	Sub Risk(s)	Packing Group	Average Quantity	Maximum Quantity
PS2	6.1		III	10,000 kg/L	15,000 kg
PS3	3		II	15,000 L	20,000 L
	3		III	15,000 L	25,000 L
	3	8	III	600 L	1,000 L
	C1			15,000 L	20,000 L
	C2			4,000 L	8,000 L
PS4	8		II	8,000 kg/L	12,000 L

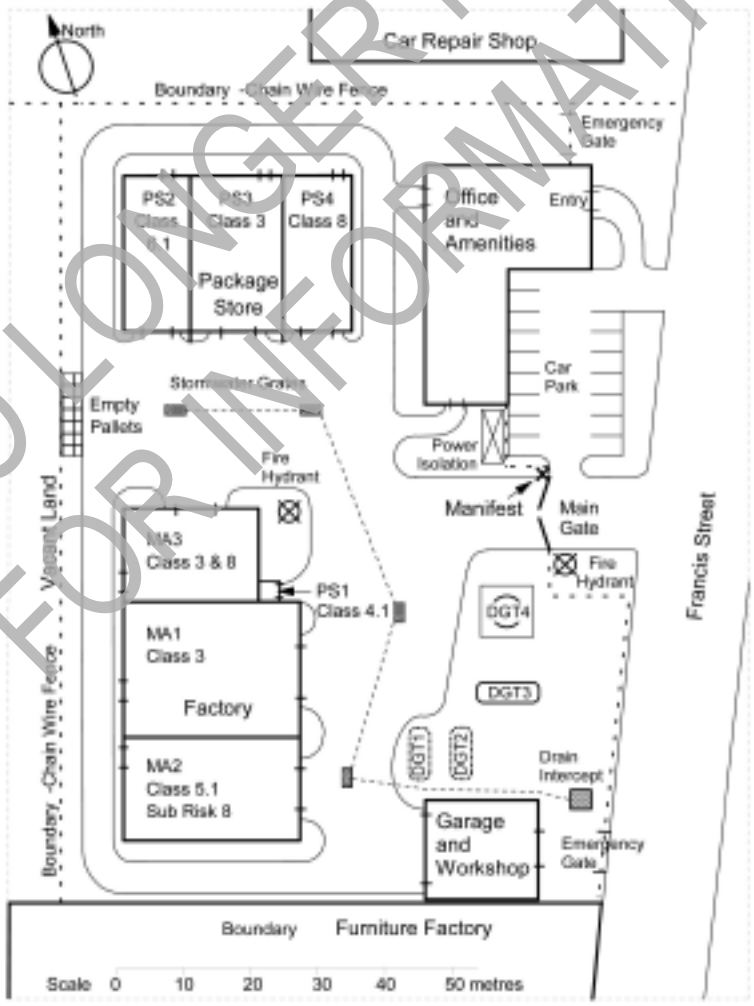
6. MANUFACTURING LOCATIONS

Location	Class	Sub Risk(s)	Packing Group	Max. Quantity
MA1	3		II	2,000 L
	3		III	10,050 L
	C2			2,000 L
MA2	5.1	8	II	1,500 L
MA3	3		II	200 L
	3		III	25 L
	8		II	100 L
	8		III	2,000 L

7. DANGEROUS GOODS LOADED ONTO VEHICLES

Loaded vehicles are not kept at the site.

8. SAMPLE PLAN OF PREMISES



APPENDIX 6 – SAMPLE EMERGENCY PROCEDURES POCKET CARD

For a Transport Depot where dangerous goods are handled – could readily be adapted for other premises

Outside

FIRE PROCEDURES

On hearing Alarm:

- Make safe whatever you are doing
- Ensure all roadways and emergency accesses in your area are clear
- Move as quickly as possible to your designated assembly area
- Have your name checked off immediately on arrival
- Watch out for emergency vehicles
- Avoid moving through smoke and any signs of emergency activity
- Follow instructions from Area Wardens
- Take contractors and visitors with you

If you discover a fire:

1. Make sure alarm is raised
2. If possible, move materials in danger away from the fire to stop it spreading
3. Avoid breathing smoke or fumes
4. Fight the fire using extinguisher or hose reel if trained to do so
5. If not involved in fire fighting, keep away and go to assembly area

NO HEROICS!

