NATIONAL CODE

Storage and Handling of Workplace Dangerous Goods

NATIONAL CODE OF PRACTICE [NOHSC:2017(2001)]

MARCH 2001

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FOREWORD

In seeking to achieve Australian workplaces free from injury and disease, NOHSC works to lead and coordinate national efforts to prevent workplace death, injury and disease. We seek to achieve our mission through the quality and relevance of information we provide and to influence the activities of all parties with roles in improving Australia's OHS performance.

NOHSC has five strategic objectives:

- Improving national data systems and analysis,
- Improving national access to OHS information,
- Improving national components of the OHS and related regulatory framework,
- Facilitating and coordinating national OHS research efforts, and
- Monitoring progress against the National OHS Improvement /framework.

This publication is a contribution to achieving those objectives.

CONTENTS

INTRODUCTION

The *National Code of Practice for the Storage and Handling of Workplace Dangerous Goods* provides guidance on how to comply with the requirements set out in the *National Standard for the Storage and Handling of Workplace Dangerous Goods* (referred to in this document as the national standard). This national code of practice *should* therefore be read in conjunction with the national standard.

Dangerous goods are widely used throughout the community under a variety of conditions, by industry, commerce and institutions, and in domestic residential situations. The methods for complying with the national standard may vary widely, depending on the nature and scope of the operations, the extent of involvement with *dangerous goods*, and whether or not there is contact with the general public.

In line with recent developments in occupational health and safety legislation, the national standard establishes performance objectives and allows industry the maximum *practicable* flexibility in achieving those objectives. Consistent with that approach, this national code of practice wherever possible allows for alternative approaches to achieving compliance with the national standard depending on the needs of the facility.

Where more detail is required than is provided in this code of practice, users are guided in the direction of documents, including Australian Standards, that identify particular technical specifications for the safe storage and *handling* of certain types of *dangerous goods* under specific conditions. Australian Standards, industry and other codes of practice may assist in many situations, but detailed compliance with these is not mandatory, provided it can be demonstrated that the requirements of the national standard can be met.

To this end a more extensive list of related standards and codes of practice is provided at **Appendix 3**. These standards and codes are incorporated in this national code and where appropriate may be relevant to complying with the national standard. .

Other references that may also be useful, include overseas standards and industry codes of practice. For instance, the Australian Gas Association industry codes of practice which provide detailed requirements applicable to some circumstances where *Class* 2.1 *dangerous goods* are stored and *handled*.

A number of aids, such as checklists, flowcharts and sample forms have been included to assist industry to comply.

The national code provides information and guidance for the storage and *handling* of *dangerous goods* in minor quantities and in consumer packages supplied by *retailer*s.

- However the *occupier*, of *premises* where minor quantities of *dangerous goods* are stored and *handled*, can elect to control those goods using **Appendix 1** or apply the *risk* management provisions of the national standard in conjunction with the requirements of the relevant Australian Standard for the *dangerous goods* on the *premises*.

- Provisions for the control of *dangerous goods* stored and *handled* on a *retailer*'s *premises* is included in **Appendix 2** – Retail *Premises*.

In the decimal numbering system used in this national code of practice, paragraph numbers commence with the number of the corresponding clause in the national standard to which they refer. Where a specific clause in the national standard is referenced in this code of practice, the letters "NS" followed by the clause number, are used to identify the clause.

e.g. **NS 10(2)(b)** is a reference to clause 10(2)(b) of the national standard.

Similarly the letters "CoP" are used to identify paragraph numbers in this code of practice.

e.g. **CoP5.2.1** is a reference to paragraph 5.2.1 in this code of practice.

The paragraph numbering system used throughout this code has been designed to assist cross-referencing with the national standard.

Where applicable, and as far as *practicable*, the number immediately following the first decimal point corresponds with the sub-clause number in the national standard to which the paragraph refers.

Where there are paragraphs for example paragraph 5.2, with no corresponding clause in the national standard, the equivalence resumes in subsequent paragraphs.

e.g. Paragraph 15.1 in this national code of practice (**CoP 15.1**) refers to the subject matter of **NS 15(1)** and **CoP 15.2** to that of **NS 15(2)**.

Sometimes a particular clause in the national standard requires no further or explanatory material in this national code of practice. In such cases, a brief note outlining the requirements for that Clause in the national standard will be provided for that paragraph number in this national code of practice (For example see Clauses 6.2 – 6.4).

PART A — PRELIMINARY

1. TITLE

This document may be cited as the *National Code of Practice for the Storage and Handling of Workplace Dangerous Goods* [NOHSC:2017(2001)] and is referred to as "the national code of practice" or simply "this code" throughout this document.

2. DECLARATION

This national code of practice was declared by the National Commission on 7 MARCH 2001.

3. PURPOSE

The purpose of this national code of practice is to provide practical guidance and advice on how to comply with the *National Standard for the Storage and Handling of Workplace Dangerous Goods*, hereafter referred to as the national standard.

- Wherever possible it endeavours to suggest various courses of action that will lead to achievement of the health and safety standards set by the national standard.
- Compliance with this code is not mandatory. Persons with obligations under the national standard may choose to meet those obligations by following the recommendations in this code. A person may choose to comply with a provision of the national standard in some other way, provided that the method used ensures that compliance.
- In some circumstances, the *risk* assessment process of **NS 13–15** may identify that following the specific recommendations of this code and referenced documents may not guarantee achievement of all the health and safety objectives of the national standard. Under those circumstances other or additional *risk* control methods will need to be identified and implemented.

4. SCOPE AND APPLICATION

This national code of practice is identical in scope and application to the national standard.

- The national standard applies only to *workplaces*. Where *dangerous goods* are stored or *handled* in private residences or other *premises* which are not *workplaces*, the national standard and this code may provide useful guidelines for ensuring health and safety. Particular attention is drawn to the minor quantities provisions in **Appendix 1**.
- A summary of goods covered by the national standard and this national code of practice is provided in **Table 1**.
- *Dangerous goods* and *goods too dangerous to be transported* are identified in the *ADG Code*.
- Much of the terminology used to describe *dangerous goods* is defined in the *ADG Code*.
- The storage and *handling* of *dangerous goods* of *Classes* 1, 6.2 and 7 is outside the scope of the national standard and this national code of practice. When storing or *handling* these classes, reference *should* be made to the relevant State or Territory legislation.
- The national standard and this code apply to hazardous substances only when they also meet the classification requirements for *dangerous goods*. – See detailed discussion on hazardous substances on page 4.

TABLE 1.
Types of Goods Covered by the National Code of Practice

Type of Goods	Description	Reference
***DANGEROUS GOODS*:**		
Class 2	Gases	
2.1	Flammable gas	
2.2	Non-flammable, non-toxic gas	*ADG Code*
2.3	Toxic gas	
Class 3	Flammable liquid	
Class 4	Flammable solids etc.	
4.1	Flammable solids; self-reactive and related substances; and desensitized explosives	
4.2	Substances liable to spontaneous combustion	
4.3	Substances that in contact with water emit flammable gases	
Class 5	Oxidizing substances, organic peroxides	
5.1	Oxidizing substances	
5.2	Organic peroxides	
Class 6.1	Toxic substances	
Class 8	Corrosive substances	
Class 9	Miscellaneous dangerous goods and articles	
GOODS TOO DANGEROUS TO BE TRANSPORTED	Goods listed in **Appendix 5** of the *ADG Code* and goods determined to be so by an *Authority*	*ADG Code*
***COMBUSTIBLE LIQUID*:**	"Any liquid other than a flammable liquid that has a flashpoint, and that has a fire point less than its boiling point"	AS 1940 – *The storage and handling of flammable and combustible liquids*
C1	*Combustible liquid* with flashpoint >60.5°C ≤150°C	
C2	*Combustible liquid* with flashpoint >150°C	

Dangerous Goods and *Hazardous substances*

Occupiers are expected to know the difference between *dangerous goods* and hazardous substances, which are classified according to different criteria. *Dangerous goods* are classified on the basis of immediate physical or chemical *hazards*, such as fire, explosion, corrosion and toxicity, that may affect life, health, property or the environment. Hazardous substances are classified only on the basis of immediate or long term health effects .

Dangerous goods and hazardous substances are covered by separate regulations, standards and codes, each focusing on controlling the different *risks* described above. Since many hazardous substances are also classified as *dangerous goods*, both sets of requirements will apply in these cases.

The National Model Regulations for the Control of Workplace Hazardous Substances [NOHSC:1005(1994)] apply to the storage, *handling* and use of hazardous substances in the *workplace*. These Model Regulations have been implemented in all States and Territories.

The National Standard for the Storage and Handling of Workplace Dangerous Goods and this code have been drafted to complement the *National Model Regulations for the Control of Workplace Hazardous Substances* as far as possible.

In some cases work carried out to ensure compliance with the Hazardous Substances Regulations will contribute significantly to complying with the national standard. Persons with duties under the Hazardous Substances Regulations *should* be able to adapt processes established for those regulations to achieve compliance with many of the requirements of the national standard.

4.1 Combustible Liquids

4.1.1 **NS 4(2)(a)** applies all the requirements of the national standard to C1 *combustible liquids* as though they were *dangerous goods*, excepting the provision and keeping of *material safety data sheets*.

The *ADG Code* does not specify how to pack or label *combustible liquids*.

4.1.2 C1 and C2 *combustible liquids* are included as *fire risk dangerous goods* as, when involved in a fire, they contribute to the fire load as though a flammable liquid. Many are also highly reactive with *Class* 5 *dangerous goods*, leading to ignition and an intense fire.

4.1.3 The separation distances and construction requirements for barriers to achieve isolation under **NS 4(2)(c)** *must* be such that a reasonably foreseeable incident involving the C1 liquids will not spread to the *dangerous goods*, and vice versa.

For further discussion of isolation, see **CoP 16**.

4.2 Dangerous Goods in Fuel Systems or Equipment or Otherwise Essential to Operation of Equipment

4.2.1 The general duty of care imposed by **NS 8** is the only condition placed on *dangerous goods* in fuel systems or otherwise essential to the operation of equipment.

Examples of storage and *handling* systems to which only **NS 8** applies under **NS 4(3)** include:

- batteries connected to and essential for the operation of plant, equipment, vehicles, boats and appliances;
- fuel in fuel *tanks* and systems connected to and essential for the operation of plant, equipment, vehicles, boats and appliances;
- *dangerous goods* contained in portable firefighting or medical equipment deployed for use at the *premises*

4.2.2 Under Regulation 1.18 of the *Road Transport Reform (Dangerous goods) Regulations*, the Competent Authority may determine that particular substances or articles are or are not *dangerous goods*, notwithstanding whether or not they would otherwise be *dangerous goods* under the *ADG Code*. Applying **NS 4(3)(a)**, a determination that goods are not *dangerous goods* would exempt those goods from the application of the national standard.

