Government of **Western Australia**
Department of **Mines, Industry Regulation and Safety**

GUIDE

Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007

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Contents

Foreword

The Act

A key focus of the *Dangerous Goods Safety Act 2004* (the Act) is the duty to minimise risk from dangerous goods.

The duty to minimise risk not only applies to employers and employees but to all persons, including members of the public. This duty is placed on everyone involved with dangerous goods and goes beyond the workplace duties of the *Occupational Safety and Health Act 1984* and the *Mines Safety and Inspection Act 1994*.

Regulations

The Act is supported by the Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007 (the regulations). It is essential to understand and comply with this legislation and adopt a risk management approach using all relevant codes and standards.

The regulations are enforceable and breaches may result in licence suspension, prosecution, or directions to cease operations and undertake remedial action.

Due to the inherently high hazards of dangerous goods to people, property and the environment (heat, fire, toxicity, explosion and corrosion) the regulations include specific dangerous goods safety measures that must be implemented.

An important part of these requirements relate to emergency services and emergency response. To have internationally recognized safety advice that is consistent from site to site improves safe and appropriate emergency response and greatly assists off-site emergency response personnel. Examples of emergency response measures include emergency plans, *DFES Emergency Response Guide* (FES-ERG), dangerous goods placarding, site plans, signage, dangerous goods manifest, SDS, ensuring safe access, and onsite emergency response materials.

Codes of practice

Approved codes of practice provide safety recommendations to assist people in meeting their obligations under the Act and regulations. The codes are approved and gazetted by the Minister under section 20 of the Act, and may be used as a defence in law (under section 62 of the Act).

These codes are not intended to prevent innovative safety practice or use of equipment that improves safety performance. Although compliance with an approved code is not mandatory, it is expected that deviations from recommended practice will be justified using a risk management approach, and it can be demonstrated that the use of alternative risk control measures provides an equivalent or lower level of risk.

Scope and application

This guide provides practical guidance on how to comply with the regulations for persons who manufacture, import, supply, store or handle dangerous goods and all persons at dangerous goods sites. This guide also applies to major hazard facilities (MHFs) which have additional duties under the Dangerous Goods Safety (Major Hazard Facilities) Regulations 2007 (the MHF Regulations).

A glossary of terms and abbreviations used in this guide are given in Appendices 3 and 4.

How to use this guide

In providing guidance, the word 'should' is used in this guide to indicate a recommended course of action, while 'may' is used to indicate an optional course of action. The words 'must', 'requires' or 'mandatory' indicate that a legal requirement exists that must be complied with. Examples in this guide are normative and form an integral part of this guide.

This guide provides a general overview of regulatory requirements and should be used in conjunction with specific codes of practice that deal with particular subject matters. This guide also includes various references to provisions of the Act, regulations and mandatory codes of practice which set out legal requirements. These references are not exhaustive and this guide should be read in conjunction with the Act and regulations.

This guide also refers to other approved codes of practice which provide specific and detailed technical instructions on dealing with regulatory requirements and Australian Standards that deal with hazardous areas or various classes or mixed classes of dangerous goods.

Though every effort has been made this guide cannot cover every possibility. Persons who have duties under the Act and associated regulations should conduct a specific review of their operations (risk assessment) and consult with competent persons to determine what further measures may be necessary or desirable for the safe storage and handling of dangerous goods, considering good work practices and local circumstances.

PART 1

WHEN DOES THIS GUIDE APPLY?

1 Introduction

1.1 What is a dangerous goods site?

A dangerous goods site is a place where dangerous goods are, or are intended to be, stored or handled.

Rural dangerous goods locations and small quantity dangerous goods locations are not considered dangerous goods sites under the regulations. For safety guidance for these locations see Section 1.5.

1.2 What goods are dangerous goods?

Regulation 8 – Dangerous goods defined

This guide applies to substances, mixtures and articles which are defined as dangerous goods under the regulations (see a list of included dangerous goods in Table 1 and dangerous goods that are specifically excluded in Section 1.5).

If determined to be dangerous goods under the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (Australian Dangerous Goods Code, ADG Code) including special provisions (e.g. for the purposes of transport) – the goods are also considered to be dangerous goods under the regulations.

Example

UN 3082 and 3077 are listed in the ADG Code Dangerous Goods List (Table 3.2.3) as Class 9 dangerous goods with special provisions (column 6 of Table 3.2.3) including SP AU01. AU01 indicates that UN 3077 and UN 3082 are not subject to the code when transported by road or rail in packages or intermediate bulk containers (IBCs).

This means these products are not considered Class 9 dangerous goods when they are in packages or IBCs. However, if the product is in a bulk storage and handling system it will be a Class 9 dangerous goods.

This guide applies to:

- dangerous goods of Classes 2, 3, 4, 5, 8, 9 and Division 6.1 (see Table 1)
- combustible liquids (see Table 1)
- goods too dangerous to be transported (GDT)
- sulphur in all forms
- goods determined to be dangerous goods by the Chief Dangerous Goods Officer.

Note: Combustible liquids may be a component of other dangerous goods (e.g. labelled as Class 3, Division 6.1 or Class 9) but should be considered separately to the dangerous goods classification indicated on the safety data sheet (SDS) and dangerous goods label.

1.3 What is the difference between dangerous goods and hazardous chemicals?

Dangerous goods are classified on the basis of immediate physical or chemical effects, such as: explosion, fire, toxicity, chemical burns, cold burns, metal corrosion or asphyxiation, which can affect people, property or the environment.

Hazardous chemicals are substances, mixtures and articles that can pose a risk to health and safety if not managed correctly. They may have health hazards, physical hazards or both (e.g. corrosives, poisons, carcinogens). A hazardous chemical is any substance, mixture or article that satisfies the criteria of one or more classification in the *Globally Harmonised System of Classification and Labelling of Chemicals* (GHS). Infectious substances, radioactive sources and chemicals that are only hazardous to the environment are not considered hazardous chemicals.

Dangerous goods and hazardous chemicals are regulated under separate legislation focusing on controlling different risks. Where a hazardous chemical is also a dangerous good, dangerous goods legislation would apply in addition to the other legislation.

Table 1 Goods covered by this guide

Type of goods	Description	Dangerous goods label	Reference for classification
Class 2	Gases		ADG Code
Division 2.1	Flammable gases		
Division 2.2	Non-flammable, non-toxic gases		
Division 2.3	Toxic gases		
Class 3	Flammable liquids		ADG Code
Class 4	Flammable solids and other reactive substances		
Division 4.1	Flammable solids, including all forms of sulphur		
Division 4.2	Substances liable to spontaneous combustion		
Division 4.3	Substances that in contact with water emit flammable gases		

Table 1 continued

Type of goods	Description	Dangerous goods label	Reference for classification
Class 5	Oxidising substances, organic peroxides		
Division 5.1	Oxidising substances		
Division 5.2	Organic peroxides		ADG Code
Division 6.1	Toxic substances		
Class 8	Corrosive substances		
Class 9	Miscellaneous dangerous goods and articles		
Goods too dangerous to be transported (GDT)	Goods as listed in the Australian Dangerous Goods Code		
Combustible liquids	Combustible liquids e.g. diesel, pesticide solvents	COMBUSTIBLE LIQUID	DG Regulations
Goods determined to be dangerous goods by the Chief Dangerous Goods Officer	As specified by Chief Dangerous Goods Officer	As specified by Chief Dangerous Goods Officer	

1.4 What is a placarding and manifest quantity of dangerous goods?

> Regulation 12 – Quantity of dangerous goods, determining
>
> Schedule 1 – Quantities of dangerous goods

Placards must be applied to dangerous goods sites where the minimum placarding quantity is exceeded.

When dangerous goods quantity exceeds manifest threshold, additional requirements are triggered. These are:

- dangerous goods site plan and manifest
- written risk assessment for the site
- dangerous goods site licence.

A manifest quantity is a quantity of dangerous goods specified in the column 'Manifest quantity' (Table 2), stored or handled at a dangerous goods site.

A placarding quantity is a quantity of dangerous goods specified in the column headed 'Placarding quantity' (Table 2) is stored or handled at a dangerous goods site.

To determine the quantity of dangerous goods in a storage or handling system the following rules apply, depending on the form of the dangerous goods and its container:

- Class 2 dangerous goods – the total capacity of the container (bulk or packaged) or storage and handling system, in L
- solids (not Class 2) – loose (undivided mass, in kg), packaged (mass, in kg); bulk containers (design capacity of the container, in kg)
- liquids (not Class 2) – packaged (total capacity of the container, in L), bulk (design capacity of the container, in L)
- articles – the quantity of dangerous goods the article contains (e.g. battery acid in lead-acid batteries).

To determine whether this is calculated quantity is a placarding or manifest quantity, refer to Table 2.

Table 2 Placarding and manifest quantities of dangerous goods (Schedule 1 in the regulations)

Item	Description of dangerous goods	Packing group	Placarding quantity	Manifest quantity
1.	Division 2.1 except aerosols	N/A	500 L	5,000 L
2.	Division 2.2 except aerosols	N/A	1,000 L	10,000 L
3.	Division 2.3	N/A	50 L	500 L
4.	Division 2.1 and 2.2 aerosols	N/A	5 000 L	10,000 L
5.	Any one of Class 3, Division 4.1, 4.2 or 4.3, Division 5.1 or 5.2, Division 6.1, Class 8 or Class 9, or any combination of those classes or divisions	I	50 kg or L	500 kg or L
		II and III (aggregate)	1,000 kg or L	10,000 kg or L
		I, II and III (aggregate) where quantity of goods in packing group I does not exceed 50 kg or L	1,000 kg or L	10,000 kg or L
6.	Goods too dangerous to transport	N/A	5 kg or L	50 kg or L
7.	Combustible liquids with fire risk dangerous goods**	N/A	1,000 L	10,000 L
8.	Combustible liquids	N/A	10,000 L	100,000 L

See next page for note for this schedule.

Note for this schedule

For the purposes of item 5 in the table –

(a) All Type B Division 4.1 Self Reactive Substances that do not have a packing group assigned to them are to be taken to be assigned to packing group I.

(b) All Types C to F Division 4.1 Self Reactive Substances that do not have a packing group assigned to them are to be taken to be assigned to packing group II.

(c) All Type B Division 5.2 Organic Peroxides that do not have a packing group assigned to them are to be taken to be assigned to packing group I.

(d) All Types C to F Division 5.2 Organic Peroxides that do not have a packing group assigned to them are to be taken to be assigned to packing group II.

(e) Class 9 dangerous goods that do not have a packing group assigned to them are to be taken to be assigned to packing group III.

(f) All other articles and things that do not have a packing group assigned to them are to be taken to be assigned to packing group II.

*** Fire risk dangerous goods means dangerous goods of Class, Division or Subsidiary hazard classifications 2.1, 3, 4 or 5.*

Examples to determine dangerous goods quantity

In a closed process (a collection of closed vessels and pipework is defined as a container or a storage and handling system under the Act and Regulations respectively), the liquid phase in the process should be taken as the design capacity of liquid dangerous goods in the process expressed in L and Class 2 dangerous goods the process is the total capacity of the container. This could mean under the Regulations the total quantity of dangerous goods expressed as L will be greater than the total capacity of the container.

In a storage tank containing liquid dangerous goods the quantity of dangerous goods for the Regulations should be taken as the safe fill level of the tank (as defined in the appropriate approved code of practice or reputable standard).

1.5 When does this guide not apply?

Regulation 8 – Dangerous goods defined

Regulations 123-133 – Rural dangerous goods locations or small quantity dangerous goods locations

This guide does not apply to:

- small quantity dangerous goods locations (a place where less than placarding quantities of dangerous goods is stored or handled)
- rural dangerous goods locations
- Division 6.2 Infectious substances
- Class 7 Radioactive hazards
- Class 1 Explosives.

Regulation 6 – Application of Regulations

The guide does not apply to dangerous goods in many situations, including:

- when the Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007 applies
- at certain places where dangerous goods are used in limited quantity (e.g. medical oxygen, home use of pool chemicals, portable fire fighting or medical equipment)
- vehicle fuel tanks and batteries
- vehicle tyres
- potable liquids in retail outlets
- heap leaching, tailings dams and unprocessed ore.

For the comprehensive list, refer to regulation 6.

Regulation 4 – Terms used

Rural dangerous goods locations are places:

- outside the metropolitan region [s. 4(1), *Planning and Development Act 2005*]
- outside a townsite [s. 3(1), *Land Administration Act 1997*]
- that is one or more lots [s. 4(1), *Planning and Development Act 2005*] that are adjoining an area 5 ha or larger and at which dangerous goods used for agricultural, aquacultural, floricultural, horticultural or pastoral purposes are stored or handled but not supplied to others.

Note: Regulations 123-133 detail specific requirements that apply to rural dangerous goods locations and small quantity dangerous goods locations. Further guidance on the obligations of rural dangerous goods sites is available in the Licensing and exemptions for storage and handling – guidance note on the Department's website.

PART 2
DUTIES AND LICENSING

2 Duties of persons

2.1 Manufacturers and importers

Determine if goods are dangerous goods

> Regulations 12A, 13A and 13B – A person who manufactures or imports dangerous goods must classify and name the goods in accordance with the ADG Code

A person who manufactures or imports any goods (including waste materials) must determine if they are dangerous goods using the ADG Code, which refers to international standardised tests used for determination and classification. If they are found to be dangerous goods, they must be classified and assigned a United Nations (UN) number, proper shipping name and a packing group (if applicable), in accordance with the ADG Code.

Note: Combustible liquids are not usually classified as dangerous goods in the ADG Code and are not identified as dangerous goods on dangerous goods labels (e.g. diesel and some agricultural chemicals). Combustible liquids may be a component of other dangerous goods and labelled as, for example, Division 6.1 (Toxic substance). However, combustible liquids should be considered separately to the dangerous goods classification indicated on the safety data sheet (SDS) and may require a combustible liquids label.

Substances that may undergo change during processing, should be classified to identify the significant dangerous goods hazard(s) present in the particular vessel or pipework.

> Regulation 135 – Storage and handling systems and pipelines, duties of manufacturers etc. of

The manufacturer, supplier or installer of a dangerous goods storage or handling system must ensure it is designed, built, installed and commissioned so that it can be operated with minimal risk.

Packing, marking, labelling

> Regulations 13C, 13 and 14 – Dangerous goods must be packaged and the container labelled as required

Dangerous goods that are stored or supplied to another person must be:

- packed into a container that complies with the ADG Code
- labelled as required by the ADG Code (inner packages may use GHS).

Where the dangerous good is recognised only in the regulations (e.g. combustible liquids, forms of sulphur), the container must be leakproof, made of a material that will not react with the goods and be clearly labelled with the product name.

For retail sales of dangerous goods, other than Class 2 and that do not exceed 30 kg or L, the goods must be supplied in a container that must not be able to be mistaken for a food container, is leakproof and made of a material that will not react with the goods. The container must be clearly labelled with the product name.

Dangerous goods markings are not required for any dangerous goods that are used immediately and the container is then cleared of dangerous goods.

Dangerous goods labelling, marking and placarding must be removed from any container that is cleared and free of dangerous goods.

Preparing safety data sheets (SDS) and safety information

> Regulations 18, 19 and 20 – A manufacturer or importer must prepare a safety data sheet (SDS)

A safety data sheet (SDS), previously known as a material safety data sheet (MSDS), is a document that provides information describing risks (and how to minimise risks) associated with a dangerous good. A person who produces or imports dangerous goods must prepare a SDS.

The SDS must be revised when the contents require updating, correcting, or at least every five years.

An SDS prepared to meet GHS requirements, is considered as meeting dangerous goods regulatory requirements.

The SDS must be provided to any person to whom the dangerous goods are supplied for the first time, and on request to the operator or persons engaged at a dangerous goods site or dangerous goods pipeline.