[Company Details]

SITE EMERGENCY PROCEDURES

Emergencies include:

- FIRE
- COLLISION
- Any INJURY to persons
- CHEMICAL SPILL or LEAK
- Any other incident threatening life, health, property or the environment

In any Emergency:

1. Raise the alarm
2. Notify your Supervisor
3. Warn anyone in danger
4. Then give whatever assistance it is safe for you to give
5. If not involved with the Emergency, keep away from the scene.

NEVER PUT YOURSELF AT RISK

CHEMICAL EMERGENCY

If you discover a DANGEROUS GOODS or Chemical Spill or Leak:

- Keep away until positively identified
- Keep upwind
- Avoid all contact with material
- Avoid breathing gas, fumes, mist or dust
- Immediately notify Supervisor
- Warn nearby persons
- Keep all ignitions sources away

Assess if it is a serious incident, based on type and quantity of leaking substance

Raise alarm if serious incident

Obtain information from:

- Manifest
- Shipping Documentation
- Labels and Placards
- EPG or HB76
- MSDS

Observe HAZCHEM precautions

Stop leakage if safe to do so

Prevent spillage from entering drains

HAZCHEM INTERPRETATION

NUMBER	
1	Water Jets
2	Water Fog
3	Foam
4	Dry Agent

FIRST LETTER			
P	V	Full Protective Clothing*	DILUTE
R		Full Protective Clothing*	
S	V	Breathing Apparatus	
S	V	Breathing Apparatus for Fire Only	
T		Breathing Apparatus	
T		Breathing Apparatus for Fire Only	
W	V	Full Protective Clothing*	CONTAIN
X		Full Protective Clothing*	
Y	V	Breathing Apparatus	
Y	V	Breathing Apparatus for Fire Only	
Z		Breathing Apparatus	
Z		Breathing Apparatus for Fire Only	

SECOND LETTER	
E	Consider Evacuation

Note V: Danger of violent reaction or explosion
* Full Protective Clothing includes Breathing Apparatus

Note – this will be revised in the next edition of the ADG code

APPENDIX 7 – INDICATION OF COMPATIBILITY BASED ON CLASS

This Appendix may be used for guidance as to compatibility between the different classes of dangerous goods, in the absence of more detailed compatibility information about specific products, which should be available from MSDS.

CLASS	2.1	2.2	2.3	3	4.1	4.2	4.3	5.1	5.2	6.1	8	9
2.1 Flammable Gas	**A**	**E**	**C**	**B**	**B**	**D**	**B**	**D**	**D**	**C**	**B**	**B**
2.2 Non-flammable Non-toxic Gas	**E**	**A**	**B**	**E**	**E**	**E**	**E**	**B**	**E**	**B**	**B**	**B**
2.3 Toxic Gas	**C**	**B**	**A**	**C**	**C**	**C**	**C**	**C**	**C**	**B**	**B**	**B**
3 Flammable Liquid	**B**	**E**	**C**	**A**	**B**	**D**	**B**	**D**	**D**	**C**	**B**	**B**
4.1 Flammable Solid	**B**	**E**	**C**	**B**	**A**	**D**	**B**	**D**	**D**	**C**	**B**	**B**
4.2 Spontaneously Combustible	**D**	**E**	**C**	**D**	**D**	**A**	**B**	**D**	**D**	**C**	**B**	**B**
4.3 Dangerous When Wet	**B**	**E**	**C**	**B**	**B**	**B**	**A**	**D**	**D**	**C**	**D**	**B**
5.1 Oxidizing Agent	**D**	**B**	**C**	**D**	**D**	**D**	**D**	**A**	**D**	**F**	**D**	**F**
5.2 Organic Peroxide	**D**	**E**	**C**	**D**	**D**	**D**	**D**	**D**	**G**	**F**	**D**	**F**
6.1 Toxic	**C**	**B**	**B**	**C**	**C**	**C**	**C**	**F**	**F**	**A**	**B**	**B**
8 Corrosive	**B**	**B**	**B**	**B**	**B**	**B**	**D**	**D**	**D**	**B**	**G**	**B**
9 Miscellaneous Dangerous Goods	**B**	**B**	**B**	**B**	**B**	**B**	**B**	**F**	**F**	**B**	**B**	**A**

In this table, combustible liquids should be included with Class 3.