- *The Road Transport Reform (Dangerous Goods) Regulations* also include a mechanism, through the 'Competent Authorities Panel' for mutual recognition of determinations by all jurisdictions.
- An example of where there may be an inconsistency between the national standard and other legislated requirements may be the placarding requirements for a freight *container* that is being loaded with *dangerous goods* for transport by sea under the *IMDG Code*.

5. INTERPRETATION

This national code of practice uses the definitions provided in the national standard. Where required, other terms are described in the text or in footnotes.

Practicability Criteria

Practicability is a concept used throughout the national standard, but most frequently in regard to *occupiers* duties.

Practicable does not just mean the cost in dollar terms.

To determine what is practicable, a duty holder, must take into account:

(a) the severity of the hazard or risk in question

i.e. How likely is it that the storage and *handling* of the *dangerous goods* will result in injury to people or the likelihood of damage occurring to property?

How serious is the injury and property damage likely to be and how many people could be affected?

(b) the state of knowledge about the hazard or risk and ways it may be removed or mitigated

i.e. What is known about the *hazards* or *risks* associated with the storage and *handling* and the ways to control the *risk*?

What do manufacturers and suppliers of *dangerous goods* know about the *hazards* and *risks*?

What do workplaces dealing with similar *dangerous goods* do to control the *risk*?

What information can industry professionals and organisation, unions and government agencies provide?

(c) the availability and suitability of ways to remove or mitigate the hazard or risk

i.e. Are the *risk* controls that have been identified readily available?

Are they suitable for the *premises* and the *employee*s involved?

(d) the cost of removing or mitigating the hazard or risk

i.e. Are the costs of implementing the *risk* control commensurate with the benefits gained?

Unless time and money invested in selecting and implementing *risk* controls results in the elimination or significant reduction in *risks,* more cost effective *risk* controls *should* be identified.

6. INCORPORATION OF REFERENCES

6.1 When applying the provisions and specifications from a referenced document, such as an Australian Standard or industry code of practice, the latest edition *should* always be followed to ensure that the latest safety developments are incorporated.

When a later edition is subsequently published with updated provisions, the implications for existing installations will need to be assessed. In such circumstances a *risk* assessment *should* be carried out (**see NS 15(3)**) to determine whether upgrading is required.

- Documents such as Australian Standards are periodically updated to incorporate the latest state of safety knowledge and experience.
- An installation that complied with an earlier edition may no longer comply.
- Upgrading of the facility to meet the new provisions may not be necessary if a *risk* assessment indicates that the current control measures are still satisfactory

6.2 – 6.4 Clause 6.2 – 6.4 of the national standard address the issues of referenced documents and *approval*s given by the *Authority* and the Competent Authorities Panel.

7. Clause 7 of the national standard addresses the duty of each person to comply with the provisions of the national standard regardless of whether another person with that duty or other duty has complied with the requirements of the national standard.

PART B — DUTIES

GENERAL DUTY OF CARE

8. Clause 8 of the national standard states the general duty of care for the purposes of this national standard.

Under **NS 8** anyone with the means and responsibility to take preventative action (implement *risk* control) is in breach of duty of care when any injury to persons, or damage to property or the environment occurs and all practicable steps had not been taken to prevent that outcome. It *should* be noted that this is subject to the test of *practicability*. —see **CoP 5.1**

DUTIES OF MANUFACTURERS, SUPPLIERS, IMPORTERS, DESIGNERS AND INSTALLERS

This section of the national standard **(NS 9–11)** imposes a range of duties on specified people with respect to:

- classification, packaging and labelling of *dangerous goods*;
- ensuring that goods are in a safe condition for storage and *handling*;
- providing safety information including *MSDS*; and
- the supply and installation of any plant and structures used for the storage and *handling* of *dangerous goods*.

9. DANGEROUS GOODS

9.1 — 9.3 Clauses **NS 9.1 - 9.3** of the national standard are the requirements for a manufacture or *importer* to classify *dangerous goods*.

Classification

- Under **NS 9(1, 2 & 3)** the importer or manufacturer of any goods has the responsibility to determine if they are *dangerous goods* and, if so to classify them in accordance with the *ADG Code*
- In Australia, the *ADG Code* is the principal source of information for *dangerous goods* classification.
- The *ADG Code* is itself based on the United Nations Recommendations on the Transport of *Dangerous goods* which is revised every two years.
- International Codes such as the *IMDG Code*, *ICAO Rules* and *IATA Regulations* also use the UN classification system, as do the European agreements for road and rail transport (ADR and RID)

Labelling

- The *ADG Code* contains detailed instructions on labelling. The requirements found in the 6th Edition of the *ADG Code* are summarised in **CoP 9.4**.

9.4 The supplier of *dangerous goods should* ensure that:

To ensure that *dangerous goods* are in a safe condition, the supplier *should* determine:

- the product specification, including the level of any inhibitor, stabiliser and any other critical chemical or physical characteristics
- any particular controls necessary to control reactivity, such as temperature control or additional packaging.

(a) the goods supplied are packed in accordance with the *ADG Code*, with particular importance given to the need for the packagings to be in sound condition and compatible with the goods; and

(b) the goods supplied are in all respects in accordance with any specific storage and *handling* requirements specified by the manufacturer.

(c) where *dangerous goods* are supplied in *package*s above the minimum size specified in the *ADG Code* they are labelled in accordance with the *ADG Code*. Depending on the *Class* and *Packing Group* of the *dangerous goods*, those minimum sizes range from 20 mL or 20 g to 2 L or 2 kg, . The minimum sizes are determined from a series of flow charts in the *ADG Code* which have been summarised as **Appendix 10**.

(d) where *package*s are prepared for transport that require marking, they are marked with an Australian contact name and address, plus, for each type of *dangerous goods* in the *package*:

The *ADG Code* refers to labelling as:

- marking of *packages*; and
- placarding of *IBC*s.

(i) the *Proper shipping name*;

(ii) the *UN Number*;

(iii) the *Class label*; and

(iv) all applicable *Subsidiary Risk labels* (except where these would duplicate *Class* labels).

in the *ADG Code* flow charts, this is referred to as “standard marking for a *package*”.

(e) where inner packagings are marked, they are marked with the:

(i) *Proper shipping name* or technical name for the *dangerous goods*;

(ii) *Class label*; and

(iii) applicable *Subsidiary Risk labels*.

in the *ADG Code* flow charts, this is referred to as “inner *package* marking”.

(f) where *dangerous goods* are used in that *workplace* they are labelled in accordance with the National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)], in order to protect the health and safety of people using those *dangerous goods*.

9.5 Clause 9.5 of the national standard restricts the supplier from supplying *dangerous goods* where they would reasonably be expected to know that the goods are not contained, labelled or *package*d in accordance with the *ADG Code*.

9.6 A Person Who Retails Dangerous Goods

When determining under **NS 9(6)(a)** whether a *container* provided by the purchaser is suitable for *dangerous goods*, the *retailer should* be reasonably satisfied that the *container*:

(a) is of a type usually associated with the particular *dangerous goods*. If not, does it appear sufficiently robust and constructed of a material that is unlikely to be affected by the *dangerous goods*?

(b) has a closure that is tight fitting that could be expected to prevent the spillage of *dangerous goods* from the *container* under normal conditions of *handling*; and

(c) is free from any substance that could present a *risk* with the *dangerous goods*.

Where a *retailer* has concerns regarding a *container* provided by the customer to be filled with *dangerous goods*, the *retailer should* advise the customer that the *container should* not be filled, if it is not:

- In good condition
- Correctly labelled
- Capable of being properly secured; and
- Being refilled with the same product.

For purchaser supplied *containers* to be filled with fuel:

- *containers* which comply with Australian Standard AS 2906 *Fuel Containers - Portable - Plastics and Metal* are preferred;
- other metal containers may be filled with fuel provided that they are substantial and have a secure and leakproof closure; and
- plastics containers *should* only be used if they comply with AS 2906 *Fuel containers – portable – Plastics and metal*.

A fuel *tank* of an engine or vehicle may also be used as a fuel *container*.

9.7 Filling of Cylinders and Disposable Containers for Class 2 Dangerous Goods

9.7.1 Gas cylinders manufactured in Australia are marked in accordance with the provisions of Australian Standard *AS 2030.1 Cylinders for compressed* gases to indicate that they have been physically tested to demonstrate their ability to withstand their design pressures. The specified period of test validity (commonly 10 years) is indicated.

9.7.2 An imported gas cylinder *should* only be filled if it has similar marking and test date indicating an equivalent performance to that required by *AS 2030.1*.

9.7.3 A cylinder outside its current test date *should* not be filled. If it is intended for reuse, it *should* be retested in accordance with *AS 2030* and marked with new test dates prior to filling.

9.7.4 Prior to filling, a cylinder *should* be inspected for excessive corrosion, physical damage; and serviceability of valves, fittings and any protective devices like neck rings and shrouds. A cylinder that shows evidence of excessive damage *should* not be filled.

9.7.5 A cylinder *should* only be filled with a gas for which it is suitable.

- Most cylinders are designed to be used for a specific gas or group of gases, and have fittings that are only suitable for those gases.
- Some cylinders are distinctively painted or marked to readily identify their intended contents.

These are safety factors which discourage contamination and incorrect usage.

For example: oxygen cylinders are painted a different colour to acetylene cylinders and their valve assemblies are not interchangeable, preventing inadvertent mistaken identity.

9.7.6 A cylinder *should* only be filled using equipment specifically designed for the purpose. The use of adaptors is discouraged unless the use of those adaptors has been authorised by the original supplier of the gas or the manufacturer of the cylinder.

10. PROVISION OF MATERIAL SAFETY DATA SHEETS

10.1 A *MSDS* which conforms with the provisions of the *National Code of Practice for the Preparation of Material Safety Data Sheets [NOHSC:2011(1994)]* would generally meet the *MSDS* requirements of this national standard.

- It is expected that the *National Code of Practice for the Preparation of Material Safety Data Sheets* [NOHSC:2011(1994)] will be revised and retitled to incorporate *dangerous goods*.
- Other acceptable *MSDS* formats include those of the European Union and the International Labour Office, as described in the *MSDS* national code of practice. Any overseas *MSDS* provided in Australia *should* include the relevant Australian information, for example, supplier contact details and any relevant exposure standard.