> Regulations 22 and 23 – A manufacturer, importer or supplier must provide additional information if requested

In addition to an SDS and label information a person must provide, if requested:

- any additional information to customers that is relevant to the safe storage and handling of the dangerous goods
- the chemical identity to medical practitioners of any ingredients in the dangerous goods to assist with the medical management of a patient.

2.2 Site operators

A site operator is a person in charge of a dangerous goods site and/or pipeline. It is their duty to ensure that:

- all dangerous goods facilities are designed and constructed to comply with legislative requirements to eliminate or minimise risks and should use approved codes of practice
- all facilities remain in compliance during their operational life
- dangerous goods facilities are operated in a safe manner
- people, property and the environment are protected from dangerous goods incidents.

Note: This guide applies to site operators, except where specifically noted otherwise. In addition to the general duties discussed below, specific regulatory requirements are discussed in further chapters.

Manifest and site plan

> Regulation 78 – Manifest and dangerous goods site plan, requirements as to

A manifest and site plan must be provided where the quantities of dangerous goods on site exceed manifest quantity (manifest quantity is specified in Schedule 1 of the Regulations).

The primary purpose of a manifest (and site plan) is to provide emergency services organisations with information to assist with the control of a dangerous goods emergency.

The manifest and site plan must:

- include information detailed in Schedule 3 of the Regulations
- be revised within seven days of any significant changes on site
- be revised every three years, even if there are no significant changes on site.

The manifest and site plan should be readily available onsite and the specifics vary with the site.

- Dangerous goods sites:
  - The manifest and site plan must be readily accessible on site to Dangerous Goods Officers (DGOs) and officers of the Department of Fire and Emergency Services (DFES). SDSs must also be provided to DFES or DGOs if required.
  - Documents should be in a weatherproof container, in a prominent and secure location near an entrance to the site.
- Ports:
  - The manifest for port operations would usually be in the form of Marine Order 41 (MO41) or transport documents.
- In transit:
  - The manifest for transit storage may be in the form of a compilation of the transport documents.

Refer to *Manifest and site plan requirements for dangerous goods sites – guidance note* on the Department's website for a template and details on how to prepare a manifest.

Note: The quantity calculated for licensing purposes can in some instances be different to the quantity calculated for emergency response manifest purposes. For the emergency response manifest, the quantity is determined as the summation of all the dangerous goods, at placard quantity and above, on a property.

> Regulations 82 and 83 – Emergency plan and risk assessment requirements

The site risk assessment and emergency plan must be written in consultation with the site personnel and be readily available onsite.

The risk assessment and emergency plan must:

- include information detailed in Schedule 3 of the regulations
- be revised after any significant change(s) on site
- be revised every three years for the emergency plan and every five years for the risk assessment, even if there are no significant changes on site.

Safety data sheets (SDS)

> Regulation 79 – Requirements as to SDS for dangerous goods

The SDS must be readily accessible by any person authorised onsite, including DFES officers and dangerous goods officers. Relevant SDSs should be readily available in each work area.

Although an SDS is not required for retailers, operators must provide alternative information on safe storage and handling that is consistent with the information provided by a relevant SDS and is clearly identified as provided by the operator.

Note: SDSs must be revised within five years.

Training and supervision

> Regulation 81 – Training, supervision etc. of people involved with dangerous goods

Training and supervision should always be provided to ensure procedures, administrative controls, and the selection and use of personal protective equipment (PPE) are effective.

Inductions, information, training and supervision must be provided to any person involved with dangerous goods in a language and manner appropriate to the person on the:

- site emergency response plan and duties under it
- nature of the hazards and properties of dangerous goods
- processes used for identification of the risks relevant to the persons duties
- purpose, use and maintenance of risk control measures
- system of work
- conduct of persons
- operation of emergency plan
- operation of fire protection equipment
- operation of risk control equipment and resources
- use, fitting and maintenance of PPE and risk control equipment.

Training and supervision should include:

- information from SDSs, container labels and the emergency response plan
- dangerous goods safety requirements such as ignition sources in hazardous areas and general duties of people on site
- high risk work specifically including transfer operations, operating in hazardous zones and maintaining and understanding segregation
- first aid
- first response to incidents
- location of SDSs, emergency plan, manifest and site dangerous goods plan, risk assessments, job safety analysis (JSAs) and standard operating procedures (SOPs), PPE, safety showers, emergency response equipment.

Records of training provided to workers must be kept to provide proof that appropriate training was provided. The records should document who was trained, when and on what, and include assessments of the training. Assessments should include practical and written assessments appropriate to the person, the degree of risks and the person's duties.

Training, assessments and the training material should be reviewed regularly.

Training and induction records must be made and kept for at least five years, and made available to a DGO on request.

Signage, labelling and placarding

Container labelling; re-use and disposal

> Regulation 59 – Packaged dangerous goods etc., requirements as to delivery of etc.

Container labelling on packaged dangerous goods delivered as packaged or in intermediate bulk containers (IBCs) must comply with the ADG Code or GHS.

If the dangerous goods from a container are used on a site and the container remains labelled as when it was first delivered on site then it must only be re-filled with the same type of dangerous goods. It is not to be used for any other type of dangerous goods.

Any container that is to be disposed of must be cleaned so that it is free of dangerous goods, have its label removed and made unusable.

Pipework labelling

> Regulation 60 – Pipework containing dangerous goods, labelling of

Dangerous goods sites often have several pipes containing liquids or gases. Knowing the contents of a particular pipe is an important risk control measure. To take appropriate precautions or respond to a harmful situation the contents of a pipe (and surrounding pipes) must be known.

Pipework containing dangerous goods must be clearly identified.

Note: Detailed advice on pipework labelling is provided in the Australian Standard AS 1345 Identification of the contents of pipes, conduits and ducts.

Placarding

> Regulations 21, 68-72 – Requirements for placarding and signs
>
> Schedule 1 – Quantities of dangerous goods
>
> Schedule 4 – Placarding requirements

A placard is a sign or notice about the dangerous goods, intended to be displayed in a prominent place or next to a storage area of dangerous goods that contains more than a placard quantity of dangerous goods. It is especially important advice for emergency services to ensure personal safety and appropriate emergency response.

Any dangerous goods storage and handling site with more than a placard quantity of dangerous goods must:

- ensure that an Outer warning placard (Figure 1) is displayed at every entrance to site
- the placard must display the word 'HAZCHEM' in red letters on a white or silver background; and
- be visible from the normal direction of approach to site

Figure 1 Sample outer warning placard (Figure 1 in the regulations)

- display appropriate dangerous goods placard(s) at each location with more than a placard quantity of dangerous goods. Placards should be:
  - displayed at outdoor sites, at entrances to buildings containing dangerous goods and also within the building
  - used to ensure dangerous goods are always in appropriate locations within the building to ensure compliance with dangerous goods requirements (e.g. segregation, hazardous areas, ignition sources, ventilation, access and egress)
- keep placards in good legible order and visible (unobstructed) at all times
- correct placards when placard information becomes incorrect.

Exceptions:

- placards are not required for underground storage at service stations
- containers in transit storage areas must be placarded in accordance with the ADG Code
- alternative locations for placards may be considered if agreed to (in writing) by a Dangerous Goods Officer
- combustible liquids in packages or IBCs and stored with flammable liquids must be placarded with a Class 3 placard.

Placard requirements are detailed in the Regulations. Placard quantity is specified in Schedule 1 of the Regulations. Placard design requirements are specified in schedule 4 of the Regulations. Placard dimensions for bulk and packaged dangerous goods respectively are illustrated below (Figure 2).

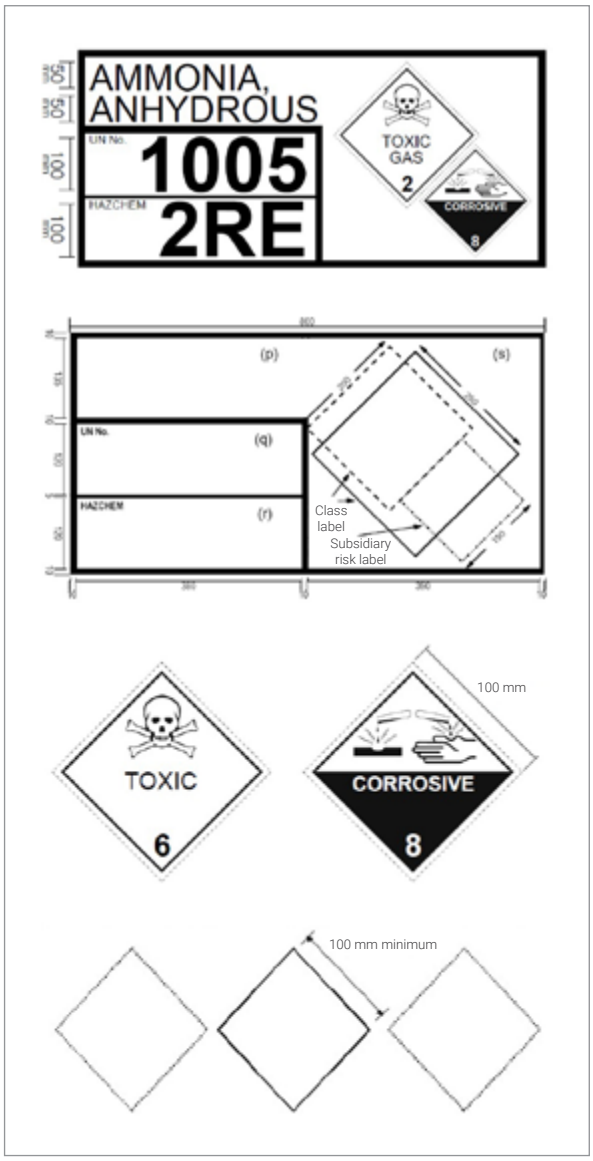

Figure 2 Sample placards for bulk and packaged dangerous goods (Figures 2 and 3 in the regulations)

Examples – marking and labelling process vessels

- Processes, process vessels and refrigeration systems that contain dangerous goods must also be marked, placarded or labelled in respect of the principal dangerous goods hazards. Labelling must be clearly displayed and include proper shipping name and class label(s). The proper shipping name for elevated temperature substances must also convey that it is an elevated temperature substance e.g. hot sodium hydroxide solution
- At gold mines, carbon in pulp (CIP) or carbon in leach (CIL) process vessels typically contain packing group III (PG III) toxic substances. Elution columns typically contain corrosive and toxic dangerous goods, and may require the elevated temperature symbol. Pregnant liquor tanks (tanks containing a gold-rich solution) typically contain corrosive and toxic dangerous goods that may also be at elevated temperatures.
- In alumina refineries the process tanks contain typically corrosive dangerous goods. The digester vessels may contain corrosive dangerous goods at elevated temperatures and should include the elevated temperature symbol or another means that describes the hazard.

Safety signage

> Regulation 81 – Training, supervision etc. of people involved with dangerous goods
>
> Regulation 84 – Visitors, supervision of etc.

Safety signs assist in protecting workers as well as visitors from risks associated with the dangerous goods on the premises. Safety signs are not 'instructions', but provide information or reminders to comply with previously communicated instructions or procedures.

Types of safety signs can be classified as follows:

- regulatory signs
- hazard warning signs
- precautionary signs
- emergency information signs.

Safety signs should be:

- readily recognisable, understandable and durable
- in a format appropriate for the intended audience (e.g. may be pictorial rather than written)
- visible against background structures
- easily interpreted in any conditions (e.g. low light).
- additional information can be found in AS 1319 Safety signs for the occupational environment

Visitors at dangerous goods sites

> Regulation 84 – Visitors, supervision of etc.

Visitors must be provided with supervision and information sufficient to ensure their safety while visiting site and should include:

- a site safety induction, including but not limited to: hazardous areas, PPE, emergency procedures, alarms, communication and escape routes
- training and use of the site's emergency escape equipment
- JSAs and SOPs for high risk work
- instruction signs e.g. transfer instructions, 'no smoking', 'turn engine off when refuelling'
- safety signs e.g. emergency exits, emergency showers, fire protection, and emergency response equipment

2.3 All persons on a dangerous goods site

> Regulation 80 – Persons under 15 on sites
>
> Regulation 85 – General duties of people other than operator of site
>
> Regulation 86 – Damaging etc. storage or handling system, offence

Any person on a dangerous goods site must:

- not be under the age of 15 unless supervised by an operator or employee of the operator aged 18 years or more
- take all reasonably practicable measures to ensure that dangerous goods do not adversely affect anyone's safety or health
- comply with the site operator's dangerous goods safety instructions
- not adversely affect any label or placard
- not be under the influence of alcohol or drugs
- not possess any ignition source in a hazardous area
- report incidents and regulatory non-compliance to the site operator
- not adversely damage or interfere with a storage and handling system.

2.4 Persons at ports

> Regulation 134 – Terms used
>
> Regulations 135A–135G – Duties of people involved at ports
>
> Regulations 135H – 135P – Duties of people involved at ports with explosion risk goods in port areas

Packaging and documents

A person who imports dangerous goods into a port must comply with the International Maritime Dangerous Goods Code (IMDG Code) or ADG Code requirements.

A person who consigns dangerous goods must comply with IMDG Code requirements or ADG Code requirements, as applicable.

Emergency plans

The master of a vessel transporting into a port with more than a manifest quantity of dangerous goods on board must have:

- a written emergency plan
- suitable emergency response equipment and crew trained in emergency response
- given a copy of the emergency plan to the harbour master, and obtained the harbour master's agreement to the plan.

Loading and unloading

The berth operator must ensure dangerous goods are loaded and unloaded and moved from the berth as soon as practicable.

Special berth (non-explosives)

A special berth (non-explosives) is required for berthing of vessels in the following circumstances:

- explosion risk goods exceeding 1,030 tonnes in transit on board a vessel berthed at a port
- loading or unloading of 30 tonnes of explosion risk goods to or from a vessel at a berth.

Refer to the *Handling of explosion risk goods (ERGs) at a special berth (non-explosives) – guidance note* for more information.

Explosion risk goods are listed in r. 135B of the regulations (reproduced in Table 3 below).

Table 3 Explosion risk goods

Dangerous goods	UN No.	Class
Ammonium nitrate, with not more than 0.2 per cent total combustible material, including any organic substance, calculated as carbon to the exclusion of any other added substance	1942	5.1
Ammonium nitrate based fertiliser	2067	5.1
Ammonium nitrate, liquid (hot concentrated solution)	2426	5.1
Ammonium nitrate emulsion or suspension or gel, intermediate for blasting explosives	3375	5.1
Calcium hypochlorite, dry or calcium hypochlorite mixture, dry, with more than 39 per cent available chlorine (8.8 % available oxygen)	1748	5.1
Calcium hypochlorite, dry with more than 10 per cent but not more than 39 per cent available chlorine	2208	5.1
Calcium hypochlorite, hydrated or calcium hypochlorite, hydrated mixture, with not less than 5.5 per cent but not more than 16 per cent water	2880	5.1
Calcium hypochlorite, dry, corrosive or calcium hypochlorite mixture, dry, corrosive with more than 39 per cent available chlorine (8.8 % available oxygen)	3485	5.1
Calcium hypochlorite mixture, dry, corrosive with more than 10 per cent but not more than 39 per cent available chlorine	3486	5.1
Calcium hypochlorite, hydrated, corrosive or calcium hypochlorite, hydrated mixture, corrosive with not less than 5.5 per cent but not more than 16 per cent water	3487	5.1

Refer to Section 3.4 for more information on special berth (non-explosive) declaration.

The regulations specify additional duties for masters of vessels transporting more than the manifest quantity of dangerous goods and berth operators for explosion risk goods in port areas.