Letters A–G have the following meaning:

A. – Most dangerous goods of the same Class have similar primary hazards and are usually considered to be compatible.

B. – With a few exceptions which should be indicated on MSDS, goods of these two classes are usually non-reactive with each other. However in an emergency such as a spill, leak or fire, the presence of the second Class may lead to different hazards or increased risk such that additional control measures are required.

C. – While goods of these two classes are usually non-reactive with each other, a fire involving the fire risk goods may lead to the release of large clouds of toxic gases or vapours.

D. – Goods of these two classes are likely to interact with each other in such a way as to significantly increase risk. In some cases, interaction may result in fire or evolution of toxic vapours. For those that do not interact, a fire involving one may be violently accelerated by the presence of the other. These classes should not be kept in the same area unless it can be demonstrated that the risks are fully controlled.

E. – **D**, if the Class 2.2 has a Subsidiary Risk 5.1. –**B**, otherwise.

F. – **D**, if the Class 6.1 or 9 is a fire risk substance. –**B**, otherwise.

G. – **D**, if one material is a concentrated, strong acid and the other is a concentrated, strong alkali. –**A**, otherwise.

APPENDIX 8 – FORKLIFTS AND INDUSTRIAL TRUCKS IN HAZARDOUS AREAS

This Appendix provides guidance on the design and protection of industrial trucks such as forklifts operating in hazardous areas, and situations where protection may be necessary.

RISKS WITH FORKLIFTS AND OTHER INDUSTRIAL TRUCKS

Industrial trucks used in hazardous areas present a fire hazard in dangerous goods storage and handling areas where flammable or explosive atmospheres may be present, unless protected. The following guidance addresses a number of specific design and construction issues to assist in reducing the risk. As a general rule, these guidelines should be regarded as the minimum standard to apply, unless the particular risk assessment shows this to be unnecessary.

LP Gas and petrol powered forklifts are not suitable as they cannot be protected. Diesel forklifts can be flame proofed – they can be recognised by a water wash box in the exhaust pipe. Battery electric forklifts can be flame proofed, but battery chargers and the charging process are not and so cannot be carried out in a hazardous area.

As an alternative, a manually operated pallet lifter could be used to move pallets in and out of the store to a position outside the hazardous area where an ordinary forklift can pick up the load.

WHERE PROTECTION MAY NOT BE NECESSARY

A forklift (or other industrial truck) may not need special protection if the risks are not great. Examples are where there are small amounts (eg "minor" storage quantities below the placard level), or the liquids are stored in a flammable liquids cabinet.

For example, the following situation of stored packages of flammable liquids would not require protection if all the following criteria are met:

- the flammable liquids are in small packages (less than 1 L) and are a small proportion of the goods stored
- the flammable liquids are viscous (eg paint or glue)
- the packages are not opened in the area
- the packages are robust and unlikely to be accidentally damaged by the forklift
- the packages are secured onto a pallet (eg by strapping or shrink wrapping)
- the pallets are stored on racks or shelves
- access is easy – there is plenty of room for the forklift to gain access and the pathway to the goods is short and direct
- no packing group (PG) I are kept in the area
- ventilation of the area is good
- public access is restricted when the forklift is in use.

See Appendix D of AS 1940 for further advice on the use of non-explosion protected forklift trucks and vehicles in flammable liquids package stores.

ZONE 1 HAZARDOUS AREAS AS DEFINED IN AS 2430.3

An industrial truck used in a zone 1 hazardous area (as defined in AS 2430.3) should conform to the following:

- if battery operated – the requirements of AS 1915 *electrical equipment for explosive atmospheres – battery operated vehicles*
- if powered by a compression ignition internal combustion engine (ie Diesel) – the recommended provisions shown below.