10.2 For *dangerous goods* that may be unstable except under controlled conditions, it is essential that the *MSDS* provide full details of those conditions and specify the recommended proportion and safe limits for every ingredient that stabilises the *dangerous goods*. These *should* include all phlegmatizers, diluents, solvents, wetting agents, stabilizers, inhibitors, and/or adulterants that are necessary to maintain safety.

Examples of such controls include:

- ethylene oxide gas which depends on the addition of an inhibitor to ensure it remains chemically stable and does not start to polymerise;
- acetylene gas which is normally absorbed onto an acetone saturated substrate in a cylinder to ensure stability; and
- most organic peroxides which must be stored below a *control temperature* to prevent self-accelerating decomposition that may result in explosion.

10.2.1 Reviewing and Revising MSDS

10.2.1.1 Manufacturers and *importer*s of *dangerous goods* are required to review *MSDS* as often as necessary to ensure the information remains accurate and current. Review *should* take place:

(a) whenever there is a change in the formulation of a product;

(b) whenever new information on the *hazard*ous properties or the health effects of the product or one of its *ingredients* becomes available;

(c) whenever, through review or other means, it becomes apparent that the information provided may not be completely accurate, current or comprehensive.

10.2.1.2 In any event, manufacturers and *importers must* ensure the *MSDS* is reviewed no later than five years after the last date of review.

10.2.1.3 After any review or revision, the *MSDS should* be reissued with the review date.

- **NS 10(2)(a)** extends the responsibility to supply *MSDS* on request to anyone who may be affected by the *dangerous goods*.

  This obligation is not restricted to persons who may be affected in *workplaces*

  For further information on requirements for *occupiers* to keep *MSDS* for *dangerous goods* being stored and *handled*, –see **NS/CoP 51**

10.3 Providing a Current MSDS

10.3.1 Under **NS 10(2)(b)**, suppliers of *dangerous goods* are obligated to provide a copy of the current *MSDS* on or before the first occasion that *dangerous goods* are supplied to a *workplace* and on the first supply of those goods following revision of the *MSDS*.

10.3.2 The concession provided by **NS 10(3)** means that a *retailer* does not have to supply *MSDS* for products and transactions of the types indicated.

11. PROVISION OF OTHER INFORMATION

11.1 Situations where other information might be requested under **NS 11** may include where *dangerous goods* are encountered in a use not covered by the *MSDS*, or where the *MSDS* does not provide sufficient information for a particular use.

Two examples of other safety information are:

- summary reports produced under the *Industrial Chemicals (Notification and Assessment) Act 1989 (Cwlth);* and
- where it is available, specific information relating to the conditions for safe use, *compatibility* and chemical stability under particular circumstances.

11.2 Where the requested information is not immediately available to the supplier, the supplier may be able to obtain it from the manufacturer.

12. PLANT AND STRUCTURES USED FOR STORAGE AND HANDLING

12.1 **NS 12** applies to all structures and *plant* associated with the storage and *handling* of *dangerous goods*, including:

This is an indicative list of examples only.

- Plant will normally be required to comply with the *National Standard for Plant* [NOHSC:1010(1994)]
- Structures will normally be required to comply with the *Building Code of Australia*.

(a) buildings

(b) all building fittings

(c) shelves and racking

(d) *tank*s, other *bulk* storage facilities

(e) *pipework*

(f) pumps

(g) process and reaction vessels

(h) mixing vessels

(i) mills

(j) dispersers

(k) driers

(l) filters.

12.1.1 Ideally, all structures and *plant* will be designed and built for use with the specific *dangerous goods*. This enables all the aspects of the design, commissioning, operation, testing, maintenance, repair and decommissioning to be anticipated and planned for at the design stage. It also permits control mechanisms, for the *risks* arising from the *hazards* of the *dangerous goods*, to be incorporated in the initial design.

12.1.2 Where structures and *plant* that were not designed and built for use with the particular *dangerous goods* are subsequently to be introduced to that use, additional care is required to ensure suitability and that *risks* are controlled.

An example of plant that is commonly used to store *bulk* liquid *dangerous goods* at atmospheric pressure or just above atmospheric pressure, is a storage *tank* constructed to AS 1692 - Tanks for Flammable and Combustible liquids. A *tank* built to that specification may be able to be used to store other classes of liquid *dangerous goods* such as corrosive or toxic liquids, subject to a number of factors, including:

- materials of construction; and
- specific gravity.

A *tank* that has originally been designed and constructed for the storage of a *Class* 3 flammable liquid like petrol may be structurally able to contain diesel (C1 *combustible liquid*) or hydrochloric acid (*Class* 8 *dangerous goods*).

The decision on the suitability of the *tank* is subject to more than just structural considerations and must take into account the chemical and physical characteristics of diesel and hydrochloric acid.

Unless the material of construction of the *tank* is suitable for use with the hydrochloric acid then the *tank should* not be used. Even if it were suitable, the maintenance practices and the frequency of carrying out any maintenance are only partly determined by the *tank* and more likely to be determined by the type of *dangerous goods* the *tank* contains.

Other features of the *tank* may also need to be modified to make it suitable for use.

- The operating procedures that were in place when the *tank* was storing petrol may no longer be suitable.
- The operating procedures and the types of PPE would also need to be reviewed with the change in the product.

Table 2
An Overview of the Risk Management Process

A systematic approach to managing *risk* is a core requirement of the national standard.

The approach of the national standard to *risk* management is basically a three step process, plus recording and review, as indicated below.

Step		Key Elements	References
Step 1	Identify the *Hazards*	♦ Identify all of the *dangerous goods* and their associated *hazards* ♦ Identify the *hazards* in or arising from the storage and *handling* processes ♦ Identify any neighbouring or external *hazards*	**NS 13** **CoP 13**
Step 2	Assess the *Risks*	♦ Assess the potential severity of outcome of incidents arising from each *hazard* (S) ♦ Assess the likelihood of this incident taking place (L) ♦ Determine initial prioritisation of *risk* (L x S) ♦ *Record* results of assessment	**NS 14** **CoP 14**
Step 3	Control the *Risks*	♦ Apply Practicability Test (based on feasibility and cost of mitigating *risk*) ♦ Determine final *risk* ranking ♦ Eliminate *hazards* leading to *risk* where *practicable* ♦ Determine *risk* control measure/s to reduce *risk* as far as *practicable* ♦ Implement *risk* control measures	**CoP 5.1** **NS 15** **CoP 15**
	Review	♦ Repeat Steps 1 and 2 to ensure *risks* mitigated ♦ *Record* results of second assessment ♦ Implement additional *risk* control measure/s	**NS 13-15** **CoP 13-15**

13. HAZARD IDENTIFICATION

13.1 General

Hazard identification is the first step in the safety *risk* management process —see **Table 2**

13.1.1 Under **NS 13(1)**, the *occupier* is expected to identify every *hazard* associated with the storage and *handling* of *dangerous goods* and/or *combustible liquids*, of which knowledge is reasonably available. Sources of *hazard* knowledge are discussed in **CoP13.2—13.7**.

13.1.2 When identifying *hazards*, the *occupier should* consider, but not be limited to undertaking the following activities:

(a) consulting with *employees*;

(b) consulting with the suppliers of the *dangerous goods*, structures, equipment and supplies, or other persons with specific expertise;

(c) walking through and inspecting the *premises* and the methods of storage and *handling*;

(d) thoroughly examining plans of the *premises*, including all buildings and services, including water, gas, electricity, compressed air, steam, drains, fire services, chemical *pipeline*s, roads and access ways and engineering drawings of relevant *plant*;

(e) discussing *risks* with *occupiers* of nearby *premises* and the *emergency services authority*; and

(f) consulting injury and illness *record*s.

13.2 Dangerous Goods

CoP 13.2 refers to **NS 13(2)(a)(b) & (f)**

13.2.1 The starting point for identifying the *hazards* associated with *dangerous goods* and *combustible liquids* will normally be the *MSDS*. Care needs to be taken to extract all relevant *hazard* information, however, as:

(a) all *hazard* information is not always grouped together;

(b) some of the properties which may constitute *hazards* when storing and *handling dangerous goods* may be listed as physical properties; and

(c) *MSDS* historically have tended to emphasise the toxicological *hazards* which are crucial for *workplace* hazardous substances, whereas the acute physico-chemical *hazards* are of primary importance with *dangerous goods*.

13.2.2 The nature of the *hazards* to be identified is not restricted to those inherent in the primary *dangerous goods* classification. Equally important are any secondary *dangerous goods hazards* as indicated by one or more *Subsidiary Risks* in addition to the primary *Class*.

13.2.3 The degree of danger posed by the classification *hazard*, as indicated by the *Packing Group* of certain *dangerous goods*, may also be a useful guide.

13.2.4 The physical properties of the *dangerous goods* may represent or contribute to *hazards* in the particular storage and *handling* situation. Relevant physical properties include:

(a) physical state solid/liquid/gas;

- if solid what potential for dust cloud explosion?
- f liquid mobile/viscous/volatile/miscible?
- if gas lighter/heavier than air?

(b) flashpoint, firepoint and explosive limits;

(c) viscosity;

(d) density;

(e) particle size;

(f) vapour pressure;

(g) solubility and pH;

(h) reactivity;

(i) boiling and/or freezing point or range;

(j) electrical and/or heat conductivity; and

(k) the nature and concentration of combustion products.

13.2.5 To assist in identifying all the relevant *hazards* associated with the *dangerous goods* and *combustible liquids*, a checklist has been included at Appendix 4. This may be used to *record* the *hazards* associated with each type of *dangerous goods* separately or, where multiple *dangerous goods* are to be stored together, the cumulative *hazards*.

13.2.6 **Appendix 7** provides some specific guidance on certain *dangerous goods* with particular *hazards*.

13.3 Processes

CoP 13.3 refers to **NS 13(2)(c)**

13.3.1 Due to the nature of *dangerous goods*, every physical process, even simple ones like materials *handling*, may constitute a *hazard*.

13.3.2 A rigorous examination *should* be made of all processes to which the *dangerous goods* may be subjected, including, but not limited to those mentioned in **NS 13(2)(c)**.

Useful tools for identifying *hazards* of complex processes are “HAZOP” and “HAZAN” studies carried out by trained personnel.