3 Site licence and other approvals

3.1 Sites to be licensed

> Schedule 1 – Quantities of dangerous goods
>
> Regulation 12 – Quantity of dangerous goods, determining
>
> Regulation 25 – Certain sites to be licensed [s. 13]

A dangerous goods site (including ports, transit storage and parked vehicles) must be licenced when more than a manifest quantity of dangerous goods are being stored or handled on the site.

Determining the licensable quantity

A licensable quantity of dangerous goods refers to the quantity of dangerous goods that are stored or handled at a dangerous goods site, including contents in any process container and pipework. It does not include the contents of dangerous goods in vehicles, except where noted otherwise.

Note:

1. *At ports the licensable quantity of dangerous goods also includes the contents of vehicles and transfer equipment.*
2. *Transit storage and other short term storages (e.g. during maintenance shutdowns), must be considered as part of the licensable quantity, as there are no time limits in the regulations or the Act.*

Section 1.4 provides information on determining the quantity of dangerous goods in a storage or handling system.

Scattered storage and handling areas

When multiple storage and handling areas (each with between placard and manifest quantities) are not isolated from each other – i.e. a dangerous goods incident at one area would impact the other – these dangerous goods areas must be considered as a single dangerous goods site when determining manifest quantity for the purpose of determining quantity for licensing purposes.

Temporary storage and handling

For sites not classified as an MHF or not previously licensed, licensing is not required at temporary dangerous goods sites (< 6 months) with less than three times manifest quantity of dangerous goods

Under temporary storage regulations the site operator must prepare a risk assessment and complete a form to notify the Department of the temporary storage. Information on the notification to the Chief Dangerous Goods Officer and the *Notification of temporary storage or handling of dangerous goods – form* is available on the Department's website.

3.2 Dangerous goods site licencing requirements

> Regulations 26–48A – Dangerous goods site licence requirements and exceptions

The details of a dangerous goods site licence provide important information about a site in the event of an emergency. A dangerous goods site licence holder must ensure all the information on the licence is correct. If the information is or becomes incorrect, the licence holder must apply for the licence to be amended.

Application forms and detailed guidance on dangerous goods licence requirements is available from the Department's website.

3.3 Other approvals and licences under the Act

There are other non-explosive dangerous goods licence and approval requirements under the Act that are additional to a dangerous goods site licence, including:

- Pipeline registration
- Special berth (non-explosive) declaration
- Major hazard facility (MHF) notification
- Security sensitive ammonium nitrate (SSAN) licence.

Pipeline registration

> Regulations 88–110 – Pipeline registration

Pipeline owners must register dangerous goods pipelines with > 60 mm inner diameter (ID). Registration involves providing information about the pipeline, its contents, a plan of its location and a written report.

The application form, template for an accompanying written report and guidance material to register a pipeline are available on the Department's website.

Special berth declaration

> Regulations 135H, 135I, 135J–135M – Special berth declaration

A special berth declaration is required for berthing and loading (or unloading) of vessels transporting explosion risk goods (see section 2.4 table 3) at ports.

Refer to the *Special berth declaration – application form* on the Department's website for more detail.

Major hazard facility (MHF) notification

> Regulation 31 – Licence for site that is or may be major hazard facility

MHF notification is required for licensable sites that store or handle a critical quantity of particular dangerous goods as listed in Schedule 1 of the Dangerous Goods Safety (Major Hazard Facility) Regulations 2007 (the MHF Regulations). The notification is a requirement under the MHF Regulations to provide advice to the Chief Dangerous Goods Officer to determine whether to declare a site to be an MHF.

If a dangerous goods site is considered not to be an MHF, then this guide applies in full. If the site is considered an MHF, then this guide applies in conjunction with the 'Safety Case' requirements under the MHF Regulations.

The MHF Regulations require a site operator to submit an MHF notification form (*Operator notification that critical quantity of Schedule 1 substances will be exceeded – form*) if the place is storing or handling more than the critical quantity of certain dangerous goods, as specified in Schedule 1 of the MHF Regulations. The MHF notification form and guidance on notifying that critical quantity of Schedule 1 substances will be exceeded are available on and should be obtained from the Department's website.

As the outcome of an MHF notification is required before a dangerous goods site licence or amendment is granted, the MHF notification form should be submitted with (or before) the dangerous goods site licence application.

Security sensitive ammonium nitrate (SSAN) licence

An SSAN licence is required for ammonium nitrate and ammonium nitrate emulsions under the Dangerous Goods Safety (Security Sensitive Ammonium Nitrate) Regulations 2007.

The *Overview of security sensitive ammonium nitrate regulations – information sheet* and the *Ammonium nitrate guidance note No. 2 – Storage – guidance note* are available on the Department's website.

PART 3
RISK AND SAFETY MANAGEMENT

4 Managing risk

> Regulations 48, 49, 82 and 83 – A dangerous goods site operator must prepare a written risk assessment for sites exceeding manifest quantity

4.1 Risk assessment

A written risk assessment must be prepared for dangerous goods sites that exceed the manifest quantity of dangerous goods.

The risk assessment must be revised in any of the following circumstances:

- when there are any significant changes to the dangerous goods storage or handling site (e.g. quantity of dangerous goods, equipment changes)
- when evidence suggests the risks have changed (e.g. new evidence coming to light on risks of dangerous goods or equipment)
- when a reportable incident has occurred
- at least every five years.

A site risk assessment must be conducted in consultation with people associated with the dangerous goods facility. For complex or large sites, the site risk assessment should be conducted in consultation with experts in the field, emergency services (e.g. site emergency services, DFES) and the dangerous goods consultant who may be preparing the dangerous goods licence application.

Consultation ensures the best, most relevant information can be gained for a site and should be done from the very early planning stages. Consultation can be done through meetings and/or workshop site visits.

Using the hierarchy of control

A primary aim of the Act is to eliminate the risk from dangerous goods. Always aim to eliminate a hazard and associated risk first. If this is not reasonably practicable then the risk must be minimised using all reasonably practicable measures.

Providing risk control identified from a risk assessment approach should ensure all significant risks to and from dangerous goods are controlled.

The hierarchy of control (Figure 3) should be used to decide what control measures to use to minimise a risk. Control measures are ranked from the highest level of protection and reliability (elimination) to the lowest (personal protective equipment [PPE]). There will be hazards and risks requiring implementation of multiple control measures to ensure risks are minimised as required.

Only after eliminating the risk is ruled out as a control measure, should substitution, isolation and engineering controls be implemented. Administrative control measures and PPE rely on human behaviour and supervision and tend to be the least effective ways of minimising risks. PPE is the last line of defence against dangerous goods and should not be used as a primary control.

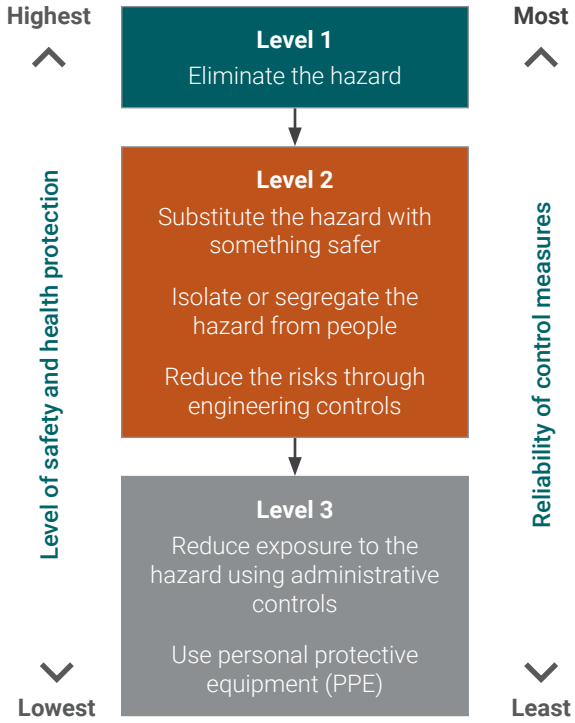

Figure 3 Hierarchy of control

Example – risk management controls

- Level 1 – Elimination
  - Use a non-harmful substance instead of dangerous goods.
  - Remove unused storage and handling systems.
- Level 2 – Substitution, isolation, engineering controls
  - Change the type or reduce quantities of goods kept on site e.g. substitute flammable dangerous goods for combustible liquids or water soluble products.
  - Install forced ventilation to remove fumes.
- Level 3 – Administrative controls, PPE
  - Modify the system of work, such as changing the times at which certain tasks are done or using hazard warning signs, specific training and work instructions.
  - Appropriate PPE and training may be required when handling dangerous goods

Determining the risk assessment approach

Eliminating or minimising risks is most easily achieved for dangerous goods storage and handling facilities by complying with an approved code of practice (see guidance in r. 48). Where a dangerous goods site was designed and installed to a specific approved code of practice and a new version of that code of practice is published, the site operator should ensure the dangerous goods site complies with the current version of that approved code of practice (e.g. conduct a risk gap analysis). Any deviation from that approved code of practice requires alternative risk controls to demonstrate that any risk is not more than what would have existed, had the change not being made.

Where there is no approved code of practice (e.g. for process facilities), a thorough risk assessment process is required. This process may include applicable sections of a code of practice and/or national or international standard for technical guidance, and can be applied in conjunction with the risk assessment.

Figure 4 illustrates the decision making process.

A traditional risk assessment approach for dangerous goods must include the following steps:

- identify all the hazards to and from the dangerous goods
- estimate the likelihood of each hazard causing a dangerous goods incident
- estimate the degree of harm each (or combination of each) incident may cause to people, property or environment
- identify ways so far as reasonably practicable to eliminate the risk or otherwise minimise the risk
- explain the methods and reasons used in the risk assessment approach.

A risk assessment should also consider:

- the extent of the risk to people, especially vulnerable persons on and off the site
- the extent of the risk to other dangerous goods, plant or buildings, critical infrastructure, environment, on and off the site
- identifying factors contributing to the risk
- determining the extent and type of controls necessary — controls should be commensurate with risk
- prioritising implementing control measures
- identifying records that need to be kept.

The Department has published a *Risk assessment for dangerous goods – guidance note*, detailing what an acceptable risk assessment is. It includes detail on the risk assessment process, as well as a risk assessment template, and can be found on the Department's website.

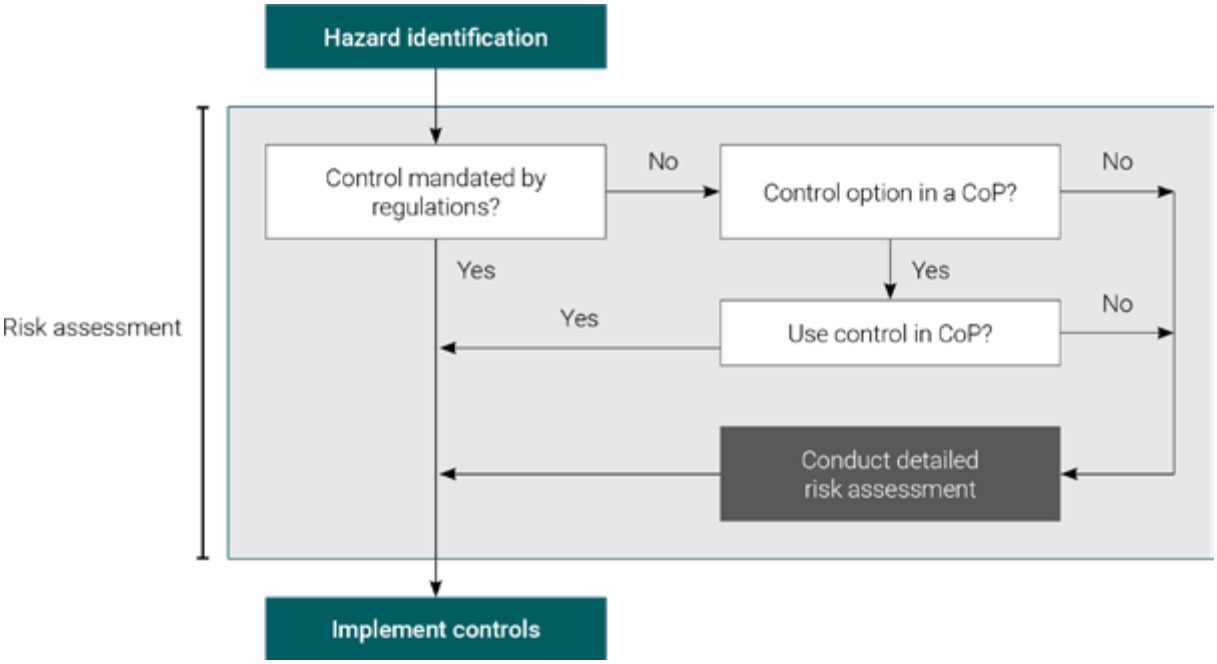

Figure 4 Determining the risk assessment approach
Note: Use approved or mandated code of practice (CoP) in flowchart

4.2 Dangerous goods management system

Documented, mandatory and clear procedural requirements for employers, employees and contractors involved in transport, storage and use of dangerous goods provides the basis for safe operations and should be captured in a dangerous goods management system.

The structure and degree of detail required within dangerous goods management systems for various facilities will vary depending on the size of the organisation, complexity of operations and risk profile.

In all management systems, it is important to ensure that procedures, tools and forms are user friendly and clearly define:

- actions required to achieve and maintain compliance
- who needs to implement actions
- the frequency actions are required to be undertaken
- how completion of actions are recorded for tracking and audit purposes.

General procedures should include, but may not be limited to:

- procedure for inspection and maintenance of dangerous goods areas
- procedure for inspection and maintenance of fire and spill response equipment and capabilities
- procedure for development of work procedures for transfer, transport, use and storage of dangerous goods
- procedure for dangerous goods risk assessment and change management
- procedure for training of personnel in dangerous goods hazards and management
- procedure for dangerous goods inspections and audits
- procedure for approval and registration of dangerous goods.

4.3 Change management

Many dangerous goods and industrial incidents have occurred worldwide as a result of inadequate change management. Changes which may appear to be good for production or risk mitigation, may well result in increased risk and non-compliance with legislative requirements, with severe consequences.

Critical changes made to dangerous goods facilities should always be:

- assessed for risk by competent persons
- authorised before they are made
- effectively communicated to the workforce
- confirmed to be effective after implementation.

A specific management of change procedure should be developed to detail requirements for submission and approval (or rejection) of change requests.

Changes captured in the scope of the procedure may include changes to:

- engineering and process design
- introduction of new dangerous goods
- increased quantities of dangerous goods
- changes to the organisational structure and staffing levels
- changes in operating procedures and critical documentation
- changes to specifications
- changes to materials, hardware and software.

Most changes, if approved, will require changes in specific drawings and documentation. As a result, any management of change procedure should be linked to document control processes so that only the most recent versions are available for reference.

4.4 System design

> Regulation 58 – Storage and handling systems, design etc. of

Regulation 58 specifies a general duty for a site operator to ensure risks from dangerous goods storage and handling systems are eliminated or minimised, so far as reasonably practicable, and it applies at all stages of a dangerous goods facility's life cycle – from its concept, location, design, operation and maintenance, through to decommissioning. This also means the risk assessment process should start at the earliest possible time (e.g. concept stage) and ensure all stages of a project are undertaken and supervised by experienced and qualified people.

PART 4

DESIGN AND OPERATION OF STORAGE AND HANDLING FACILITIES

5 Dangerous goods in processes

> Regulation 58 – Storage and handling systems, design etc. of

Dangerous goods processes involve a very wide range of activities, such as:

- chemical reactions that create dangerous goods (either as final products or intermediary products)
- using dangerous goods to create non-dangerous goods
- using dangerous goods in metallurgical processes in mining (such as gold producers using cyanide, alumina producers using caustic soda and nickel producers using sulphuric acid).

This section is intended only to give an overview of what might be considered to ensure that risks from dangerous goods in processes are minimised.