A Diesel powered truck (ie with an compression ignition internal combustion engine) should have all of the following features:

i. all electrical equipment is removed from the truck or is protected by approved flame proofing, pressurising or purging, or a combination of any or all of these methods, or by other approved means

ii. adequate flame paths are provided on all inlet and exhaust connections

iii. all joints in the inlet and exhaust lines, including the attachments of the inlet and exhaust manifold to the engine block, have at least 12 mm sealing paths. Gaskets, if used, should be of copper 1.5 mm in thickness or of other suitable material

iv. a flame trap is fitted in the air inlet line to the engine

v. a strangler is fitted in the air inlet line to the engine with controls that are within easy reach of the operator of the truck when the operator is at the operating positions

vi. a water wash box or other effective flame trap is provided for quenching exhaust gases

vii. if a water wash box is provided, it contains sufficient water to allow 8 hours' operation without refilling. It should have a low-level cut-off switch such that if the water level in the box drops to a level which renders the water wash inoperative, the motor will automatically stop and cannot be restarted until the water is replenished

viii. precautions are taken to ensure that the maximum temperature reached by any part of the truck that may come into contact with the atmosphere outside the truck does not at any time exceed 200 degrees Celsius when the truck is in operation

ix. all components of the truck are of sufficient strength to withstand an internal explosion of a mixture of propane and air giving the highest explosion pressure possible for such a mixture

x. precautions are taken to ensure that mechanical sparks cannot be produced in the engine compartment of the truck during normal operations.

ZONE 2 HAZARDOUS AREA AS DEFINED IN AS 2430.3

If an industrial truck is used in a zone 2 *hazardous area*, the occupier should ensure that the truck conforms with either that described above for a zone 1 *hazardous area*, or conform to the requirements described below.

The minimum requirements for zone 2 are as follows:

- If powered by an electric motor, the truck is not equipped with a motor or any other electrical equipment capable of arcing or sparking; or if equipped with arcing and sparking equipment, it is protected to eliminate the likelihood of it causing any ignition.
- If powered by a compression ignition internal combustion engine (ie Diesel), the truck should comply with the requirements for a Zone 1 *hazardous area*: parts (v) strangler, (vi) flame trap, (vii) temperature protection and (x) spark prevention, described above. It should also be fitted with a switch kept open at all times the truck is used in the hazardous zone to isolate all electrical equipment that may arc or spark.

APPENDIX 9 – CHECKLIST – CONTROL MEASURES FOR EACH STORAGE LOCATION FOR QUANTITIES ABOVE THE "PLACARD LEVEL" AND BELOW THE "MANIFEST LEVEL".

For each storage area use the following checklist as a guide to applying the requirements. "Yes" means that a control measure is applied; "revise" means that a measure needs to be implemented. "NA" means it does not apply in your particular case.

Class(es) stored and location:				
	Control measure	**Yes**	**Revise**	**NA**
1	The storage location is identified with the appropriate placard (with diamond sign and notices)			
2	The placards are clearly visible from all approaches			
3	Spillage containment is provided: a. for packages – 25 per cent of the total b. in tanks or IBCs – 100 per cent of the total (plus rain water allowance if outside) c. bund walls of an appropriate height.			
4	Any dangerous goods of other classes or sub-risk are separated? (See footnote)			
5	Any material that burns easily is separated? (See footnote)			
6	Any substance that could react with the dangerous goods in the storage area (eg acids are separated from alkali) is separated? (See footnote)			
7	Food or packaging for food is separated? (See footnote)			
8	Is ventilation adequate?			
9	Is temperature control required?			
10	Are additives required to be maintained to ensure stability and is a procedure in place?			
11	An appropriate fire extinguisher or method provided in or near the storage area?			
12	All packages marked with appropriate labelling?			
13	A register of goods kept with appropriate MSDS (material safety data sheets)?			

Notes:

- "separated" means the edge of the bund wall of the storage area for liquids, or the nearest package for solids is at least 5 m away from the following (5 to 8), or by a suitable barrier (liquid proof and fire proof)
- combustible material includes combustible liquids, waste paper, rags, hay, sawdust, dry grass, shrubs and overhanging tree branches.

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