13.4 Hazards Associated with Storing and Handling

CoP 13.4 refers to **NS 13(2)(d)**

13.4.1 *Hazard* identification for structures, equipment, systems of work and activities used in the storage and *handling* of *dangerous goods* primarily involves the identification of all:

An example of *hazards* that *should* be identified is all potential *ignition sources*.

For details of ignition sources, see **NS/Cop 25**.

(a) physical components or characteristics which have the potential to harm the safety and health of a person and/or cause damage to property and the environment, either in their own right or in conjunction with the *dangerous goods*;

(b) systems of work, including normal operating procedures and unusual operating conditions, which could give rise to harm or damage, and

(c) activities which may pose a threat to the *dangerous goods*.

13.4.2 *Occupiers should* systematically examine all operations to discover the possible types of failure which could occur and events which may give rise to new *hazards* or greater *risk*. Any examination *should* include consideration of the possibility of human error in the system's operation.

It *should* be borne in mind that some features which may not in themselves be hazardous, may become hazardous because of the presence of particular *dangerous goods*.

- An example would be the potential for *Class* 8 *dangerous goods* to corrode structures and equipment, leading to leakage or failure

13.4.3 To assist in identifying *hazards*, a listing of common *hazards* associated with the storage and *handling* of *dangerous goods* is attached at **Appendix 5**. Given the immense range of types of *premises* for the storage and *handling* of *dangerous goods*, each with differing features, this is not a definitive list.

13.5 External Hazards

CoP 13.5 refers to **NS 13(2)(e)**

Some activities, systems of work, structures and equipment that are not directly involved with the storage and *handling* of *dangerous goods*, may constitute a *hazard* for that storage and *handling*. Potential external *hazard* sources include:

(a) any adjacent *dangerous goods* storages;

(b) the proximity of other work areas, including on-site offices;

(c) other activities on the *premises* such as:

- the operation of *plant*;
- the movement of vehicles;
- deliveries of *dangerous goods*;
- personnel movements in normal and emergency situations;
- visitor access;
- portable sources of ignition; and
- the trial of site emergency procedures.

(d) fire *risks*, including concentrations of combustible material or uncontrolled vegetation on or off the *premises*;

An example of an external fire *risk* could be the development of a timber yard adjacent to the *premises*

(e) activities and installations on neighbouring *premises*;

(f) possible weather conditions, such as temperature extremes, wind, lightning or rainfall, including the potential for flooding;

(g) activities off the *premises* such as the location of a main road, railway line, airport, gas *pipeline*, water main, high voltage power lines and radio transmitters, including mobile phone repeater towers; and

(h) the proximity of sensitive facilities which may be put at *risk* by the presence of *dangerous goods*, such as schools, hospitals, child and aged care facilities, theatres, shopping centres and residences.

CoP 13.6 refers to **NS 13(2)(g)**

13.6 Incident Hazards

It is important to take into account both internal and external experience, where available, such as *dangerous occurrences* and *near misses* that have affected other facilities storing and *handling* similar types of *dangerous goods*. Sources of such information include:

(a) manufacturers or suppliers of the *dangerous goods* or equipment;

(b) fire services; and

(c) *dangerous goods* authorities.

14. RISK ASSESSMENT

The purpose of the *risk* assessment is to:

(a) determine those *risks* that need to be controlled;

(b) assist in making decisions about the order in which *risks should* be controlled; and

(c) develop a schedule for controlling all *risks* as soon as *practicable*.

After discovering the *hazards* associated with the storage and *handling* of *dangerous goods* in **NS/CoP13**, the *risks* associated with those *hazards* need to be assessed.

Risk assessment is the second step in the *risk* management process.

14.1 Performing Risk Assessment

14.1.1 When carrying out a *risk* assessment, the national standard require that account be taken of the information and knowledge gained about the *dangerous goods* and the matters that affect the safety in relation to the storage and *handling* of those goods.

14.1.2 There are a number of methods for carrying out a *risk* assessment.

14.1.3 At *premises* where complex *dangerous goods* processes are involved, for example chemical manufacturing processes, it may be more effective to use a more highly structured process such a *Hazard and Operability Studies (HAZOP)* or *Hazard Analysis (HAZAN)* to guide the *hazard* identification and *risk* assessment process.

- The key elements of *risk* assessment are shown in **Table 2**.
- It is important to remember that *risks* may extend to people or property with no direct involvement in the work activity.
- A relatively simple method of performing *risk* assessment, which *should* be suitable for *should* be suitable for most *premises* used for the storage and *handling* of *dangerous goods* is included at **Appendix 4**.
- More information about *risk* assessment is available in *Australian Standard AS/NZS 4360:1999 Risk Management*.
- These more structured *risk* assessment techniques will almost certainly require the services of an experienced, trained professional in the field.

14.1.4 In some situations it may be necessary to undertake quantitative *risk* analysis (QRA) to assist in the understanding of the extent of the *risks* involved.

14.2 Record Keeping

Outcomes of *risk* assessments are always required to be documented. *Risk* assessment *records should* include:

(a) name(s) of the assessor(s);

(b) date of the assessment;

(c) the *premises*/area/process to which the assessment applies;

(d) the *dangerous goods* for which the *MSDS* or other information has been reviewed;

(e) the controls in place to prevent a *risk*;

(f) details of the *risk* identified, including its nature, likelihood and consequences; and

(g) decisions about the *risk* and why they were made.

- A *record* of the *risk* assessment *should* help to identify appropriate *risk* control measures. It *should* also be of assistance when undertaking any subsequent *risk* assessments that may be necessary because of changes to the *dangerous goods* used, systems of work, plant, structures or other circumstances that could result in change to the *risk* profile of the *premises*.
- The *record* of the result of the assessment *should* be accessible to any *employee* who could be exposed to any *dangerous goods* to which the *record* relates.
- An extensive *record* of the assessment is not required if it has been identified that the storage and *handling* of the *dangerous goods* does not result in a *risk* that needs to be controlled.

14.3 Review of Assessments

14.3.1 A *risk* assessment *must* be reviewed and, if necessary, revised if the work activity or processes change significantly or if there is evidence to indicate the assessment no longer adequately assesses the *risk/s* associated with the use of *dangerous goods*. The assessment needs to be revised if:

(a) *dangerous goods* not normally kept are introduced into the *premises*;

(b) *dangerous goods* are introduced to a different area or process;

(c) the process or *plant* is modified;

(d) new information on the *hazards* of the *dangerous goods* becomes available;

(e) monitoring indicates inadequate *risk* control;

(f) incidents or *near misses* have occurred which may be due to inadequate control; or

(g) new or improved control measures become available or *practicable*.

14.3.2 Where it is known that circumstances will change, it may be possible able to prepare a *risk* assessment that takes the projected or known changes into account.

14.3.3 In any case, a *risk* assessment *must* be reviewed at intervals not exceeding five years.

- If the assessment remains valid (that is, adequately assesses the *risk*), simply *record* the date of review.
- If the assessment is no longer valid, it *premises* be revised or a new assessment undertaken, depending on how much of the information recorded is still applicable. The results of any revised assessment *should* be recorded.

15. CONTROL OF RISK

Risk control is the process of determining and implementing appropriate measures to control the *risks* associated with the storage and *handling* of *dangerous goods*.

15.1 Principles of Risk Control

15.1.1 All *risks* with unacceptable consequences require immediate action. It may even be necessary to eliminate the *risk* in the short term by closing down operations until effective *risk* control measures are in place.

15.1.2 Control measures *should*, wherever possible, first be applied to the highest priority *risks*. This *should* not, however, preclude attention to those lesser *risks* that can be easily dealt with at minimum cost.

15.1.3 Effective *risk* control may require the application of more than one control measure. A hierarchical approach is required by **NS 16(2)** (see **CoP 16.2**).

15.1.4 In applying *risk* control measures, care *should* be taken to ensure that action taken to correct one *risk* does not itself initiate another *risk*. *Risk* control measures *should* themselves be subjected to the same processes of *hazard* identification and *risk* assessment as all other activities.

15.2 Hierarchy of Control Measures

- **NS 15(2)** provides the initial hierarchy of controls aimed at eliminating or minimising the *risk* by removing, or reducing the quantity of, *dangerous goods*.
- Where this is not *practicable*, or those methods do not sufficiently reduce *risk*, other control measures will be necessary.
- An example of where the measures listed in the National Standard would not be applicable is a contract warehouse specifically intended for *dangerous goods* storage,

The preferred sequence of application of *risk* control measures is:

(a) elimination;

(b) substitution;

(c) quantity reduction;

—as required by **NS 15(2)**.

Where the above do not achieve the necessary *risk* reduction, other measures that *should* be applied are:

(a) isolation;

(b) engineering controls;

(c) administrative controls; and

(d) personal protective clothing and equipment.

15.2.1 Elimination

The most effective method of *risk* reduction is the elimination of *hazards* and *risks* at the source. This includes eliminating either the *dangerous goods* or the activity which gives rise to the *risk*:

15.2.1.1 Examples of elimination of *dangerous goods* include:

(a) use of a physical process rather than a chemical process to clean an object; for example, the use of ultra-sound, high pressure water or even steam cleaning techniques rather than solvent washing;

(b) water based paints or powder coating rather than solvent based;

(c) clips, clamps, bolts or rivets instead of an adhesive;

(d) hot melt or water based adhesives instead of solvent based; and

(e) producing chlorine in-situ by electrolysis rather than having to store or *handle* other *dangerous goods* which are comprised of chlorine or its compounds on the *premises.*

15.2.1.2 Examples of eliminating an activity which gives rise to *risk* include:

(a) preventing the use of the storage and *handling* area as a thoroughfare; and

(b) prohibiting the carriage of matches, lighters and the use of spark producing tools in the area.

15.2.2 Substitution

Substitution is frequently cost effective. For example, substituting a less volatile material to control a vapour *hazard* usually costs far less than the installation of a mechanical ventilation system.

Substitution is the replacement of *dangerous goods* which present a high degree of *hazard* with *dangerous goods* or other substances of lesser *hazard*, and hazardous activities by less *hazard*ous ones.

15.2.2.1 Substituting *dangerous goods* by another substance with a lesser *hazard* can be achieved by using, for example:

(a) non-*dangerous goods* in place of *dangerous goods*, such as degreasing with detergent instead of a chlorinated or volatile solvent.