Each stage of a project – including construction, commissioning, ramp-up, operation, care and maintenance and decommissioning – needs proper consideration. Special care is also needed for out-of-service storage and handling systems being brought back into service. These should be recertified to original design standards by inspections, tests and maintenance, as required. As a minimum, all the risk reduction measures required in the Regulations must be well considered and addressed.

There should be design documentation that demonstrates the risks from the dangerous goods are minimised. The documentation should be prepared and endorsed by suitably qualified, experienced professionals.

Process design

Design considerations should include:

- site layout, safety, maintenance, operability, emergency response and safe access/egress
- risk assessments conducted for all stages of a project, including initial concept, detailed design, procurement, construction and commissioning.

Process safety management

Process safety management considerations should include:

- process hazard analysis (e.g. hazard and operability study [HAZOP], hazard identification study [HAZID], Bow Tie or layers of protection analysis [LOPA])
- management of change e.g. brownfield upgrades, upgrade of pressure safety valve (PSV)
- maintenance management, especially for high hazard storage and handling systems
- commissioning.

Note: For safety-critical elements, consider the need for Safety integrity level (SIL), Safety instrumented system (SIS) and/or LOPA.

Spill and leak controls

Spill and leak control considerations should include:

- sufficient ullage and process controls for prevention of overflows
- provisions for overflows to safely overflow to containment
- reverse flow (non-return valves)
- excess flow (valves)
- anti-siphon and/or auto shut-off valves
- emergency shut-off and remote shut-off valves
- pipework – hoses should not be used as pipework
- emergency power shut-off provisions.

Vapour controls

Vapour control considerations should include:

- control of vapours, mists and gas from vents (e.g. pots or carbon filter)
- transfer pressure risks – vents and system designed for transfer pressure.

Design to allow safe maintenance

Safe maintenance considerations should include:

- ease of access and escapes for inspection and maintenance
- allowances for processes to continue (e.g. redundant containers, interconnecting containers/vessels)
- redundant valves for valve maintenance (e.g. double block and bleed).

6 Isolation

Risk reduction by isolation or segregation applies to several risks associated with dangerous goods.

Segregation is used to describe isolating dangerous goods from other goods where an interaction can cause a hazard or an incident.

The separation distance is a measurement for the isolation of dangerous goods from people, property and the environment.

Isolation from ignition sources is addressed in Chapter 9.

6.1 Segregation from other goods

Regulation 52 – Segregation of dangerous goods

An operator of a dangerous goods site must segregate dangerous goods from other goods, including from other dangerous goods, food packaging, human or animal food and in any case where the interaction can cause a hazard or incident. Compatibility or incompatibility requirements also apply for the materials used for storing or handling containers, secondary containment or any facility that can be in contact with the dangerous goods.

Segregation can be achieved using physical barriers, distances (measured horizontally) or utilising separate spill compounds. Dangerous goods on shelves should not be stored above or below other chemicals or other goods which may be incompatible or that can cause contamination.

The degree of segregation required increases as the potential risk increases. To determine the potential risk of dangerous goods interaction, always check for compatibility and incompatibilities by referring to the dangerous goods SDS and the relevant Australian Standard.

Dangerous goods should never be stored where they could contaminate food, food packaging and other items like personal use products, cosmetics, cigarettes, medication and toiletries.

Refer to relevant Australian Standards

Australian Standards relevant to the storage and handling of each class of dangerous good provide detailed advice on achieving segregation.

For example, AS/NZS 3833 *The storage and handling of mixed classes of dangerous goods*, in packages and intermediate bulk containers specifies segregating dangerous goods from:

- food or goods that react dangerously – segregate in separate spill containment systems, separated by at least five metres. The separation distance is measured from the inside edge of the spill containment system (bunds)
- goods that are incompatible – segregate in separate compounds or by 3 m in the same compound when one or both goods are liquid or by at least 1 m when all the goods are solids.

Compatibility information about specific products should be available from the SDS. In the absence of more detailed compatibility information about specific products, Table 4 may be used for guidance on compatibility of dangerous goods.

Segregation considerations

- Pool chemicals include dangerous goods that can be dangerously reactive (e.g. acids react with hypochlorite solutions to produce toxic gas, dry pool chlorines (calcium hypochlorite) react with pool stabilizers to cause fires and toxic gas).
- Class 5 dangerous goods are all highly reactive and can support combustion. They can react and are incompatible with a range of substances including organic materials (wood, paper) and hydrocarbon solvents.
- Class 5 dangerous goods are often incompatible with each other and may react dangerously – checking the SDS is essential to determine compatibility.
- Class 8 corrosive substances and mixtures can be either alkaline or acidic and these two categories are incompatible. Acids should never be stored with alkaline chemicals due to the potential for harmful reactions. Some reactions of acids and alkaline chemicals can rapidly generate large quantities of gas and causing an explosion.

Table 4 Guidance on compatibility of dangerous goods

Class/Division		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 and combustible 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	Oxidising 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 the absence of more detailed compatibility information about specific products (which should be available from the SDS), this table may be used for guidance as to compatibility between the classes of dangerous goods

Note:

1. *In all cases, the SDS or supplier of the goods should be consulted.*
2. *Combustible liquids should be segregated in the same manner as Class 3 flammable liquids.*
3. *If the dangerous goods have a subsidiary hazard of another class, then the segregation requirements for the subsidiary hazard need to be determined and the more stringent segregation requirements applied.*

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 in the SDS, goods of these two classes are usually compatible. However, in an emergency such as a 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 compatible 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. Interaction may result in fire or toxic vapours. 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 risks are fully controlled.*

E. *If the Division 2.2 has a subsidiary hazard 5.1, then this is D, otherwise it is B.*

F. *If the Division 6.1 or 9 is a fire risk substance, then this is D, otherwise it is B.*

G. *If one material is a concentrated, strong acid and the other is a concentrated, strong alkali, or contains cyanide then this is D, otherwise it is A.*

	Dangerous goods of the same class should be compatible: consult SDS or suppliers about requirements for the individual substances.
	Dangerous goods of the same class could be incompatible or react dangerously. Consult SDS or suppliers about requirements for the individual substances.
	Segregation of these classes may be necessary. Consult the SDS or supplier.
	Dangerous goods of these classes should be kept apart by at least 3m. Consult SDS or supplier.
	These combinations of dangerous goods should be segregated by at least 5m and kept in separate compounds or building compartments.
	This requirement applies to organic peroxides, for which dedicated stores or storage cabinets are recommended. Adequate separation from other buildings and boundaries is required.

6.2 Separation distance

> Regulation 58 – Storage and handling systems, design etc. of

Separation distance must be sufficient to ensure people, property and the environment are not affected by a dangerous goods incident.

Locate dangerous goods storage and handling systems carefully by:

- considering the site to ensure it enables the safest operation of a dangerous goods site. Considerations should include the nature of the site (e.g. natural features and environment), soil, buildings, services, bushfire, lightning, rainfall, debris, trees and roots, other dangerous goods storage nearby)
- avoiding sensitive land uses such as hospitals, childcare, water catchments, sensitive environments, forest and bushland with severe hazards (e.g. fire risk) and river or ocean inundation areas.

Separation distances are typically measured from the dangerous goods storage and handling system, such as a spill compound for a package store or bulk container, to a protected place. A protected place is usually a place where people are present or another offsite dangerous goods storage and handling system. Separation distance is often reduced for onsite protected places compared to offsite separation distance. Separation distance also applies to property boundaries and security fences.

Separation distance may be achieved by distance or be measured around suitable physical barriers. The barrier must be sufficiently resistant to the hazards of the dangerous goods and have dimensions to provide protection from the dangerous goods. To achieve separation to goods with a fire risk the physical barrier must include a high fire resistance and for gases and flammable liquids it must be gas/vapour proof.

In Australian standards, separation distances are typically measurements based on the quantity of dangerous goods present and the sensitivity of the protected place to the effects of the hazard. The details on design and construction of physical barriers to provide separation distance and the actual distance required varies with the dangerous goods and should be obtained from approved codes of practice relevant to the dangerous goods.

7 Chemical stability

Regulation 53 – Stability of dangerous goods, requirements for

Many dangerous goods are inherently unstable or highly reactive, or they can become unstable under certain conditions.

A person must ensure controls are provided, monitored and maintained to prevent uncontrolled dangerous reactions. This regulation is not to prevent the legitimate use of the dangerous goods where the dangerous reactions are intended and controlled.

Any chemical not suitable for use must be rendered safe and disposed of in accordance with manufacturer's instructions and local laws.

To keep dangerous goods stable, you should:

- follow manufacturer's instructions or instructions on the SDS
- maintain the specified proportions of ingredients, goods and other components that constitute the dangerous goods
- include a stabilising ingredient where appropriate (e.g. phlegmatizers, diluents, solvents, wetting agents, desensitisers, inhibitors and/or other adulterants)
- keep the dangerous goods within a controlled temperature range where necessary
- keep the packaging dry, unless the packages themselves are impervious to moisture
- check an expiry date on the label and SDS. Where a chemical has passed its expiry date it should not be used
- provide an inert atmosphere, when required.

8 Impact protection

Regulation 54 – Dangerous goods to be protected from impact

An operator of a dangerous goods site must ensure that dangerous goods and any storage or handling system for dangerous goods at the site is protected against damage from impact. This includes the risk of impacts, imposed loads or mechanical stress to spill containment systems, containers, pipework, pumps, and attachments from impact.

Impact protection needs to be fit for purpose – e.g. small bollards may not be suitable impact protection, for refuelling stations or above ground tanks, from heavy mining vehicles. Higher speeds may increase the likelihood and effect of impact. Piping parallel to roads may be less at risk of impact.

Impacts can be caused by a number of different mechanisms, including:

- mechanical handling equipment for moving containers (e.g. forklifts, overhead lifting grabs) damaging containers, structures or pipes
- digging equipment impacting underground pipework
- vehicles impacting piping adjacent to roads or under roads
- unsupported piping
- vehicles entering or leaving fuel dispensing facilities
- severe weather
- corrosion of supporting structures.

Impact protection measures may include:

- isolating storage and handling facilities away from roads and other trafficable areas. Buried pipework might be considered isolation
- provide physical protection (e.g. from vehicle loads and diggers) and identify buried pipes (on relevant plans, with underground flagging, signs, dial before you dig)
- preventing vehicle access
- providing physical barriers that are fit for purpose (e.g. where vehicles, mobile plant, or boats come close). Barriers to consider include railings, bunding, windrows, bollards or stanchions.

9 Ignition sources and hazardous areas

Regulation 56 – Ignition sources in hazardous areas, requirements as to

An ignition source is anything that can ignite a flammable atmosphere. Examples of ignition sources are shown in Table 5 below.

Table 5 Examples of ignition sources

Type of ignition source	Examples
Flames	Welding flames, gas heaters, pilot lights, cigarettes, matches.
Sparks	Welding arcs, cigarette lighters and telephones Static electricity including from friction sources Lightning Friction from drilling, grinding, scraping of metal on concrete.
Electrical Wiring	Starters for fluorescent lighting, electric motors, electrical equipment like power points and switches.
Heat	Hot surfaces including light bulbs, ovens, radiators or heaters, flue pipes, vehicle engines and exhaust systems, pumps and generators Heat generating chemical reactions.

A hazardous area can exist when flammable or combustible gases, vapours, dusts, fumes or mists may be present in a flammable or explosive concentration. A hazardous area is likely to be present around any storage or handling facility that contains flammable dangerous goods, including Division 2.1, Class 3 or Class 4 or dangerous goods with these subsidiary hazards.

The classification of hazardous areas due to the accumulation of dusts is complex and depends on many factors, including the rate of dispersion, sedimentation characteristics and particle size.

Other dangerous goods that may also create hazardous areas:

- xanthate solutions which decompose to form flammable gas
- ammonia gas in refrigeration systems
- aerosols
- Class 9 copper or nickel concentrates (give off flammable gases).

Detailed guidance on hazardous areas is provided in AS/NZS 60079 *Explosive atmospheres*.

For further information on hazardous areas and equipment that is suitable for use in hazardous areas see:

- AS/NZS 60079.10.1 *Explosive atmospheres – Classification of areas – Explosive gas atmospheres*
- AS/NZS 60079.10.2 *Explosive atmospheres – Classification of areas – Combustible dust atmospheres*
- AS/NZS 4745 *Code of practice for handling combustible dusts*
- AS 1940 *The Storage and handling of flammable and combustible liquids*

A site with flammable dangerous goods should prepare a hazardous area dossier if required.

9.1 General risk control measures

Eliminating or minimising the risk from ignition sources may be achieved by:

- removing hot surfaces and combustible materials from a hazardous area. The auto-ignition temperature of the hazardous chemical should be considered as some dangerous goods may ignite spontaneously above certain temperatures
- using hazardous area rated electrical equipment or intrinsically safe electrical equipment
- using motors and motorised equipment certified for use in a hazardous area
- implementing administrative controls such as permit systems preventing hot work (for example, welding) in these areas
- controlling static electricity by design (e.g. electrically bonded, earthed or using transfer equipment that is conductive that doesn't build up static electricity). Information on control of static electricity can be found in AS 1020 *The control of undesirable static electricity*
- using earth bars, electrical bonding and lightning electrodes to conduct stray currents
- using flammable material detection systems (gas, dust, lower explosive limit (LEL) detectors) incorporating electrical isolation, if required, to prevent ignition from non-certified electrical equipment. Inspect, test and maintain the shutdown systems and gas detection systems regularly.

Notes:

1. *Maintenance: many of these control measures require records of regular inspection, testing and maintenance.*
2. *Work permits are required for working in hazardous areas. Example of a work permit is contained in AS 1940 The storage and handling of flammable and combustible liquids.*
3. *When assessing hazardous areas, AS/NZS 60079 Explosive atmospheres defines sufficient ventilation for natural ventilation as open air. Natural ventilation in the dangerous goods standards (e.g. AS 1940) is not considered sufficient ventilation for controlling the extent of a hazardous area.*
4. *Illustrated examples in the appendices of AS/NZS 60079.10 are examples only, and do not form part of the Standard's requirements.*

9.2 Risk control measures for hazardous areas

Eliminating or minimising the risk from hazardous areas may be achieved by:

- ventilating and minimising confined spaces. Accumulation of vapours creates the potential for a hazardous area to exist
- using enclosed transfer systems and vapour recovery connections
- keeping lids on, or open only for the minimum period required for transfer minimising exposed surface areas
- avoiding splash filling
- minimising the temperature of liquids being transferred
- providing extraction ventilation (at source of flammable materials)
- removing heat sources. This prevents a combustible liquid that would not normally have a hazardous area being considered to have a hazardous area equivalent to that of a flammable liquid
- administering controls including: preparing hazardous area dossiers, preventing unauthorised persons entering hazardous areas, training all people on hazardous areas, marking hazardous area, providing safety signage for hazardous areas
- providing PPE that is suitable for hazardous areas (including control of static)
- removing combustible materials and oxidising agents from hazardous areas – they aggravate the risk of fire or reaction
- regularly clearing combustible dusts, to prevent accumulation. Combustible dusts may be stirred up by air currents or mechanical action and form an explosive dust and air combination. Undetected dust deposits are commonly found in ventilation ducts and on top of girders and plant — as little as 30 g of combustible dust suspended in a cubic metre of air may be flammable.

10 Hazardous atmospheres

> Regulation 57 – Hazardous atmosphere, requirements as to

A hazardous atmosphere:

- does not contain a safe level of oxygen (asphyxiation hazard <19.5% oxygen) or
- contains dangerous goods that exceed the national safe exposure standard – refer to SDSs for exposure standards or
- contains flammable dangerous goods (as vapour, gas, mists) at more than 5% of the LEL or
- contains combustible dust that creates a hazardous area.