(b) a combustible liquid instead of a *Class* 3 flammable liquid, such as using dieseline for degreasing rather than kerosene or petrol;

Packing Group is an indication of the degree of danger. —see **CoP 14**

Examples of Packing Group substitution include

- xylene (PGIII) for toluene (PGII)
- dilute instead of concentrated acids or alkalis (PGII or III for PGI or II)

(c) a substance having a higher numerical *Packing Group* number; such as substituting *Packing Group* III (PGIII) for PGII or PGII for PGI;

(d) a less hazardous propellant in an Aerosol, such as carbon dioxide *Class* 2.2 rather than unodorised LPG of *Class* 2.1;

(e) a *Class* 2.2 (non-flammable non-toxic gas) as a refrigerant rather than *Class* 2.3 (toxic gas) such as anhydrous ammonia; or *Class* 2.1 (flammable gas) such as LPG; and

(f) *dangerous goods* with a single *hazard*, as indicated by a single *Class* without *Subsidiary Risk*, rather than goods having one or more *Subsidiary Risks*.

15.2.2.2 Examples of substituting safer activities include:

(a) unitising palletised goods by stretch wrapping rather than flame heat shrink;

(b) unitising *package*s with a pallet cage rather than stretch wrap in areas where the static electricity generated during wrap and unwrap of plastics film may be a *hazard*;

(c) using a solid substance in paste or pellet form, or even as a solution, rather than a dusty powder;

(d) applying paint by brush or roller rather than from an aerosol can;

(e) *transferring package*s by conveyor rather than forklift; and

(f) using non-sparking tools in a *hazardous area*.

15.2.3 Quantity Reduction

Reducing the inventories of *dangerous goods* at the *premises* usually leads to an overall reduction in *risk*. Methods of inventory reduction include:

(a) careful attention to inventory levels through effective stock control, such as the use of just-in-time ordering and supply arrangements; and

(b) legal, prompt disposal of *dangerous goods* no longer needed.

Care is necessary, however, to achieve the optimum inventory level. Indeed, further *risk* can be created by the additional vehicular movements associated with more frequent delivery.

Whilst reducing quantities of *dangerous goods* being stored and *handled* will usually reduce *risk*, this is not always the case. For example:

- a storage facility specially designed to accept the production output from a *dangerous goods* manufacturing facility;
- a contract warehouse for storing *dangerous goods* on behalf of clients without appropriate facilities; or
- where the *risk* assessment process identifies that a minimum inventory of particular *dangerous goods*, such as stabilisers, needs to be maintained for safety reasons

15.2.4 Isolation

Isolation may be described as the total effective separation of one *hazard*, such as *dangerous goods*, from another *hazard* such as other *dangerous goods* being stored or *handled*, or from a *hazard*ous activity. Or it may be separation of the *hazard* from people or from other facilities in need of protection from the *hazard*.

The principle of isolation *should* be given a high priority when establishing new *premises* for the storage and *handling* of large quantities of, or high-*risk*, *dangerous goods*.

When such *premises* are located remote from residences and other sensitive developments, community concerns may be allayed.

Isolation may be achieved by enclosing, or separating by distance or by the use of a barrier. Examples of isolation include:

(a) distancing the *dangerous goods* from *protected works*, other *dangerous goods*, people and other property such that interaction is not possible; (see **NS/CoP16**)

(b) enclosing a hazardous activity;

Performing decanting in a fume cupboard where emissions can be controlled is an example of enclosing a hazardous activity:

(c) storing incompatible *dangerous goods*, such as *Class* 5.1 oxidizing agents and flammable or combustible materials, in separate buildings that are separated by sufficient distance that interaction is impossible and an incident in one will not involve the other; and

(d) installing a screen wall which is a vapour barrier that has an appropriate fire resistance level (FRL) to provide additional isolation.

Fire resistance level (FRL)' gives a measure of the protection offered by a wall or structure when exposed to fire. The ratings are in terms of structural adequacy, integrity and insulation.

The FRL rating system is defined in AS 1530.4.

Further information about screen walls and vapour barriers may be found in AS 1940 and the Building Code of Australia.

The Role of Design in Controlling Risk

The importance of design in anticipating and reducing *risk* - whether it is risk from *dangerous goods* or any other source cannot be emphasised strongly enough. When approached properly, design is the most effective tool available to reduce *risk* to an optimal level. Good design reduces establishment costs. It also helps to avoid

- ongoing operational costs that are inherent to poorly set out *premises*; and
- the more complex systems of work that must be devised to work within the constraints of the *premises*.

An effective design process means that problems can be anticipated and solved before they become real "bricks and mortar" problems.

Process Design

One of the determining factors in the level of risk that may be present (and require control) where a chemical and physical process is involved is the decision on the actual process or processes to be employed.

Where there is a choice of chemical reactions available that involve *dangerous goods*, whether as raw materials, intermediates or finished products, each possible reaction pathway will have certain inherent *hazards* and *risks* associated with it. Other factors, that will influence the decision to select a particular chemical reaction pathway, include complexity of the process, equipment, efficiency, by products, cost, reliability and energy demand.

Similarly there may be a choice in relation to the physical processes that are available to achieve the same end product. Some processes may involve high temperatures and pressures while the alternatives may involve low temperatures and low pressures; e.g. evaporation compared with freeze drying.

For each of the alternatives, the process *hazards must* be identified and their relative *risks* assessed. The processes which result in the lowest overall level of *risk should* be selected subject to practicability.

Location of Storage and Handling

One of the most effective design factors is locating the facilities where *dangerous goods* are stored and *handled* in such a way as to minimise risk factors. There is far greater scope for minimising risk where a purpose built facility is to be located on a greenfield site.

Factors include:

- a location well away from other *hazards* and other sensitive facilities;
- sufficient area to allow for isolation of incompatible *dangerous goods*, spill and firewater retention; and
- ease of access, such that *transfer* and transport risks are minimised.

Design of Structures and Plant

It is far simpler and usually far more effective to incorporate isolation and engineering controls into structures and *plant* at design stage, than to try to modify existing designs or installations. It may not be *practicable* to retro fit control features such as natural ventilation or spill containment.

Design Information

It is most important that design be based on information that represents the current state of knowledge.

In addition to technical knowledge about the *dangerous goods* and processes, and the necessary engineering expertise, there is also the need for knowledge of external factors, which can often be obtained through consultation with:

- the *Authority*;
- local government; and
- the emergency services.

15.2.5 Engineering Controls

Engineering controls that *should* be considered for controlling *risk* in the storage and *handling* of *dangerous goods*, include:

(a) totally or partially enclosing of the *dangerous goods* or external *hazard*;

(b) providing adequate ventilation, including local exhaust ventilation, to eliminate flammable or harmful atmospheres;

(c) sparging or blanketing exposed liquid surfaces with an inert atmosphere to reduce evaporation and prevent explosive atmosphere formation;

(d) automating processes to eliminate human exposure and error;

(e) fitting sensors and controls for liquid levels, pressure and/or temperature, to minimise loss and formation of hazardous atmospheres, and to eliminate overflow and uncontrolled reactions;

(f) specifying and installing appropriately rated electrical circuitry, fittings and equipment to minimise ignition *hazard*;

(g) installing lighting which provides ample illumination for the tasks to be performed;

(h) providing adequate spill control to deal with the largest foreseeable spill, and with operation of the fire control system;

(i) constructing effective barriers between incompatible goods;

(j) installing detection systems and alarms for fire and *hazard*ous atmospheres;

(k) incorporating suitable devices to protect installations from external *hazards*; and

(l) specifying and installing suitable fire control systems.

Engineering controls include structures, *plant*, equipment and processes which are designed to reduce the *hazards* associated with the storage and *handling* of *dangerous goods*. They achieve this in a number of ways including:

- minimising the generation of *dangerous goods*;
- containing or suppressing *dangerous goods*, including their vapours and dusts;
- eliminating, confining or controlling hazardous processes, plant or equipment that may pose some threat to the *dangerous goods*;
- protecting *dangerous goods* and installations from external *hazards* and/or environmental factors such as rain or sunshine; or
- limiting the area of contamination in the event of spills or leaks.

An example of a protective device is a crash barrier to protect storage from damage by moving vehicles

A number of documents, including Australian Standards, listed in **Appendix 3**, specify engineering controls that can be generically applied to particular *Classes* of *dangerous goods* and, in a number of instances, to specific activities.

For *dangerous goods* storage and *handling* facilities as described in those documents, implementing those *risk* controls will in general satisfy the *risk* control duty for many *risks* that have been identified.

It is important to be aware that in most of these documents, the *risk* control systems have been prepared as an integrated package, frequently involving engineering and administrative controls, in addition to personal protection equipment. The application of *risk* controls from a referenced document is therefore only likely to satisfy the *risk* control duty imposed by the national standard, if all of the associated controls specified in the document, having a bearing on the particular *risk,* are adopted.

A particular *risk* control from a referenced document *should* not be applied in isolation unless the *occupier* is totally satisfied that the other *risk* controls have no bearing on the *risk* that *must* be controlled, or other effective controls are introduced based on the *risk* assessment.

15.2.6 Administrative Controls

Administrative controls are systems of work than eliminate or reduce *risk*. They consist of properly designed and implemented work practices and procedures, often used in support of engineering controls. Examples of administrative controls include:

The most important aspect of introducing effective administrative controls is the people that are to implement the controls. They rely heavily on people to religiously follow agreed work practices and procedures.

For administrative controls to be effective, it is important that:

- their complexity is minimised; and
- the controls being developed are matched to the skills and capabilities of the people who will implement them.

(a) safe work procedures that describe the correct methods for performing all activities associated with storing and *handling* *dangerous goods*.

(b) operating procedures that ensure the integrity of structures, *plant* and equipment is maintained at all times;

(c) training and supervision to provide the necessary knowledge and skill and ensure correct procedures are followed safely;

(d) methods of limiting the number of personnel in the *dangerous goods* work area, while, where *practicable*, preventing lone occupancy;

(e) consideration of job rotation of *employee*s with the appropriate skills to limit the period of exposure for individual *employee*s;

(f) procedures to ensure that work involving inspection, maintenance, repair, testing and cleaning is carried out without *risk*;

The use of internal work permits that exclude non -essential access may assist in ensuring non-routine and maintenance tasks are performed safely. –see **CoP 26**.

(g) good housekeeping, including regular cleaning of contamination from walls and surfaces, dust and drip removal from all work areas, and keeping lids on *container*s when not in use;

(h) *workplace* monitoring to ensure safe working conditions are maintained;

(i) procedures for waste disposal and effective decontamination;

(j) well designed and rehearsed emergency procedures;

(k) procedures which ensure that all other *risk* control measures, including quantity reduction and the use of personal protective clothing and equipment; are applied as necessary; and

(l) controls on activities that are inconsistent with the safe storage and *handling* of *dangerous goods*:

Examples of inconsistent activities may include:

- eating, drinking, smoking and the carrying of matches and lighters in contaminated areas;
- sampling of *dangerous goods* in a storage area where the release of the *dangerous goods* or its vapour may pose a *risk* to *employee*s, the *dangerous goods* and/or the structures, plant and equipment; and
- activities involving the use of heat in a hazardous zone.

15.2.7 Personal Protective Clothing and Equipment

- Personal protective clothing and equipment consists of devices and clothing that provide individual *employees* with some protection from *hazards*. It is essentially a last line of defence when all else fails
- As a matter of principle, personal protective equipment *should* not be used as the sole control measure except where no other measures are practicable. Its use with other control measures, however, provides additional confidence that *risks* are controlled, and the required level of protection is provided.
- Examples may include full-length overalls, aprons, abrasion resistant or chemically resistant gloves, dust masks, respirators or breathing apparatus, safety footwear or chemical-resistant boots, goggles or face shields, hard hats, hearing protection and fully encapsulated suits.
- Further guidance on the selection, use and maintenance of personal protective equipment may be found in **NS/CoP 26** and the relevant referenced documents in **Appendix 3**.

15.2.7.1 Despite the use of other control measures, appropriate personal protective clothing and equipment *should* be provided and worn whenever there is any foreseeable possibility of contamination or harm to personnel arising from the storage and *handling* of *dangerous goods*. Personal protective equipment *should* provide full protection as required for normal work activity, and adequate defence against possible unplanned events and emergencies.

Situations where use of suitable personal protective equipment may be necessary include:

(a) where it is not technically feasible to achieve adequate control by other means;

(b) where personal protective equipment is necessary to safeguard safety and health until such time as adequate control is achieved by other means, for example, where urgent action is required because of *plant* failure;

(c) during routine maintenance operations where the infrequency and small number of people involved may make other control measures impracticable; or

(d) where, even though a safe working environment exists under normal conditions, protection may be required from acute *hazards* in the event of sudden *plant* failure or other unexpected incident.

15.2.7.2 *MSDS* will normally contain recommendations on the selection and use of personal protective equipment for the particular *dangerous goods*. This advice *should* be followed unless the *occupier* determines, by applying the *risk* management processes of the national standard, and in consultation with *employees*, that other protection measures would be more appropriate.

15.2.7.3 An effective personal protective clothing and equipment system requires considerable effort by the *employer* to ensure that:

(a) protective devices are selected which are suitable for the individual and give the required level of protection from the *risks* associated with the particular task;

(b) only clothing and equipment meeting Australian Standards, or other recognised standards, is utilised;

(c) use is enforced when required;

(d) equipment that is provided is readily available, clean and functional, and *employee*s are individually fitted;

(e) there is proper instruction on the need for, and correct use of, personal protective clothing; and

(f) an effective system of cleaning and maintenance is devised, including maintenance by appropriately trained staff in accordance with a maintenance and servicing program.

15.3 Implementation of Risk Control Measures

- Over time, there is an ever increasing *risk* that familiarity in working with a *hazard* will lead to complacency and shortcuts with potentially tragic results.
- It is recommended that the occupier explore with *employee*s or the *employee* representative, creative ways to guard against this.

15.3.1 When the *occupier* has determined what *risk* control measures are to be implemented, a mechanism needs to be put in place to ensure they are applied and practised without exception on an ongoing basis.

15.3.2 Where there a great number of *risk* controls to be implemented, including administrative controls, consideration *should* be given to developing and implementing a further administrative control to keep track of and monitor compliance with the all the other controls that have been put in place. The development of such an administrative control is more commonly known as a Safety Management System.

Whether or not a Safety Management System (SMS) *should* be developed and the detail that it *should* cover is very dependent on the nature of the activities at the *premises*. There are many corporate and proprietary systems that exist but they all have some common features including:

- scope, policy and objectives;
- assignment of responsibilities;
- operating procedures;
- standards, codes and laws
- management of change
- scheduling and establishing procedures for reviews
- system auditing and corrective action

15.4 Design, Operation, Maintenance and Repair

The principles of eliminating *hazards* giving rise to *risk* or reducing the *risk* as far as *practicable must* be applied to all areas and activities associated with the storage and *handling* of *dangerous goods*.

15.4.1 All structures and *plant* associated with the storage and *handling* of *dangerous goods should* be:

(a) designed in such a way that the *risks* associated with each item are eliminated as far as *practicable*, while ensuring that the *risk* of the total system is minimised;

(b) manufactured to a high standard within the design specification, and from quality, durable materials which will not be adversely affected by the planned storage and *handling* of the *dangerous goods*;

(c) installed only after all *hazards* associated with the installation have been identified, the *risks* assessed and control measures implemented as required;

(d) commissioned only after they have undergone thorough testing to ensure that any unpredicted *hazards* have been identified, control measures implemented as required, and agreed procedures developed to ensure they can be operated safely;

(e) operated only in accordance with the agreed procedures by personnel who have received appropriate training (see **CoP 15.4.2**);

(f) maintained and repaired as required to ensure that no additional *hazards* or increased *risk* arise due to normal operation, wear and tear and breakdown; and

(g) maintained, repaired and, when the need arises, decommissioned in a manner which does not introduce additional *risks* or, where this is not *practicable*, the additional *risks* are minimised and controlled.

15.4.2 **NS 15(4)(b)** extends the requirements of **NS 15(4)** to all other installations, activities and materials at the *premises* that might in any way put at *risk* the storage and *handling* of *dangerous goods*.

15.4.3 Adverse interaction with the public [**NS 15(4)(c)**] *should* be minimised by giving attention to both current and projected neighbouring activities. The need for further *risk* control measures *should* be assessed whenever there is any change in use of other public facilities and *premises* in the vicinity.

DUTIES OF OCCUPIERS - SPECIFIC

16. SEPARATION BY PHYSICAL MEANS

Separation actually fulfils a dual purpose:

- protecting the other occupancies from the *dangerous goods*; and
- protecting the *dangerous goods* from the other occupancies

16.1 Physical separation by isolation of *dangerous goods* from *protected works*, other *dangerous goods* storage and *handling* areas, people and other property, is the principal method by which *risks* to those other occupancies are minimised.

16.2 Isolation may be achieved by distance, the use of effective barriers or a combination of both.

16.2.1 As far as *practicable*, separation distances *should* be determined and applied in such a way that the resultant *risk* to the other occupancy, as determined through the *risk* assessment process [**NS/CoP 14**] would not require the application of additional control measures. Factors to consider in determining separation distances include:

(a) the types of *hazards* exhibited by the *dangerous goods* and the *risks* they pose to the other occupancy;

(b) the quantity of *dangerous goods* stored and *handled* in the work area;

(c) the type of installation and the processes applied to the *dangerous goods* in the work area and their associated *hazards* and *risks*;

(d) all other activities in the work area, which may increase the *risk*; and

(e) any control measures in place which will reduce the *risk*.

For most classes of *dangerous goods*, minimum separation distances are specified in the *Class*-specific Australian Standard as listed in **Appendix 3**.

For example, AS 1940 includes a number of separate tables for *bulk* storages and package stores of flammable and *combustible liquids*, showing distances from *protected works*, boundaries and on-site facilities. Distances vary depending on quantities, *Packing Group* (or C1, C2 classification), whether packages are opened or closed and, in one instance, *tank* diameter.

It *should* be noted, however, that AS 1940 has direct application only to storage and usage situations. It does not apply to plant or equipment (including integral vessels) in which flammable or *combustible liquids* are processed , even though processing usually gives rise to increased *risk*. Similar limitations apply to most other Standards listed.

For typical installations of the types covered by the Australian Standards, a generic *risk* assessment has been made by the drafters. It is therefore recommended that the minimum distances specified in the appropriate Standards be applied unless there are peculiar *risks* associated with the particular facility, which either increase or decrease the *risks* to the other occupancies.

16.2.2 Where barriers are used in lieu of, or in conjunction with, distances to achieve required separation, the protection they provide *must* be effective with the particular *dangerous goods*. Factors to consider include:

(a) the types of *hazards* exhibited by the *dangerous goods* and the *risks* they pose to the barrier;

(b) the extent of vapour barrier required and its effectiveness in varied climatic conditions.

(c) appropriate levels of fire resistance (FRL) to be provided, depending on the potential heat load from internal or external incidents; and

(d) structural sufficiency to withstand weather and any overpressure resulting from internal or external incidents.

17.

- Most *Class*-specific Australian Standard as listed in **Appendix 3** allow separation distances to be measured around suitable barriers, which are variously referred to as vapour barriers, screen walls and fire walls.
- Minimum requirements are specified, as are conditions of use. These *should* be regarded as minimum requirements unless there are particular *hazards* associated with or external to the area which necessitate additional features or conditions.
- Further advice on the use of screen walls can be found in Australian/New Zealand Standard AS/NZS 3833 *The Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Intermediate Bulk Containers*, and in Australian Standard AS 1940 *The Storage and Handling of Flammable and Combustible Liquids*, which uses the term fire wall for this purpose.
- 'FRL' ('Fire Resistance Level'), represents the times in minutes, determined in accordance with AS 1530.4 *Methods for Fire Tests on Building Materials, Components and Structures*; for (a) structural adequacy, (b) integrity and (c) insulation, and expressed in that order, for example 60/60/60. (NOTE: Where an FRL is required, reference *should* be made to the *Building Code of Australia* (BCA) for guidance.)

SEGREGATION OF DANGEROUS GOODS

17.1 To prevent dangerous interaction, *dangerous goods should* be kept apart (segregated) from all other goods with which they are not compatible.

17.2 Segregation can be achieved by storing and *handling* incompatible goods in separate areas or by the use of physical barriers or distances within the same area.

17.3 As a general rule, *dangerous goods should* not be stored above or below other goods with which they may interact.

Useful guidance for segregating incompatible *dangerous goods* is provided in Australian/New Zealand Standard AS/NZS 3833 *The Storage and Handling of Mixed Classes of Dangerous Goods in Packages and Intermediate Bulk Containers*.

For *dangerous goods* in transit, the segregation rules of the *ADG Code* provide useful guidelines.

For discussion on the use of barriers, see **CoP 16**.

17.4 When segregating incompatible goods, it may also be necessary to prevent mingling of spilled materials by the use of separate compounds —see **NS/CoP 20**.