Ventilation is a primary means of minimising the presence of a hazardous atmosphere. Ventilation design needs to be suitable for the properties of the dangerous goods (e.g. fine dust, vapour pressure, vapour density, toxicity or flammability) and the use of the dangerous goods (storage, transfer or processing).

Some items to consider when designing ventilation systems include:

- ensuring vent exhaust terminals are venting to a safe area - outside buildings
- separating ignition sources from vent exhaust terminals of flammable dangerous goods – there will be a hazardous area surrounding a vent exhaust terminal for flammable dangerous goods
- controlling static build up – e.g. use anti-static material or electrical bonding
- not blocking or obstructing the inlets and exhaust terminals of a ventilation system.

In addition to ventilation to maintain a safe atmosphere, testing and monitoring may be required, consistent with the risks identified in the risk assessment. Storage and handling systems containing toxic gases, including chlorine at swimming pools, should include leak detection and automatic leak control systems.

10.1 Mechanical ventilation

Mechanical ventilation systems must be compatible with the dangerous goods, must be suitable for a hazardous area (if applicable) and must not be an ignition source.

Mechanical ventilation systems may produce sources of ignition including moving parts that can heat up (bearing and impellers) and may produce sparks (steel impellers).

Inlet and outlet vents located on opposite sides of the storage area at low levels 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 or room never exceeds that outside and airflow into any adjoining work areas and offices is prevented.

Ventilation systems must be designed with sufficient capacity to prevent atmospheric contamination. Its correct use must be incorporated into the site's operational procedures.

10.2 Local exhaust ventilation

Local exhaust ventilation is used to control the extent of a hazardous atmosphere. Local exhaust ventilation removes airborne contaminants before they create a hazardous atmosphere or reach the breathing area of workers in the area. It is used for effective control of more highly toxic contaminants created in large quantities and is applied close to the source of generation. It is more effective than increasing general ventilation to try to dilute toxic contaminants.

10.3 Natural ventilation

Natural ventilation can be used to control small quantities of relatively low toxicity contaminants including dusts, fumes, gases and vapours which have low and steady rates of generation.

Process and filling areas produce more airborne contaminants than storage and so may require additional ventilation.

Natural ventilation systems must be designed with sufficient capacity to prevent atmospheric contamination. Specific guidance should be obtained from an appropriate Australian Standard relevant to the dangerous good requiring natural ventilation.

11 Containing spills

Regulations 51 and 55 – The operator of a dangerous goods site must provide spill containment to enable the containment and recovery of dangerous goods

Site operators must ensure that there is provision to contain spills in each area at the site where dangerous goods are stored or handled (including transit areas and bulk transfer locations). To ensure ongoing effective spill containment, spill containment systems should also be adequately maintained.

The spill containment system should be a limited area, leakproof and ensure all spills are retained on the site. Risks from leaks or spills going offsite, especially to any adjacent premises or public places, must be eliminated. The spill containment system must not create additional hazards especially by causing or not controlling incompatibility hazards.

Where provision of a system to enable the containment and recovery of any spilled or leaked dangerous goods from pipework is impractical there should be other spill management systems, including sufficient valves to isolate pipework and provide emergency shut off, inspection processes and preventative maintenance programs.

Spill containment for liquids should include:

- providing drains to a purpose built on-site catchment (e.g. 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
- using double-walled containers
- enclosing a tank with a partial or full-height bund
- auto shutoff drain valves for stormwater drainage
- signage informing drain valves must be kept closed and locked.

Example – maintaining spill containment systems

Spill containment systems should be well maintained. If:

- there are visible cracks, repair and seal them
- there are holes in walls (e.g. holes for services or pipework), seal around these
- the material of construction is porous (e.g. damaged by weeds, damaged by expansion/ contraction of soils), repair damage and seal with suitable resistant sealant
- damaged by corrosion or dissolving or fire caused by the dangerous goods it must be refurbished (with materials that are resistant to the hazards of the dangerous goods).

When designing spill containment systems consider the following:

- physical nature of the dangerous goods (e.g. viscosity)
- sufficient capacity to contain:
  - the quantity of the dangerous goods released from the largest reasonably foreseeable spill
  - fire water or rainwater (e.g. increase containment volume or use separators and drains)
- design and durability so that spills will be held safely until cleaned up:
  - compatibility of the spill containment with the dangerous goods (e.g. resistant to corrosion, fire and suitable for hazardous areas)
  - isolation of incompatible goods within the spill containment system
  - maintaining the system's integrity and remaining leakproof in any reasonably foreseeable incident
- design for recovery of spillage:
  - ability to recover spillage and waste water (e.g. using a sump or locked drain valve)
  - all resources to recover spillage are compatible with the dangerous goods
  - the potential impact if the dangerous goods escape to the environment
  - providing other resources to prevent contamination of groundwater or soil (e.g. absorbents, transportable barriers)
- hazardous areas if the containment may contain flammable materials
- sufficient distance from the dangerous goods to the compound perimeter (e.g. for access, to ensure dangerous goods will not fall outside of the containment – deflector screens can be used in some situations).

Example – recovery of spills

Spill containment capacity can be compromised when spill containment areas are filled or partially filled with liquid (e.g. fire water, rainwater, or leaked or spilled dangerous goods).

- Containment areas should be maintained regularly, which includes draining rainwater, as required.
- Drain valves should be maintained in good working condition, and locked when not in use.

Example – capacity

Intermediate bulk containers (IBCs) are often stored on pallets on a factory floor, using portable (self-contained) bunds (pallet bunds) for spill containment.

- Pallet bunds may be suitable for non-flammable dangerous goods in non-fire risk areas for packaged dangerous goods (e.g. 205 L drums) facilities especially as additional containment in a bunded area or for minor storage on a factory floor.
- IBC bunds are also available that are designed to hold some IBCs with sufficient spill capacity and can be used as indicated above.

Pallet bunds are not suitable as stand-alone spill containment for IBCs because they will not hold the full contents of an IBC and leaks from the side of an IBC may not fall into the bund.

Example – compatibility of materials

Spill containment materials must be compatible with the dangerous goods, e.g. concrete is incompatible with corrosive dangerous goods. If incompatible materials are used, the containment will disintegrate and leak, often causing further incidents such as tank foundations also disintegrating.

- Select correct materials for components in spill containment systems (e.g. some stainless steels or plastic valves with acids).
- Line concrete with epoxy or corrosive-proof bitumen for acids.
- Ensure containment is heat resistant or fireproof, especially when storing combustible materials or dangerous goods such as some acids that may react exothermically with water (e.g. when there is rain water in the spill containment area).

11.1 Bunding

A bund is an embankment or wall, which may form part of the perimeter of a compound, designed to contain spills of liquids. Bunding as spill containment, has the advantage that it can be retrofitted to existing buildings and installations. Bunding is commonly used for above ground bulk storage installations.

Both the bund and the compound floor must be sufficiently impervious to retain spillage or leakage and resistant to the hazards of the dangerous goods it contains (e.g. fire resistant for combustible goods, corrosion resistant for corrosive liquids).

If using a liner to provide leakproof spill containment the liner needs to be protected (e.g. from impact, environmental degradation, fire or heat) to ensure it remains leakproof and in good order. Refer to Figure 5 for a recommended design.

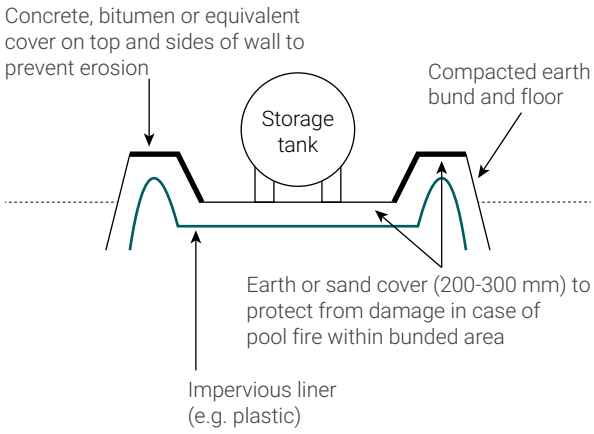

Figure 5 Recommended design for leakproof spill containment using a liner

A bund wall needs to be designed to contain not just leaks at ground level, but also falling containers (stored within the bund) and liquid squirting from a tank or container.

The closer the wall is to the tank or packages, the higher the wall needs to be. Alternatively, deflectors such as shields attached to the bund or tank, or double-skinned tanks could be used to prevent spillage outside the spill containment.

11.2 Spill containment for viscous substances

Very viscous substances such as ammonium nitrate emulsions (ANEs) and bitumen do not flow easily. Spill containment for the storage of these substances may not be necessary, subject to:

- separate any drainage system from protected works and incompatible dangerous goods
- being stored and handled on raised earth or concrete that prevents flows entering the area and wastes remaining in the area.

11.3 Spill control for vertical tanks installed prior to 2008

Schedule 6 Division 1 cl. 4 – Spill containment

With a suitable risk assessment, regulation 51 may not apply to flat bottomed tanks installed prior to these Regulations coming into operation.

Where it is practicable to provide spill containment it is expected that existing non-compliant spill compound floors and bunds will be upgraded so they are impervious and retain the dangerous goods until the spill is cleaned up.

The application of a comprehensive risk based storage facility management plan may be permitted instead of retrofitting spill containment under the tank, which may be impracticable.

Vertical flat bottomed above ground containers without spill containment are permitted if:

- tank containers are in good operational condition and regular integrity assessments are conducted for all tanks. Integrity testing should include one or more non-destructive testing (NDT) methods (e.g. visual examination, ultrasonic thickness testing, acoustic emission testing, dye-penetration, x-ray, quantitative product mass measurement or equivalent methodologies).

  Note: Risk assessments and documented management plans are integral parts of these assessments.
- alternate spill prevention measures are applied to the containers, which may include:
  - installation of automatic leak detection system (gas monitors, pH monitors)
  - installation of overfill protection and monitoring
  - statistical inventory analysis of inflow and outflows to and from the tanks
  - installation of under tank impervious lining
  - providing an alternative to impracticable under-tank spill containment upgrades
  - minimising the risk of offsite migration of spills
  - appropriate spill management resources and documented procedures.

12 Bulk containers

12.1 Design

Regulation 58 – Storage and handling systems, design etc. of

Design standards for dangerous goods storage and handling systems are specified in the applicable Australian standards for the class of dangerous goods. Many dangerous goods containers and vessels, including pressure vessels, are 'classified plant' that must also comply with other legislation administered by the Department.

Bulk containers may include glass fibre, polyethylene, transportable containers (as per ADG Code requirements) and IBCs.

Specific design standards include:

- Australian Standards:
  - AS 1692 *Steel tanks for flammable and combustible liquids*
  - AS 1210 *Pressure vessels*
- American Petroleum Institute Standards:
  - API 650 *Welded steel tanks for oil storage*
  - API 620 *Design and construction of large, welded, low-pressure storage tanks*.

These should be considered in bulk container design and installation.

Container or vessel design:

- process (including reactions), process conditions (e.g. temperatures, pressures) and properties of the dangerous goods (e.g. specific gravity, density, pH and corrosivity)
- tank construction materials compatibility (including corrosion resistance, fire resistance)
- tank design life (including corrosion allowance before recertification, maintenance requirements)
- fire and explosion risk control (e.g. hazardous areas, process reaction control measures, inert gas blanket, prevention of ignition, emergency vents, vent terminal gauze)
- over pressurisation controls and sufficient layers of protection (e.g. vents, non-return valves, pressure relief devices (including burst discs))
- overfill controls and sufficient layers of protection (e.g. level indications, alarms, auto shutdowns that are audible and/or visible to operators, emergency shutdowns, visible overflows, overflow returns to safe locations such as return lines, bunds and containers, tested and well maintained control systems and procedures).

Pipework and fittings:

- valves and fittings compatible, fire safe, scale resistant, vent blockage prevention, corrosion resistance
- pressure relief between valved off sections
- vent terminal in safe location: outside buildings, away from ignition sources, away from fire risks (fire gauze) and contamination risks (e.g. water vapour into sulphuric acid)
- vent terminals prevent contamination and fire risk
- vent and fittings to eliminate or minimise harmful gas or vapour release that vent to a safe location and not adjacent to protected places.

Maintenance and serviceability:

- components should be compatible with the dangerous goods (fire, corrosion, scale), durable, require minimal maintenance and be adequately protected from damage.

Emergency:

- remote alarms
- remote shutdown.

12.2 Installation and maintenance

Regulations 58 and 61 – Bulk dangerous goods installation requirements

Bulk dangerous goods containers must have:

- stable foundations and supports (e.g. compatible with the goods, and fire rated). Design of suitable foundation and supports should also include consideration of:
  - ground conditions – soils including water table, movement, shrinkage/expansion including by effects of the dangerous goods
  - environmental conditions – local weather/ climate conditions (including cyclones, lightning, high wind), salt and other high corrosive environments
- pipework and plant is designed to prevent excessive stress on the container, pipework or plant
- the container and pipework is protected from corrosion
- the container is inspected at sufficient intervals to ensure integrity and serviceability
- records of container inspections must be retained for the life of the container and passed to any new owner of the container.

13 Underground mines

Regulation 58 – Storage and handling systems, design etc. of

Risks from the dangerous goods in underground mines can be expected to be increased compared to dangerous goods on the surface, due to the underground environment, space restriction, and from the types of operations undertaken.

Dangerous goods are essential for underground mining and what is not stored underground must be transported to and from the surface, increasing the transport risks. The risks of increased transport must be weighed against the increased risks of storing dangerous goods underground.

Storage of any dangerous goods underground should be minimised without increasing the risk of transporting the dangerous goods underground. For storage and handling of dangerous goods in underground mines there must be additional risk control measures in place compared to above ground storages. The highest standard of maintenance and housekeeping is essential to ensure risks remain minimised.

In addition to dangerous goods safety legislation, mines safety legislation applies and must be consulted.

13.1 Ammonium nitrate (AN) and AN emulsions (ANE) in underground mines

AN and ANE are also regulated under the Dangerous Goods Safety (Security Sensitive Ammonium Nitrate) Regulations 2007 and have strict security requirements that must be adhered to.

For the safe storage and handling of ANE in underground mines refer to AEISG UN3375 code of practice.

AN and ANE may be stored if treated as explosives in a underground explosives magazine licenced under the Dangerous Goods Safety (Explosives) Regulations 2007 to meet both security requirements of the SSAN Regulations and safety requirements of the DG regulations.

13.2 Fuel in underground mines

Fuel storage and handling systems in underground mines must comply with all relevant regulations and in addition fuel storage and handling facilities should:

- minimise the quantity of fuel
- be located adjacent to return air ducts
- be capable of being isolated from the mine ventilation system (including, separated using a physical barrier, fire door(s) to seal off the refuelling bay area to prevent smoke entering intake airways)
- include automatic fire detection and fire suppression systems, suitable for use with fuel and motor vehicles, with manual activation from a safe distance
- have an automatic fire alarm with manual activation from a safe location
- have a floor that is impervious with sufficient spill containment so spills remain on site and accumulate in a safe location
- be separate from ignition sources, fire risks and any combustible materials
- have spill and emergency equipment that includes facilities, supplies and equipment to:
  - quickly contain spills
  - isolate spills from any potential ignition source
  - clean up and remove fuel spills (approved containers containing and made from compatible material properly labelled) and rubbish, safely to a safe location
- have adequate lighting
- be protected from impact, preferably located away from trafficable areas.

Signage should be displayed at any entrance(s) to fuel storage areas.

Consideration should be given to other appropriate signage that may be required, such as:

- at the fuel storage area
- restricting access to authorised persons only
- no smoking or naked flames
- hot work prohibited
- shut down engines before refuelling
- emergency procedures: in case of fires and spills
- location of nearest refuge chambers
- housekeeping requirements.