17.5 Systems and procedures *should* be developed and enforced, and personnel involved in the storage and *handling* of *dangerous goods should* be trained and supervised to ensure segregation is maintained at all times.

Information about the required nature of necessary phlegmatizers, diluents, solvents, wetting agents, stabilizers, inhibitors, and/or adulterants, their required levels, together with any *control temperature*s, *should* be provided by the supplier and included in the *MSDS*.

18. STABILITY OF DANGEROUS GOODS

18.1 Many *dangerous goods* are highly reactive, unstable or self-reactive except under controlled conditions. The application of **NS 18** will ensure that those controlled conditions are maintained. To meet the requirements of this clause, the *occupier should* ensure that:

(a) product specifications have been obtained from the manufacturer or supplier; and

(b) *dangerous goods* are kept and maintained in accordance with supplier specifications until they are ready to be used.

Any change in product specification of the *dangerous goods* will necessitate a reassessment of storage and *handling* methods.

18.2 **NS 18(2)** provides a necessary exemption from the stability requirement for *dangerous goods* that are about to be consumed or used in manufacture. In such situations, the presence of inhibitors or phlegmatizers may prevent required reactions from taking place. Care needs to be taken to ensure the instability and reactions take place only under controlled conditions.

19. CONTAINERS FOR BULK DANGEROUS GOODS

19.1 Integrity of Container

19.1.1 Given the *risks* associated with leaks from *bulk container*s, particular care *should* be given to ensuring that the integrity of the storage and its associated *handling* system is maintained in all normal, and foreseeable abnormal, operating conditions.

19.1.2 Factors to be considered in ensuring the integrity of the *container* include:

(a) structural soundness to withstand stresses from the product being stored;

Detailed design parameters for different types of *bulk tanks* are given in several of the referenced documents in **Appendix 3**.

(b) stability, rigidity and suitability of foundations;

(c) stresses imposed by *pipework* and other attachments;

(d) atmospheric loadings, from sun, wind and rain;

(e) the effects of external impacts; and

(f) the extent to which corrosion is to be allowed for over the service life of the *container*

Impact protection

The initial design of a *bulk container* would normally be based on loading considerations. This would not adequately provide for the effects from external impacts.

For example, a wall thickness of 2–3 mm for a vertical steel storage *tank* for flammable liquids may be sufficient to satisfy the criteria for structural integrity. However a 2 mm wall thickness is unlikely to withstand a localised impact like that from the sharp corner of a truck tray reversing into the *tank*.

For other aspects of impact protection, see **CoP 21**.

19.1.3 The design, layout and location of *pipework* associated with *bulk* storage *should* be subjected to rigorous *risk* assessment.

19.2 Location

19.2.1 *Bulk container*s *should* be located so that the minimum separation from other occupancies, as determined from **NS/CoP 16**, is provided.

19.3 Underground Tanks

19.3.1 Underground *tank*s *should* be constructed, located and protected so as to eliminate *risk*s and threats to the environment from:

(a) failure, usually due to corrosion or stress loading, allowing the escape of *dangerous goods* into the water table; and

(b) spills from above ground *pipework* and filling points.

- The gradual escape of *dangerous goods* from an underground *tank*, or through faulty foundations of an above ground *tank*, can go undetected for years.
- Leaked material can migrate through the water table to present a *risk* to people and property a long way from the *tank*.
- For example flammable or toxic vapours can accumulate in telecommunications pits or seep into basements of buildings and endanger the occupants of those buildings or any person who entered the pit to do work.

The mechanisms for corrosion in soils and the ways to protect underground *tanks* from corrosion can be complex and often require the assistance of specialists to recommend methods that are suited to the soil conditions in the particular area.

19.3.2 Guidance on the various aspects of underground *tank* installations can be found in Australian Institute of Petroleum *CP4 Code of Practice for Design, Installation and Operation of Underground Petroleum Storage Systems*. The guidance in that code has been developed for petroleum storage systems and care *should* be taken when it is being considered for application to other *dangerous goods*.

19.3.3 Underground storage installations for *bulk dangerous goods* and *combustible liquids* are usually subject to additional controls from environmental authorities. and local government

20. SPILLS AND CONTAINMENT

20.1 The national standard requires that all spills of *dangerous goods*, other than gases, be contained on the site. The extent to which this will require the installations of physical spill containment devices will depend on many factors including:

(a) the nature of the *dangerous goods* (whether liquid or solid);

- if liquid, whether it is mobile or viscous;
- if solid, whether or not it may become molten in a fire;

(b) the quantity of the *dangerous goods*;

(c) the size of the largest *container* or reasonably foreseeable largest spill;

(d) the potential impact *should* the *dangerous goods* escape to the environment; and

(e) whether or not it is necessary to provide for the management of firewater from an incident.

One of the principal sources of *dangerous goods* incidents, including spillages, generation of hazardous atmosphere and even fire, is containers which are left open when not in use.

Procedures, supervision and training *should* ensure *packages* are always kept closed when not in use.

20.2 Spill containment for liquids, including molten solids and firewater, may be accomplished by:

(a) grading the surface so that all spills are contained by the contours;

(b) *bunding* the area where *dangerous goods* are stored or *handled* to form a compound;

(c) the provision of drains to an on-site secure catchment system such as a pit or pond; or

(d) a combination of any of the above.

- A compound is an area bounded by natural ground contours or by a bund.
- Where it can be demonstrated that the largest foreseeable spill of *dangerous goods* could not spread outside the storage area, it may not be necessary to provide a fixed spill containment system. This could apply, for example, where the *dangerous goods* are high melting point solids or highly viscous liquids (such as some paints, resins and adhesives) in packages which are small in relation to the size of the storage area.
- A number of documents referenced in **Appendix 3** provide specific guidance on spill containment. Other documents such as guidelines published by the Australian Institute of Petroleum, may also be relevant.

20.3 The design of a spill containment system *should* ensure that:

(a) separate spill containment is provided for goods that are not *compatible*;

(b) the *capacity* of the containment is sufficient for the volumes which may need to be contained in the worst possible incident;

(c) all spills can be safely held until cleaned up;

(d) all the materials of which it is constructed, together with any materials used for absorption:

- are *compatible* with the dangerous *goods* and other materials in the vicinity; and
- will prevent contamination of groundwater or soil;

(e) movement of spilled material or firewater into, or within, the containment system will not increase the spread or magnitude of an incident;

(f) system integrity will be maintained in any foreseeable incident;

(g) the system will not become ineffective due to stormwater, or to any other activities in the area; and

(h) if necessary in the event of an incident, contaminated firewater can be removed.

20.4 The immediate action in case of a spill required by **NS 20(b)** will normally only be achieved through implementation of the emergency preparedness requirements and guidelines of **NS/CoP 24**.

20.5 Specific discussion of containment of spills from underground storages may be found in **CoP 19.3**.

21. IMPACT PROTECTION

21.1 Measures required to prevent or control impact will normally depend on the situation and the nature of the *risks*. The normal hierarchy of controls *should* be applied, whereby the potential threat of impact is removed, where *practicable*, by, for example relocating either the *dangerous goods* storage or the adjacent roadway.

Vehicles and mobile *plant* are the most likely source of impact with *dangerous goods* and the structures, *plant* and *containers* in which they are stored and *handled*.

In addition to vehicular impact, the occupier may also need to consider the threat of impact from external sources such as adjacent railways, airports or construction activities

21.2 Impact protection measures may be necessary for:

(a) structures containing *dangerous goods*;

(b) *plant* and equipment including storage and process vessels, associated *pipework*, pumps and controls;

(c) storage areas (including transit storage) for *package*s and *IBC*s, and associated shelves and racks; and

(d) exposed parts of the fire protection system

21.3 The protection, which may be achieved by the installation of crash protection measures such as bollards and guard rails, *should* be designed to:

(a) absorb the energy of any reasonably foreseeable impact, having regard to the possible mass and velocity of the object; and

(b) minimise the likelihood of injury to drivers and/or passengers and damage to vehicles from the impact.

22. TRANSFER OF DANGEROUS GOODS

- *Transfer* of *dangerous goods* generally poses far greater *risk* than static storage. The goods will frequently be unconfined at some stage of the *transfer* process such as when pouring or pumping from one *container* to another.
- The *ADG Code* includes specific requirements for certain *dangerous goods* transfers.
- Several of the documents referenced in **Appendix 3** also provide detailed advice

22.1 The *transfer* system *should* be designed and operated in such a way as to achieve safe *transfer*, taking into account relevant factors including:

(a) the *hazards* associated with the *dangerous goods* and the proposed method of *transfer*;

(b) required flow or *transfer* rates and quantities; and

(c) external *hazards* and adjacent activities.

Particular care is required where there may be spillage away from spill containment installations, such as where the *transfer* is by *pipework* through unbunded areas.

22.2 Methods for preventing spills and overflow include:

(a) overflow protection equipment on receiving vessels;

(b) flow and pressure regulators on *pipework* or pumps;

(c) interlocking of valves and switches; and

(d) systems for detecting losses from *pipework* and fittings, such as static pressure loss detectors, measurement to determine losses in *transfer* or external sensors.

22.3 Static electricity generation is of particular concern when *transferring* non-conductive flammable and *combustible liquids*, finely divided combustible powders and any other *dangerous goods* with a flammability *hazard*. See **CoP 25.4** for discussion on avoidance of static electricity.

22.4 Vapour emissions resulting from *transfer* can be minimised by:

(a) the use of enclosed *transfer* systems;

(b) keeping lids open only for the minimum period required for *transfer*;

(c) minimising exposed surface areas;

(d) avoidance of splash filling;

(e) minimising the temperature of liquids being *transferred*; and

(f) providing extraction ventilation at all sources of vapour.

Further details on extraction ventilation are provided at **CoP 27**

22.5 Compatibility is required for all items that may need to interconnect, including:

(a) hoses, couplings and associated fittings;

(b) earthing connections;

(c) vapour recovery connections; and

(d) telemetry where required.

22.6 Further details on avoiding *ignition source*s is provided at **CoP 25**.

- It is also essential that all components of the *transfer* system are *compatible* with, or suitably protected from, the goods being *transferred*.
- Particular care is needed with all components of pumps and valves used for the *transfer* of corrosive materials

23. FIRE PROTECTION

The most important aspect of fire protection is that of fire prevention. That will be achieved by applying the other parts of the national standard and this national code of practice, in particular by adhering to the *hazard* identification, *risk* analysis and *risk* control requirements of **NS/CoP 13–15**.