Surface-to-underground fuel delivery pipework should be:

- purpose-designed (e.g. for pressure, pressure control, leak control, emergency shutdown, clearly identified as a fuel pipeline, constructed with leakproof joints)
- located so that it is not exposed to fire sources or ignition sources (e.g. service garage, switch room, magazine) or critical infrastructure (e.g. refuge station, first aid station)
- installed in a free draining and surveyed borehole
- stainless steel pipework with a high density polyethylene (HDPE) covering
- regularly inspected, tested and maintained
- have automatic and manual emergency systems for shutdown and alarms in case of spills, leaks and fires.

Note: there are proprietary portable fuel storages available that are designed to incorporate many of these risk control measures.

14 Underground fuel tank requirements

Regulation 62 – Underground storage or handling systems for Class 3 dangerous goods and petroleum products, requirements for

The primary requirement under this regulation is that the operator of the dangerous goods site must ensure the underground storage and handling system (underground tank) is designed, installed, operated and maintained so that it does not leak.

This section deals specifically with underground storage and handling systems. As a site's underground storage and handling system is only part of a site's overall storage and handling system these requirements also apply, including for design and installation of components associated with the underground section such as vents, fill points and fire protection that must also be included in the site's risk assessment (see the approved code of practice AS 1940).

Australian Standard AS 4897 *The design, installation and operation of underground petroleum storage systems* (AS 4897 is a mandatory code of practice) for the detailed requirements for design, manufacture, installation, maintenance or repair of underground petroleum storage (UPS) systems containing flammable liquids or petroleum products.

Alternative safety measures (deviations from sections of AS 4897) may be implemented under the condition there is a written risk assessment that clearly demonstrates risks arising from the application of the alternate safety measure are no greater than what the risks would be by adhering to the requirement specified in AS 4897.

New (including repaired sections) UPS systems must comply with the sections of AS 4897 dealing with design and installation (sections 3 and 4)

Existing UPS (installed before March 2008 which is when the regulations came into operation) and new UPS must comply with the sections of AS4897 dealing with operation, maintenance, testing and repair including inventory control and loss investigation of sections 4, 6, 8 or 9 and with specific requirements to:

- monitor for leaks (clause 4.5)
- test, inspect, maintain and repair the underground tank (sections 7.3 and 8)
- make and retain (for at least 2 years) a written record of the leak monitoring, tests, inspections, maintenance and repairs (as specified in AS 4897)
- empty, seal-off and take-out of service any leaking component of an underground tank (see also section 19.1 of this document for further requirements to decommission)

Installing petrol and diesel tanks underground can help to reduce the risk of a number of hazards, but can also increase the risk of others. These risks may not become evident until later, when heavy rains raise the water table and displaces the dangerous goods accumulated in the soil around the tank. Many parts of Western Australia have highly porous soils, so it is important that underground storage and handling systems are properly installed and maintained so they do not leak and contaminate the site or the environment. These storage or handling systems must be installed to the highest possible standard.

Leakage from underground tanks can be difficult to detect and large volumes of dangerous goods can be lost due to leakage. Leaked product moves rapidly through sandy soils and can float on the water table. Underground seepage of a flammable or combustible liquid can accumulate and penetrate into low lying areas such as telecommunication pits and building basements.

14.1 Design

UPS systems built after the commencement of the Regulations are required to be designed and built in line with the Equipment level 1 specifications from section 3 of AS 4897. Requirements include provision of:

- corrosion-resistant tanks and pipework
- secondary containment of tanks and pipework
- leak monitoring
- overfill protection
- groundwater monitoring wells.

Black and galvanised steel pipework and fittings are acceptable. Galvanised malleable (gal mal) iron pipe fittings are considered to be inferior, lack durability and should not be used (Figure 6.)

Alternative measures to those listed can be used if an equivalent or reduced level of risk is achieved – a risk assessment demonstrating how this is achieved will need to be undertaken and appropriate records kept.

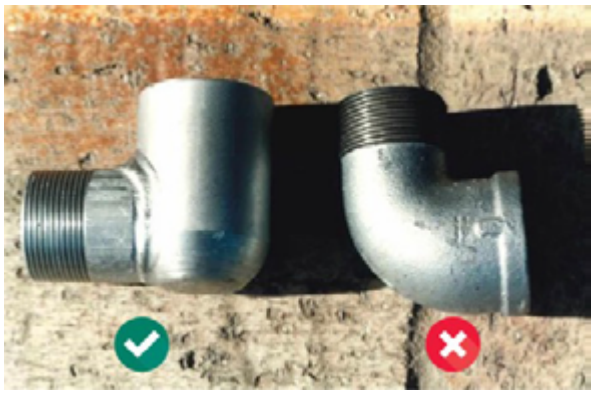

Figure 6 Galvanised malleable (gal mal) iron pipe fittings are considered to be inferior, lack durability and should not be used

14.2 Installation

Underground storage systems are required to be installed by competent and experienced personnel. Appropriate equipment integrity tests are required after all site works are completed and prior to commissioning.

Corrosion specialists who install a cathodic protection system for steel piping are required to provide certification demonstrating compliance against the requirements of AS 2832 *Cathodic – protection of metals*, Parts 1 (Pipes and cables) and 2 (Compact buried structures).

14.3 Maintenance

A UPS system is required to be maintained and tested in accordance with AS 4897 section 8. The section details the frequency of equipment integrity testing, leak monitoring system maintenance, and the requirements for cathodic protection.

Note: Specific maintenance requirements are detailed in AS 2832.

14.4 Leak detection and repairs

Sites with UPS systems are required to have some form of leak detection in place. Any component of a UPS system that is discovered to be leaking must immediately be emptied, sealed off and not used until the leak has been repaired.

Note: Refer to section 19 of AS 4897 for information relating to the decommissioning of UPS.

A number of leak detection methods can be used, including:

- automatic tank gauging in combination with either inline leak detection for pressure piping, or inventory reconciliation
- statistical inventory analysis
- interstitial monitoring (suitable for use as a back-up to a primary leak monitoring system)
- groundwater monitoring (suitable for use as a back-up to a primary leak monitoring system)
- implementing an inventory reconciliation process compliant with section 7.3 of AS 4897.

Repairs of UPS systems must meet the testing specified in section 9.2 of AS 4897.

14.5 Records

AS 4897 requires a number of records to be kept in relation to UPS systems, these include:

- design and installation certifications
- leak detection results
- equipment integrity test results
- as-built drawings
- periodic inspections
- manifest and site plan (and after decommissioning the amended documents)
- details of any decommissioned UPS.

Records must be maintained indefinitely and passed on to any subsequent owner of the site.

15 Lighting

Regulation 64 – Lighting requirements

Sufficient lighting must be provided to enable safe storage and handling of dangerous goods and to move safely around a dangerous goods site.

Lighting must be sufficient to enable persons to perform a job safely. It is especially important at locations where it is necessary to read (gauges, instructions, safety signage, emergency exits and transfer locations) and where there may be vehicles (whether on roads, indoors or trafficable locations).

Additional hazards associated with lighting and safety may be identified (during a risk assessment), and consideration may need to be given to the installation of emergency lighting, uninterrupted power supplies and/or backup power.

Note: Lighting and electrical installations must be suitable for any hazardous areas identified.

16 Access

Regulation 65 – Entrances and exits to be clear

Entrances and exits for people and vehicles at dangerous goods sites and any place or building where dangerous goods are situated must be kept accessible and safe at all times.

When considering safe access, keep hazards away from routes and emergency response equipment and include:

- multiple access and/or egress routes
- accessibility for emergency services
- accessibility for recovering injured persons
- safe access for inspection and maintenance
- safe access over bunds
- safe access to and location for safety equipment (including showers and fire extinguishers)
- protection from open containers, pressure vessels, leaking flanges.

17 Site security

Regulation 66 – Security requirements

Security must be provided to prevent unauthorised access to a dangerous goods site and prevent unauthorised activities.

A secure dangerous goods site should:

- be a restricted area
- in a physically secure place
- a store or place either locked, or subject to constant surveillance.

The degree of security required should be determined by risk assessment that includes the likelihood of unauthorised activities and the integrity and reliability of the security system design and hardware.

Appropriate security could include:

- total site isolation (e.g. mine sites)
- security fencing
- secured buildings
- closed-circuit television (CCTV)
- guards
- alarms
- locked fittings
- domes over fittings.

Security could also be localised and be considered for specific containers, transfer connections, gauges and valves, fire protection, extinguishers and other emergency equipment. Examples of localised security include:

- locking underground fuel storage tank access points
- locking drain valves and bleed valves
- locking the turret of LP gas tanks.

Note: Ammonium nitrate and ammonium nitrate emulsions (ANEs) must be secured in accordance with the Dangerous Goods Safety (Security Sensitive Ammonium Nitrate) Regulations 2007.

18 Unsupervised sites

Regulation 58 – Storage and handling systems, design etc. of

A site is considered unsupervised in any of the following circumstances:

- it is unmanned, i.e. does not have authorised person supervision, with less than weekly onsite authorised person supervision
- the site routinely operates when there is no authorised person on site to supervise the site's normal operations (e.g. unsupervised fuel stations).

It is expected that additional risk control measures (including communication systems and improved security) are provided at such sites.

Unsupervised sites should include risk controls and emergency response suitable to control risks presented by an unmanned and unsupervised site, with special consideration for emergency response and safety of persons coming to site (including customers, site operations, maintenance personnel, bulk transferrers, unauthorised intruders and emergency services).

Security is likely to require additional and more reliable controls than what might be required at a normally supervised site, and people entering unsupervised sites may not have site dangerous goods safety training.

Risk controls for unsupervised sites should include:

- additional regular inspections
- communication strategy and systems
- video surveillance
- securing access control to dangerous goods – locked
- securing access to site – locked gates
- warning signs (e.g. Authorised Persons Only, No Trespassing, Danger)
- security patrols
- automatic detectors or systems, with remote monitoring (e.g. emergency alarms, gas, bund contents, leaks, security, inventory control systems)
- display signs (including site hazards, transfer safety procedure, normal use procedure and emergency procedures, 24/7 contacts, emergency shutdown locations, procedure and use of safety equipment)
- hazardous material (HAZMAT) container (for emergency services) with manifest and site plan, SDS, emergency plan, site contacts, and emergency advice.
- automatic safety systems such as fire protection system and automatic shutdowns (e.g. for gas leaks, spills or fire)
- PPE and safety showers (with alarms).

19 Decommissioning

> Regulation 63 – Decommissioned storage or handling systems to be cleaned etc.

A storage and handling system containing dangerous goods must be cleaned and cleared of dangerous goods, or otherwise made safe during the process of decommissioning.

'Cleared' from dangerous goods means cleared to a level where risks are eliminated or are minimised so far as reasonably practicable. For example:

- less than 5% of LEL for flammable dangerous goods
- less than 1 atmosphere of pressure for Division 2.2 (with no subsidiary hazard) dangerous goods
- a safe atmosphere (see section 10 Hazardous atmospheres).
- no discernible trace of the dangerous goods.

19.1 Timing and reducing risks

The process to permanently decommission a tank should be implemented as soon as the operator of the dangerous goods site has decided any storage or handling system has no further use. If a storage and handling container is leaking it must be taken out of service immediately and cleared of dangerous goods until it can be repaired. Out of service periods for disused tanks exceeding two years is considered unacceptable. Except in unusual circumstances, such tanks should have been permanently decommissioned.

Prompt decommissioning is important because disused, nominally 'empty' tanks present significant risks including:

- a disused tank is likely to contain an explosive atmosphere of flammable vapour. It could explode if an unsuspecting person introduces an ignition source at some time in the future, especially if the site changes hands without records of the tanks having been kept. In the past, disused underground tanks have exploded and caused fatalities when power tools were used to cut into them.
- a disused tank will corrode over time and could fail, causing the collapse of adjacent structures or buildings.
- a nominally 'empty' tank can float upwards due to external water pressures and 'pop out' of the ground, causing damage to adjacent structures.
- disused tanks used for some dangerous goods often contain pyrophoric residues

Fire risk dangerous goods require monitoring of the atmosphere within the container before any activities involving heat or friction such as mechanical cutting, oxy-acetylene cutting, or grinding are undertaken.

Decommissioned plant may present immediate or future risks (e.g. residues recreating hazardous atmospheres), and the following should be undertaken:

- 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.

Cleaning methods include chemical neutralisation, curing or deactivation to the extent necessary to ensure there is no risk to health or safety. To clear a container that contains water soluble dangerous goods, thorough rinsing with water (and neutraliser as necessary) may be appropriate.

Note: Any labelling indicating the presence of dangerous goods must be removed once a container has been cleared.

To ensure safe entry into a vessel or tank that has previously contained dangerous goods, the following actions are recommended:

- follow appropriate confined space entry procedures
- provide signage indicating the previous use with dangerous goods
- ensure records on previous use of the vessel or tank with dangerous goods are provided to the appropriate person(s) throughout the lifecycle of the unit.
- amend the dangerous goods manifest and site plan.

Rendering tanks permanently safe should only be undertaken by qualified and experienced specialists.

Prior to decommissioning works proceeding, the operator should ensure documented work instructions and all relevant work permits have been issued to the contractor.

Notifications

Following the decommissioning of any tank or UPS at a licensed dangerous goods site, the dangerous goods site licence must be amended. The following details are required:

- dangerous goods site licence number
- number, size and location of tanks decommissioned
- for underground petroleum storage and handling systems, the responsible person confirms compliance with AS 4976.

The Department of Water and Environmental Regulation should be contacted if soil contamination is suspected.

19.2 Decommissioning of underground petroleum storages (UPS)

As soon as any component of a UPS system is unfit for further use or it is no longer required for use, it should be promptly cleared of dangerous goods, decommissioned and removed. A disused, nominally 'empty' UPS system presents significant risks to people, property and the environment.

Prompt decommissioning is important to meet the duty under the Act to minimise risks from dangerous goods. The approved code of practice AS 4976 sets out procedures for decommissioning, purging of dangerous goods, removal from the ground, transport and off-site disposal of an UPS.

Rendering tanks permanently safe should only be undertaken by people specialising in the installation, maintenance and decommissioning of underground petroleum product tanks, and the process must be done in accordance with AS 4976. A list of appropriate contractors is available from the Petroleum Industry Contractor's Association of Western Australia (www.picawa.org.au).

Prior to decommissioning works proceeding, the operator should ensure that documented work instructions and all relevant work permits have been issued to the contractor.

Removal of tanks

If a site ceases to be used for petroleum product storage, all tanks should be removed for disposal off-site in compliance with section 5 of AS 4976:2008.

Section 5 includes the procedures for the removal of tanks and their off-site and on-site purging. It also deals with transport issues. The Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007 and ADG Code apply for a tank that is not vapour free.

Details of the disposal of used tanks and tank material are also given in section 8 of AS 4976:2008

19.3 Waste management

Waste produced in the process of decommissioning dangerous goods storage or handling systems should be contained and disposed of appropriately. If the waste falls within the classification of a dangerous good it should be stored and handled in line with regulatory requirements. Guidance on the handling of waste can often be found in the relevant approved codes of practice (e.g. AS 1940).

19.4 Risks of not decommissioning systems

A dangerous goods storage or handling system should be assessed for decommissioning after it has remained, or is likely to remain, unused (e.g. plant going into 'care and maintenance'). To not properly decommission such systems, may pose an increased risk of an incident occurring involving the dangerous goods.

Example – why decommissioning is important

- A mine site in care and maintenance for several years had an onsite tank farm comprising of four 2,000,000L tanks containing 98% sulphuric acid (H_2SO_4). Over time, a slight weep of acid from a tank's nozzle flange leaked about 250L of the acid into the concrete secondary containment bund. The bund sump dissolved, leaking acid into the underlying soil. The soil reacted with the acid and expanded, with an increase in the ground level of up to 500 mm, severely damaging parts of the bund and its walls, and the pipework foundations.
- Fuel containers or tanks, and gas cylinders are often repurposed. However, without proper decontamination, these vessels present a risk of vapour explosion from residual dangerous goods inside when attempting to cut or weld on the vessels.

PART 5
TRANSIT STORAGE AND TRANSFER

20 Managing risk during transfer operations

> Regulation 55 – Transferring dangerous goods, requirements for

Transfer is a higher risk and hazard process because it usually involves moving large volumes of dangerous goods to and/or from storage and handling systems, through hoses and piping, often with manual connections and disconnections. Consequently, transferring dangerous goods requires a higher standard of risk assessment and risk controls than what might be acceptable at other parts of storage and handling systems.

An operator of a dangerous goods site must take all reasonably practicable measures to avoid spillage, minimise static electricity, dusts, vapours, mists and ensure fittings are compatible.

ADG Code provides detailed equipment, maintenance and operational advice on transferring dangerous goods which should be implemented. The ADG Code requirements are mandatory on public roads.

For example, for flammable and combustible liquids transfer hoses and hose fittings should be designed, inspected and maintained in accordance with the ADG Code. The ADG Code requires hoses to be pressure tested at least annually and continuity tested at least six-monthly.

20.1 General risk reduction measures

Consider the following measures to reduce risk for transfer operations:

- providing a spill containment system
- system designing (e.g. overflow protection, emergency shut-offs, avoiding splash filling, specific transfer fitting for each product)
- implementing administrative controls (e.g. SOP and site supervision, checking available content space/ fill level, checking transfer hoses, signage on safety, instructions and/or product name at connection point)
- implementing appropriate change management when changing transfer methods. Changing transfer from gravity to pumping via pressure differential may greatly increase risks and the storage and handling system must be designed to suit
- addressing sources of ignition: reduce static electricity discharges – particularly important for flammable goods and for combustible dusts (e.g. providing earths, ensuring electrical continuity and using conductive materials)
- ensuring equipment and transfer fittings are compatible (including with the dangerous goods), as designed and its maintenance is managed
- eliminating hazardous areas and atmospheres. Use closed systems (vapour and dust recovery systems) such as those used during the processing and transfer of flammable liquids or the use of glove boxes or glove bags
- installing of flow and pressure regulators
- installing of interlocking valves and switches
- implementing systems for detecting losses from pipe work and fittings (e.g. static pressure loss detectors, measurement to determine losses in transfer, external sensors)
- providing independent, reliable and multiple redundant systems to prevent incidents e.g. automatic high level or overfilling prevention especially for remote filling (including for many elevated tanks and manifolded tanks), and use reliable equipment. Mechanical float valves are not considered reliable for this application.

Note: If possible, have the transport company provide transfer hoses. Transferring dangerous goods is their core business. They should implement regular checks of their equipment, ensuring the transfer hoses are designed, inspected, tested and maintained as required.

This duty of the licensee is from the connection to the storage and handling system.

20.2 Personal safety for transfer operators

There is an increased risk of spills and leaks from operations that include large transfers, high pressures, splash filling, decanting, blending and pressure differential transfers.

During bulk transfer, operators are usually involved in connection, disconnection and clearing lines. They are generally required to be in close proximity to the transfer operation and are subject to unavoidable additional risks.

There are numerous examples of serious incidents that occur during transfer operations – many caused by insufficient inspection and maintenance of transfer hoses and fittings – where transfer operators suffered severe injury.

In addition to engineering as a primary risk control, PPE should be provided and used as an additional risk control measure (layers of protection). PPE must be carefully selected and maintained to ensure the risks are minimised so far as reasonably practicable.

- Anti-static or cotton clothing and underclothing should be considered when transferring flammable materials (e.g. when decanting LP gas). Cotton reduces static electricity and provides some protection from cold and heat burns. Synthetic material increases static and can melt onto skin, causing painful injuries.
- Eye/face washes and safety showers should be provided as an additional risk control measure where there is a risk of spills or leaks where harm from products should be treated with water flushing. Locate the eye/face washes and/or safety showers where they are readily accessible and in a safe location adjacent to the risk.

21 Filling tanks

Regulation 55 – Transferring dangerous goods, requirements for

21.1 Filling elevated tanks

Fill point connections must be installed and located to ensure risks are minimised, either at ground level or from a compliant gantry and with minimal transfer hose length.

Pipework connecting an elevated tank to the fill point must be suitably engineered to prevent spills and leaks and have a sealed connection point, anti-syphoning system and a dry-break connection (or similar).

Example

Operators sometimes have to carry a fill hose up a ladder to connect at the top of a tank. To eliminate associated risks you should have a readily accessible hose connection point with suitable spill containment at ground level.

Figure 7 Elevated tank with hose connection point at ground level
Photo courtesy Ben Wade

21.2 Fill connection with manifold for filling multiple tanks

Tanks that are filled from a common fill point or have pipework for transfer in common must have an effective and reliable system in place that:

- ensures no tank can exceed its safe fill level
- includes a completely separate system to prevent overfilling.

If a manually operated tank filling system is used then ensure individual tanks are filled sequentially with appropriate signage, procedures and training.

22 Flammable liquid dispensing

> Regulation 55 – Transferring dangerous goods, requirements for
>
> Regulation 137 – Flammable liquids, filling of tanks etc. with

In addition to regulation 55 requirements, when transferring or refuelling flammable liquids, a person must not:

- smoke or have any open flame within four metres of the fuel tank or other storage or handling system
- have the engine running (except as permitted under the *Civil Aviation Act (Cth) 1998*).

When dispensing flammable liquids into a container at a service station (that is not a fuel tank) the container must be:

- less than 25 L (exception: a container that is < 250 L may be used if the flammable liquid is to be used at the service station)
- in contact with the ground
- marked as AS/NZS 2906 approved or is otherwise leakproof, made of metal and capable of being securely closed.

Guidance on fuel dispensing operations is given in Australian standards including:

- AS/NZS 1596 *The storage and handling of LP Gas*
- AS 5092 *CNG refuelling stations*
- AS 1940 *The storage and handling of flammable and combustible liquids*
- AS 3961 *The storage and handling of liquefied natural gas*.

23 Dangerous goods in transit and storage areas

Regulation 58 – Storage and handling systems, design etc. of

Regulation 79 – dangerous goods in transit, requirements as to SDS for dangerous goods

Schedule 3 Clause 8 – manifest for dangerous goods in transit, compilation of transport documents

Transit areas are short term storage and handling systems on sites not open to the public where the dangerous goods are:

- supplied to the site in containers that are not opened at the site
- packaged or contained, marked and placarded as required by ADG Code
- not used at the site
- kept at the site for less than five consecutive days.

Dangerous goods in transit must fully comply with the relevant regulations, including licensing. The following requirements are specific to transit:

- manifest information can be provided as transport documents in accordance with the ADG Code
- placarding for the transit area (see placarding section) and can be on vehicles, in accordance with the ADG Code and
- SDSs are not required for dangerous goods in transit.

The regulations (including the above) do not apply at dangerous goods sites associated with any road open to the public (e.g. a road train assembly area), the Dangerous Goods Safety (Road and Rail Transport of Non-explosives) Regulations 2007 and the ADG Code apply.

Note: Some dangerous goods sites have bulk dangerous goods containers on site that are not connected for use (e.g. ISO at a transport logistics yard) and largely meet the dangerous goods transit definition, except the dangerous goods containers are kept at the dangerous goods site for more than the allowable time.

Approved codes of practice with sections that deal with bulk storage usually deal with bulk containers that are connected for use and maybe not be applicable to this situation. If the approved code of practice does not deal with the situation described above it is recommended the transit storage section of this guide or the transit storage section of an approved code of practice should be applied

Note: The situation described above is not a dangerous goods transit site as defined in the Regulations, however SDSs, placarding and manifest requirements apply as normal.

Transit stores must comply with the relevant Regulations and must have a dangerous goods site licence if the quantity of dangerous goods exceeds the licensing quantity specified in regulation 25.

Example – use applicable Australian Standards

Details on transit and transport storage systems should be obtained from the transit storage section of the relevant Australian Standard. If no such standard exists, then this Guide applies as a minimum.

- Section 3.9 in AS 1940 provides detailed advice for transit storage of flammable and combustible liquids
- AS/NZS 3833 provides advice on mixed classes of dangerous goods in packages and intermediate bulk containers
- Ports – the regulations and AS 3846 *The handling and transport of dangerous cargos in port areas* apply.

The following should be considered for transit and storage areas:

- clearly mark the transit store perimeter, storage bays and parking bays
- locate a transit store at least 15 metres from onsite protected works, other dangerous goods storage and handling sites, ignition sources or fire risks (for fire risk dangerous goods) and at least three metres from any security fence
- provide clear access and egress within and all around
- storage bays should be restricted to 40 tonnes of dangerous goods when on a vehicle(s) or 25 tonnes in packages, IBC or pallets
- container stacking must comply with the container specifications of ADG Code and racking design capacity and no more than two high and two deep for freight containers or transportable tanks
- segregate dangerous goods as required. Segregation distances, when the goods are on vehicles, may be reduced and goods on vehicles should be segregated as required by the ADG Code
- separation distances should be in accordance with packaged dangerous goods storages for the particular dangerous goods and measured from the perimeter of the transit store spill containment
- spill containment should be designed to contain at least 110% of the largest container and 10% of the aggregate quantity of liquid dangerous goods
- fire protection should be in accordance with packaged dangerous goods storage appropriate to the class and subsidiary hazard, and be compatible with the goods in the store. There should be fire protection within 15 metres of all areas of the transit store
- vehicles should be able to exit in a forward direction with minimal manoeuvring.

PART 6
EMERGENCY MANAGEMENT

25 Fire

Regulation 67 – Fire hazards, requirements as to

25.1 Fire hazards

There must be no fire hazards that may affect a storage and handling system, within three metres.

Fire is a significant concern to a dangerous goods system and is very likely to increase the risk associated with the storage and handling system.

For dangerous goods with a flammable hazard (combustible liquids, Division 2.1, or Class 3 and 4) the risk is obvious, while other dangerous goods affected by fire can decompose explosively (Class 5s) and/or release toxins into the atmosphere.

Pallets, cardboard, tyres, long vegetation, waste oils or cooking oils are all considered a fire risk and should be removed.

25.2 Fire control equipment

Regulation 73 – Fire control equipment required on site

All dangerous goods storage and handling sites must have adequate fire control equipment. There is no allowance for what is sometimes called 'let it burn'.

Fire protection should be provided in a safe and readily accessible location adjacent to any fire risk from the dangerous goods. It should not be so close to the fire risk that it cannot be accessed safely if there is a fire – typically no closer than 3 metres and no further away than 10 metres from the fire risk.

Fire safety studies will be required for sites with large quantities of dangerous goods, especially fire risk dangerous goods.

Fire control equipment must be designed and constructed considering:

- type and quantity of dangerous goods
- storage and handling conditions
- other materials and substances on site
- preventing fires from affecting dangerous goods
- compatibility with fire brigade equipment
- suitability of fire extinguishing agent.

Fire control equipment must always be:

- in proper working order
- properly installed and maintained
- regularly tested
- accessible and usable.

The latest test date for testing fire protection should be recorded on a durable tag on the fire protection equipment or otherwise the record should be kept on site. Fire extinguishers should be inspected every six months or less.

If fire control equipment is not fully operational it must be repaired immediately (so far as reasonably practicable) and until it is repaired, equally effective alternative fire control measures must be taken. These may include:

- providing alternative fire control equipment
- reducing the quantity of dangerous goods
- stopping or limiting dangerous goods storage or handling
- modifying systems of work.

Note: Detailed advice is provided in the Australian Standards relevant to fire protection and the storage and handling of each class of dangerous goods. If there is no fire protection specified in an appropriate approved code of practice, the minimum requirement should be as specified by the Building Code of Australia.

26 Risk control equipment and materials

Regulation 74 – Other risk control equipment, requirements for

All dangerous goods storage and handling sites must provide any risk control equipment and materials identified in the risk assessment. Risk control equipment and materials must be:

- kept at site
- be properly maintained
- accessible at all times.

People needing to use the equipment must be regularly trained on how and when to use it.

Risk control equipment may include:

- leak detection systems and alarms
- manual, remote or automatic emergency shutoff devices
- neutralising agents
- absorbent material (e.g. sand bags)
- safety showers and eye washes
- first aid equipment and supplies
- explosimeters
- wind direction indicators
- spill clean-up and disposal kits
- PPE.

Note: Detailed advice is provided in the Australian standards relevant to the storage and handling of each class of dangerous goods.

26.1 Personal protective equipment (PPE)

Exposure to dangerous goods is expected to be controlled in accordance with the normal hierarchy of control assessment. PPE should not be relied on to control risk exposure (see Chapter 4).

PPE should only be used after all reasonably practicable control measures have been implemented and it is not possible to completely eliminate the risk such as interim protection for maintenance (e.g. valve maintenance, operation of valves), as supplementary protection for high risk activities (e.g. connections, disconnections, transferring) or for emergency situations.

Selection of the appropriate equipment should be suitable to control the risk. PPE must be suitable for the task being performed and requires a job specific risk assessment with reference to the dangerous good SDS, emergency procedure guides and approved codes of practice. Risk assessment should consider:

- tasks for which it is to be used, which influences the likelihood, extent and duration of exposure – such as connection and disconnection of hoses and piping, maintenance, emergency response, high pressure transfer, and product transfer. These all generate higher exposure risks and require high reliability PPE
- exposure/contact routes from splashes, sprays, mists, dusts, vapours, fumes, gas or radiation (thermal)
- hazards from dangerous goods that should be considered include: flammability (and static as an ignition source), pressure, cryogenic, thermal (gas vaporisation), toxic, corrosive, elevated temperatures
- whether or not the PPE is to be used for long periods of time
- if dexterity and clear vision are required for the task.

The effectiveness of PPE relies heavily on workers following instructions, procedures and supervision. Suitable PPE, procedures and supervision is desirable to encourage its use.

PPE should be looked after, cleaned, stored and replaced in accordance with manufacturers or suppliers recommendations. PPE that is damaged or shows signs of deterioration such as discolouration, swelling, cracking or holes should be replaced.

Training, procedures and records on PPE should include:

- selection of appropriate PPE (e.g. nature of the task such as emergency response, nature of dangerous goods hazards)
- fitting and fit testing
- use and cleaning
- inspection, testing, maintenance, storage and replacement.

Face and eyes

Face and eye protection should be considered when there is a risk of contact and harm to a person's face or eyes:

- face shields (for intermittent tasks such as transfers, mixing, cleaning)
- goggles for sealed eye protection for tasks involving mixing, transfer, cleaning
- safety glasses for protection from splashes or impact
- chemical resistant hoods for maximum protection.

Hands and arms

Hand and arm protection should be considered to control the risk of contact and harm to the hands and arms:

- Choose gloves depending on the chemical, thermal resistance and the risk (the nature of the task: emergency, maintenance, splash, gases, mists, vapour, pressure, toxicity, chemical or thermal [heat and cold] burns, corrosive or flammability)
- An experienced and qualified person should be consulted to recommend (based on risk assessment) suitable gloves or gauntlets. Suppliers and manufacturers should have charts that provide advice on the suitability of gloves with respect to particular chemicals such as breakthrough times and permeation rates. Without knowing this, it is difficult to determine the suitability.
- Gloves should be looked after, stored and replaced in accordance with manufacturers or suppliers recommendations. Gloves that are damaged or show signs of deterioration such as discolouration, swelling, cracking or holes should be replaced.

Respiratory

Respiratory protection should be provided to control risks of airborne dusts, mists, vapours, fumes or gases and must ensure airborne contaminants are less than accepted exposure standards. The selection of respirator or cartridge is specific and dependant on the particular dangerous goods.

Respiratory protection includes:

- dust masks for minor nuisance dust
- respirators for escape purposes involving intermittent, higher hazard gas or dust
- self-contained breathing apparatus for higher risk situations involving toxic or corrosive atmospheric pollutants (e.g. gases, dusts, mists, vapours).

Training, procedures and records should include:

- selection of appropriate respiratory protection
- fitting and fit testing
- use
- inspection, testing, maintenance, storage and replacement.

Body, legs and feet

Protection should be considered specific for the task to control the risk of contact and harm and resistance to the dangerous goods. It may include high-visibility, anti-static (e.g. cotton), fire-resistant (not synthetic) or chemically resistant suits, gas tight suits, aprons, overalls, shoes or boots.

26.2 Safety showers, eye and face washes

Eye/face washes and safety showers should be provided as an additional risk control measure where there is an elevated risk of spills or leaks, such as involving elevated pressure, when transferring or decanting (where persons are in close proximity to the hazard), and the harm from product should be treated with water flushing (e.g. corrosive, toxic substances, fire risk, very hot or very cold substances).

Eye/face washes and safety showers are required to be fit for purpose, readily accessible and in a safe location adjacent to the risk. There should be relevant signage and its location highlighted and lighted.

Figure 8 illustrates some design, location, installation and operational considerations.

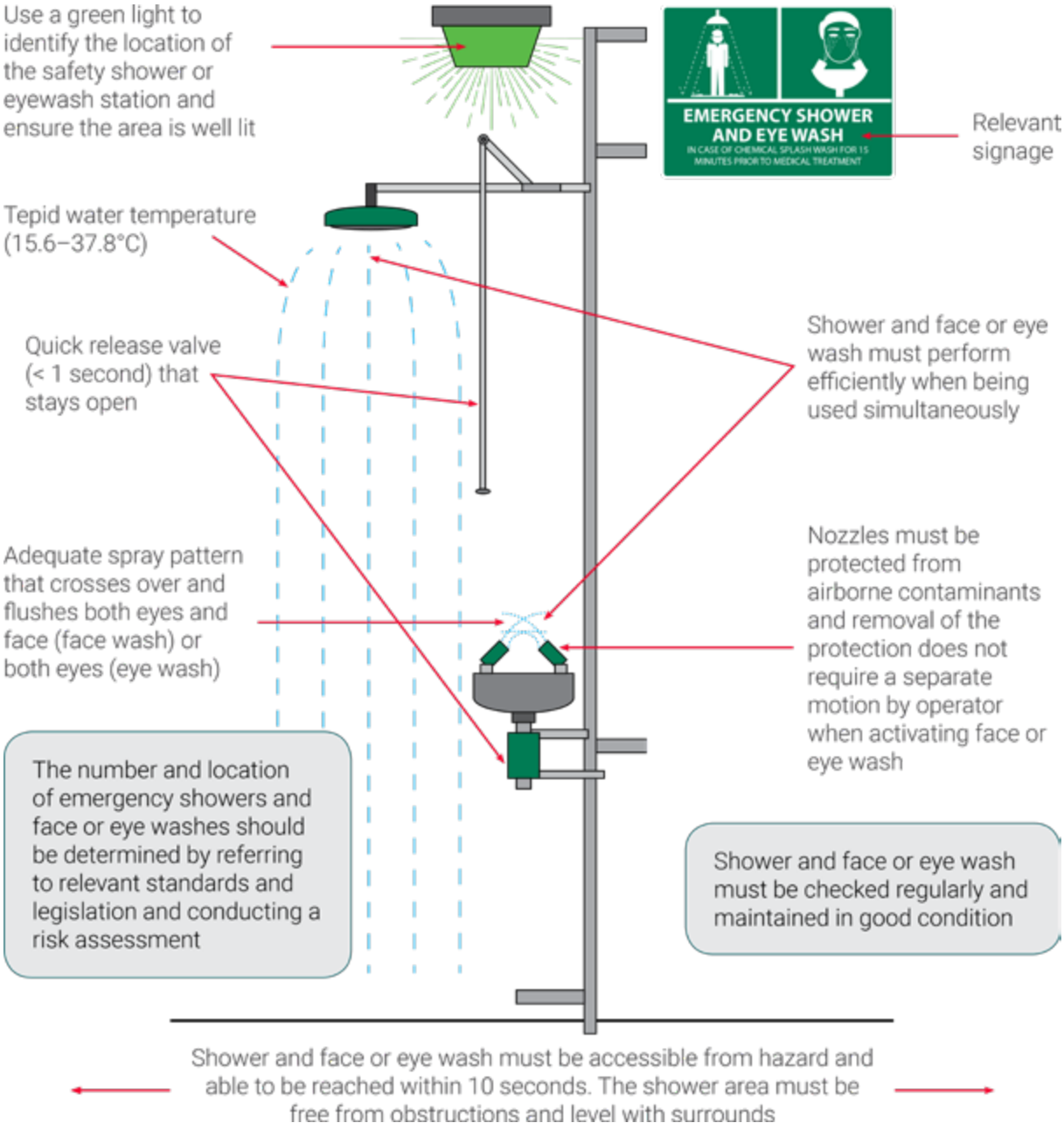

Figure 8 Emergency shower and face or eye wash requirements
(for guidance only – not to scale, refer to Australian Standard AS 4775 for details)

27 Emergencies: plans, response, reporting, reports and investigating

27.1 Emergency plan

> Regulation 75 – Emergency plan required for some sites

An emergency is any dangerous goods incident that harms or that threatens to harm people, property or the environment. Emergency plans focus on preparation for response and recovery for foreseeable emergencies. The objective of emergency planning is to protect people, minimise damage to property, minimise harm to the environment and reduce disruption to business operations in the event of an emergency.

Any site with more than a manifest quantity of dangerous goods on site must have a written emergency plan and provide incident response information to adjacent sites that would be affected by the emergency.

The emergency plan should be a practical document. It should be appropriate and specific for the site and take in to consideration: the number of people present on site, the complexity of dangerous goods activities, and the quantity and type of dangerous goods being handled.

Alarm notifications, alarm methods and response notification and information for remotely operated sites (especially for non-site persons on unmanned sites) must be robust.

If the site has an existing emergency plan, then ensure dangerous goods situations are included. The dangerous goods emergency plan should mesh with the operator's business systems (e.g. for security; safety, health and environment management; business continuity).

The emergency plan is required to:

- be written in consultation with site personnel (DFES should also be consulted)
- contain a plan of actions, procedures and information needed if a dangerous situation occurs
- be readily available to onsite persons and to DFES or DGOs
- be reviewed regularly and revised (as soon as possible as required) after:
  - any significant change of risk associated with the dangerous goods
  - any significant change to the site or offsite (that affects the risks to or from dangerous goods)
  - dangerous goods incidents (risk assessments must also be reviewed after incidents)
  - three years from the last revision of the emergency plan
  - as required by DFES or a DGO
  - changes to the site and offsite contacts and responsibilities.

Any revisions may also be required in relation to the adjacent site information the Fire and Emergency Services *Emergency response guide* (FES-ERG) (see 27.3 and 27.4).

Emergency response training, including exercises and drills, is a key requirement for emergency planning. Desk top and mock emergency drills and other practises should be performed regularly and every six months or less.

27.2 Contents and specific incident response

In general terms the emergency plan should focus on:

- what are reasonably likely dangerous goods incidents/emergencies
- preparation for the identified incidents/emergencies
- emergency response and make the site safe
- recovery and decontamination methods
- investigation of the incident
- review and revision or incidents/emergencies.

The emergency plan must include incident response requirements and, as required, should include:

- the title 'Emergency plan'
- site name and address
- name of authorising person, position and date (for review and of current revision)
- site contacts
- adjacent site contacts
- medical contacts
- emergency services contacts and prompts for providing essential information to emergency services and reporting to a DGO
- alarm systems
- when to raise the alarm, how to raise alarms
- alarm levels and appropriate personal response actions
- site specific personal emergency response roles and responsibilities

- credible site specific dangerous goods situations, identified by risk assessment
- provision of site specific emergency resources (may be kept onsite and offsite)
- site specific dangerous goods incident response actions (procedures), including for spills (large and small), leaks, fire, evacuation, injuries and first aid responses (consider customising the recommendations in the SDS and emergency response guide to be site specific)
- safe routes and locations for local or site evacuation
- making the storage and handling system and site safe
- containing dangerous goods incidents on site
- location of isolation points for services and utilities (electricity, water, gas, drainage)
- locations of emergency resources, fire equipment, first aid and safety showers
- information on how to secure the site
- declaring part or the whole site and storage and handling system safe
- site remediation advice
- incident investigation procedures
- emergency training, drills and regular desk top exercises.

27.3 Adjacent sites

> Regulation 76A – Information for occupier of site adjacent to dangerous goods site

Adjacent sites that would be affected by a dangerous goods situation must be given (at least) the following emergency information:

- the risks from the dangerous goods
- what might happen if an incident occurs
- what to do if an incident occurs
- what the site operator will do if an incident occurs and
- how to contact the dangerous goods site operator.

27.4 Fire emergency services emergency response guide (FES-ERG)

> Regulation 76B – DFES emergency response guide required for some sites

A FES-ERG is required for sites (except mine sites and petrol stations) if the quantity of dangerous goods exceeds ten times manifest quantity.

The FES-ERG is a template that contains information intended to facilitate appropriate emergency response by the attending fire brigade and a printed copy must be held at the site. To prepare or lodge a FES-ERG, visit the DFES website. The FES-ERG must be prepared and revised in consultation with the officer in charge of the local fire station. It includes name and contact details for the site operator; site layout, buildings and structures; summarised dangerous goods information; and equipment and resources available on the site to detect or deal with fires and other dangerous situations.

The FES-ERG must be reviewed, and if necessary revised:

- whenever there is a significant change to the type or quantity of dangerous goods
- whenever there is a significant change to the layout of structures on site
- as soon as practicable after a fire or other dangerous situation occurs
- at least every three years.

27.5 Incident response and reporting requirements

> Regulation 76 – Dangerous goods incidents, containment of
>
> Regulation 118 – Dangerous goods incidents, response required to
>
> Regulation 119 – Affected persons to be advised of dangerous goods incident
>
> Regulation 120 – Investigating and recording dangerous goods incidents
>
> Regulation 121 – Reportable situations prescribed [s. 9 of the Act]

The operator of a dangerous goods site where an incident occurs must take immediate action to:

- advise people on the site and any adjacent site who might be affected by the incident
- ensure only people essential to assist with incident response remain in the area that may be affected on site
- contain the incident on site
- make the incident site safe
- bring the incident under control
- ensure the storage and handling system is safe
- report 'reportable' incidents to a DGO as soon as possible
- remove and dispose of any dangerous goods contamination.

The operator of a dangerous goods site must investigate incidents to determine its cause and keep a record of the investigation for the life of the site.

Guidance on reporting incidents involving dangerous goods, as well as the *Dangerous goods incident report – form,* is available on the Department's website.

APPENDICES

Appendix 1 Legislative provisions

Dangerous Goods Safety Act 2004

s. 9	Duty to report certain situations
s. 13	Unregistered or unlicensed dangerous goods sites

Dangerous Goods Safety (Storage and Handling of Non-explosives) Regulations 2007

Part 1	Preliminary
Part 2	General
Part 3	Duties of manufacturers, importers and suppliers
Part 4	Dangerous goods sites
Part 5	Dangerous goods pipelines
Part 6	Dangerous goods incidents at dangerous goods sites and dangerous goods pipelines
Part 8A	Dangerous goods in ports
Part 8	Miscellaneous
Schedule 1	Quantities of dangerous goods
Schedule 4	Placarding requirements
Schedule 6	Savings and transitional provisions

Note: The only authorised versions of the Act and Regulations are those available from the Parliamentary Counsel's Office (www.legislation.wa.gov.au), the official publisher of Western Australian legislation and statutory information.

Appendix 2 References

Department of Mines, Industry Regulation and Safety

www.dmirs.wa.gov.au

Codes of practice

- *Emergency management for Western Australian mines – code of practice*

Forms

- *Dangerous goods site licence – application form*
- *Notification of temporary storage or handling of dangerous goods – form*
- *Operator notification that critical quantity of Schedule 1 substances will be exceeded – form*
- *Register a dangerous goods pipeline – application form*

Guidance notes

- *Licensing and exemptions for storage and handling – guidance note*
- *Manifest and site plan requirements for dangerous goods sites – guidance note*
- *Overview of security sensitive ammonium nitrate regulations – information sheet*
- *Risk assessment for dangerous goods – guidance note*

Guidance (web pages)

- Applying for approval of a safety report for a major hazard facility (MHF)
- Applying to register a dangerous goods pipeline
- Dangerous goods safety – codes of practice
- Notifying that critical quantity of Schedule 1 substances will be exceeded
- Reporting incidents involving dangerous goods
- What is involved in preparing a safety report for a major hazard facility (MHF)?

National Occupational Health and Safety Commission

- *National code of practice for the preparation of material safety data sheets [NOHSC: 2011(2003)]*

Safe Work Australia

www.safeworkaustralia.gov.au

- *Preparation of safety data sheets for hazardous chemicals*
- *Labelling of workplace hazardous chemicals – model code of practice*

WorkSafe Victoria

- *Code of practice for the storage and handling of dangerous goods*

Appendix 3 Glossary of terms

Adulterant is a substance added to a dangerous good to negate the inherent chemical instability of the dangerous good.

Compatible means substances will not react together, cause a fire, explosion, harmful reaction or the evolution of flammable, corrosive or toxic vapours; or will not react dangerously and are not incompatible.

Control temperature means the maximum temperature at which dangerous goods can be safely stored and handled as specified or determined by, or in accordance with the United Nations Treaty Collection (UNTC).

Diluent is a substance used to dilute something.

Exothermic reactions are chemical reactions that release energy by light or heat.

Handling, in relation to dangerous goods, includes to manufacture, process, pack, use, sell, supply, carry (including by pipeline), and treat the dangerous goods and to destroy or otherwise dispose of dangerous goods

Incompatible means likely to interact to increase the risk from the dangerous goods or listed in the ADG Code as being incompatible or declared by the Chief Dangerous Goods Officer as being incompatible; or where the dangerous good is likely to interact with packaging, equipment or a facility to cause damage sufficient to increase risk.

Phlegmatizer is a material added to an explosive to make it less susceptible to detonation and thus more stable and safer to handle and transport.

React dangerously means a reaction of the substances under consideration that directly creates a hazard, including: a violent reaction, an explosion, explosive products, a fire, rapid heating, toxic vapours, toxic mists or toxic gas.

Appendix 4 Abbreviations

ADG Code	Australian Code for the Transport of Dangerous Goods by Road and Rail
ANE	ammonium nitrate emulsion
CIL	carbon in leach
CIP	carbon in pulp
CoP	code of practice
DFES	Department of Fire and Emergency Services
DGO	dangerous good officer
FES-ERG	DFES Emergency Response Guide
GHS	Globally Harmonised System of Classification and Labelling of Chemicals, published by the United Nations
HAZCHEM	hazardous chemical
HAZID	hazard identification study
HAZMAT	hazardous material
HAZOP	hazard and operability study
IBC	intermediate bulk container
JSA	job safety analysis
LEL	lower explosive limit
LOPA	layers of protection analysis
MHF	major hazard facility
NDT	non-destructive testing
PPE	personal protective equipment
PSV	pressure safety valve
SDS	safety data sheet
SIL	safety integrity level
SIS	safety instrumented system
SOP	standard operating procedure
STEL	short term exposure limit
TLV	threshold limit value
UPS	underground petroleum storage

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