In this part:

- **CoP 23.1** relates to **NS 23(a)**
- **CoP 23.2** relates to **NS 23(b)**
- **CoP 23.3** relates to **NS 23(c)**
- **CoP 23.4** provides detailed requirements for fire fighting equipment)

23.1 Provision of Fire Protection and Fire Fighting Equipment

23.1.1 The Building Code of Australia specifies minimum requirements for fire protection for different types of buildings. For *dangerous goods* storage and *handling*, additional fire protection will usually be required to provide protection from their particular *hazards* and associated fire loads.

23.1.2 Where appropriate, especially for large or high *risk premises*, fire protection requirements *should* be implemented in consultation with the relevant *emergency services authority*. Consultation *should* also occur before any alterations are made to fire protection systems.

23.1.3 The fire protection system *should* provide the *capacity* to quickly control and extinguish any fire that may occur involving the *dangerous goods*. It *should* also effectively protect the dangerous *goods* from any nearby fire. To achieve this, fire protection system design *should* take account of all of the numbered issues in **NS 21(a)**, as discussed in **CoP 23.1.3.1–4**:

23.1.3.1 The fire load of the *dangerous goods* will depend on the particular *hazards* of the *dangerous goods* and *combustible liquids*, and on the quantities being stored and *handled* in the particular work area. Other factors which may influence the fire load and the amount and type of protection required include:

(a) the storage configuration, height and density of the *dangerous goods*;

(b) the location, design, type of construction and total floor area of the building or work area;

(c) the nature, including materials of construction, of any structures, *plant* and equipment; and

(d) the type of operations in the building or work area, with particular attention to:

- whether the goods are *bulk*, or in open or closed *package*s; and
- what type, if any, of processing takes place;

23.1.3.2 Features to consider with respect to other exposures on the *premises* include:

(a) other *dangerous goods* installations and operations;

(b) non-*dangerous goods* operations;

(c) on-site facilities such as office areas and amenities;

(d) mobile *hazards* such as vehicles;

(e) relevant environmental considerations; and

(f) waste.

In relation to other exposures on and off the *premises*, the fire protection system *should* as far as practicable provide protection for:

- the *dangerous goods* installation from the other exposure; and
- the other exposure from the *dangerous goods*.

23.1.3.3 Similar considerations apply to exposures from other *premises*. In addition attention *should* be given to the types of structures present, and to current and possible future activities on those *premises*:

23.1.3.4 **NS 23(a)(iv)** primarily relates to the compatibility of the fire protection system and fire fighting equipment with those other goods.

In particular, water-based suppression systems *should* not normally be used with *Class* 4.3 Dangerous When Wet.

23.1.4 Other Design Considerations

23.1.4.1 Fire protection systems for use with *dangerous goods* may be independent or, where permitted by the appropriate *Authority*, integrated with other fire protection systems on the *premises*.

23.1.4.2 Consideration may be given to integrating fire protection systems over more than one *premises*, but only where: there is a mutual benefit, it is permitted by the *Authority* and *emergency services authority* and a binding agreement is entered into by all parties.

A number of the Australian Standards and industry codes of practice, as listed in **Appendix 3**, include fire protection requirements.

The advice given in these documents may be utilised, adapted or enhanced to meet the requirements of the particular *premises*, as identified through the *risk* management process.

23.1.4.3 All firefighting appliances and equipment at the *premises should* be *compatible* with that of the relevant *emergency services authority* at all essential interfaces.

23.1.5 Water Supply

23.1.5.1 A reliable water supply will be required for the fire protection system at most *premises* where *dangerous goods* and/or *combustible liquids* are stored and *handled*. The supply *must* be sufficient to supply both the fire protection equipment at the *premises* and such additional equipment as may be used by the *emergency services authority* to control a fire at the *premises* .

23.1.5.2 Where sufficient supply is not available from the main water supply, it may be necessary to supplement this with additional water storage and/or pumps. Alternatively, where it is permitted by the appropriate regulatory authorities, additional fire service water may be obtained from reliable alternative sources such as rivers or dams.

23.1.5.3 The adequacy of the water supply *should* be checked with the *emergency services authority*. Specific guidance is provided in AS 1940 and AS 2419.

23.1.5.4 The provision of adequate water supply and pressure for large-scale firefighting may necessitate the installation of booster systems in consultation with the *emergency services authority*. This may require:

(a) installation of fixed or portable pumping equipment; or

(b) an appropriate number of booster connections and feed hydrants, together with an approved hard-standing area for emergency services pumping equipment.

23.1.6 Fire Alarm Systems

Fire alarm systems *should* be designed and installed in accordance with the relevant Australian Standards as listed in **Appendix 3**, or as agreed with the *emergency services authority*, such that:

(a) automatic systems are also capable of being operated manually using clearly identified manual alarm activators at convenient and safe locations near work areas;

(b) the alarm signal is sufficiently distinguishable from any other signals to permit ready recognition, and is clearly audible throughout the *premises*;

(c) where high noise levels or the use of protective clothing may prevent the recognition of an alarm signal, an effective alternative alarm system, such as a visual system, is also installed; and

(d) the system remains operable when the main power supply fails.

23.2 Installation, Testing and Maintenance

Installation, testing and maintenance of fire protection and fire fighting equipment *should* be in accordance with the manufacturers' specifications. The results of testing *should* be *record*ed, and *record*s kept for the life of the equipment.

23.3 Inoperative Fire Equipment

When one or more components of the fire protection or fire fighting equipment is unserviceable or inoperative, and *risks* cannot be controlled as required by **NS 23(c)**, it may be necessary to shut down *hazard*ous processes and operations until the equipment has been restored.

23.4 Fire Fighting Equipment

23.5 Compliance with Australian Standards

All fire fighting equipment *should* comply with the appropriate Australian Standards listed in **Appendix 3**.

23.5.1 Location of firefighting equipment

Firefighting equipment *should* be located so that:

(a) all *dangerous goods* and other items being protected can be directly reached by the firefighting medium, (particular attention is necessary for high rack storage);

(b) it is readily accessible in the event of an incident, preferably being sited adjacent to exit doors or on exit routes;

(c) it is in a conspicuous position; and

(d) it is convenient to, and readily accessible from, the *risk* being protected.

23.5.2 Identification of firefighting equipment

All firefighting equipment *should* be suitably labelled in accordance with the relevant Australian Standards and to the satisfaction of the relevant emergency services *Authority*.

To assist with visibility and identification, additional signs complying with Australian Standard AS 1319 *Safety Signs for the Occupational Environment* may be installed.

23.5.3 Fire Hose Reels

23.5.3.1 Hose reel systems *should* be provided and located:

(a) on every storey of a building, used to store and *handle dangerous goods,* where the total floor area exceeds 300 m^2;

(b) so that, allowing for all obstacles, every location in the building can be reached by at least one hose; and

(c) so that it is possible to reach all installations, including to the top of rack storage, with discharge from at least one fire hose reel.

- Fire hose reels *should* comply with AS 1221; and be installed to AS 2441 and the requirements of the relevant *emergency services authority* and the *Building Code of Australia*.
- Appropriate hydrant hose systems may be substituted for fire hose reels, if there are trained staff capable of safely using the equipment.
- Foam, for use on polar liquid fires, must be 'alcohol –resistant'.

23.5.3.2 Hose reels *should*:

(a) be provided with a hose length of 36 m;

(b) have appropriate signage; and

(c) if installed in an environment where it may be damaged, protected by a cabinet or other suitable means.

23.5.3.3 Where foam hose reels are installed, they *should* be capable of producing satisfactory foam that meets the manufacturer's specifications, and is suitable for the *risks* being protected. A hose reel that is equipped with foam making capabilities *should* be identified by appropriate signage.

23.5.4 Fire Hydrants

23.5.4.1 Hydrants *should* be equipped with hose, branch and nozzle except where it is not appropriate and prudent to do so, for example:

(a) where this equipment may be susceptible to theft; or

(b) there are no personnel properly trained to operate them.

- Guidance for the selection, installation and location of fire hydrants for use on *premises* where *dangerous goods* are stored and *handled* can be found in Australian Standard AS 2419.
- Detailed fire protection requirements are included in AS 1940 for *premises* where there are flammable and *combustible liquids*.
- Further advice may be obtained from the relevant fire brigade.

23.5.4.2 External hydrants *should* be:

(a) positioned convenient to, but a safe distance from, exit doors and hard-standing areas;

(b) easily visible, with appropriate identification signs; and

(c) capable of providing the appropriate coverage.

23.5.5 Monitors

23.5.5.1 Monitors *should* be installed in accordance with the manufacturers' specifications and would normally be located 15–30 m from the facility to be protected. Where, for any reason, monitors are required closer to the facility, or where the expected heat flux may exceed 2 kW/m^2, the need for radiant heat protection for personnel at the *premises should* be taken into account. In such situations, monitors would normally be operated by remote control.

- The installation of monitors may be indicated where fire control may require the direction of large quantities of fire or cooling water at a fixed installation, with minimum exposure of firefighters.
- Monitors *should* normally be installed in consultation with the relevant fire brigade.

23.5.5.2 Monitors *should* be capable of applying the required density and quantity of water under adverse wind conditions. This requires at least 50 per cent more water flow than under still conditions.

23.5.5.3 Nozzles may be fixed, or adjustable to provide straight stream, spray, fog or foam as required, so that the facility is suitably protected but not damaged by a solid stream at shorter ranges. If adjustable, the means of operation and control of direction and/or spray pattern *should* be operable from a safe remote location.

23.5.6 Automatic Sprinkler Systems

Sprinkler systems may comprise:

(a) individual-actuation sprinklers;

(b) deluge sprinklers;

(c) foam sprinklers; or

(d) a combination of any of the above.

- Where fire sprinkler systems are required, they *should* be installed in accordance with AS 2118 and maintained in accordance with AS 1851.3.
- Where foam systems are required, it may be necessary to refer to other codes such as those issued by Factory Mutual or the National Fire Protection Association (USA). Advice on these may be obtained from potential suppliers and the relevant fire brigade.

23.5.7 Portable Fire Extinguishers

23.5.7.1 Suitable and sufficient portable fire extinguishers *should* be provided, located and identified in accordance with AS 2444. Extinguishers *should* be:

Advice on the selection of extinguishers suitable to the *risk* will be found in the Australian Standards relating to the particular *Class(es)* of *dangerous goods*.

(a) clearly visible, readily available, unobstructed, convenient to the relevant *risk*; and

(b) not adversely affected by *hazard*ous or climatic conditions.

23.5.7.2 Where powder-type and foam extinguishers are likely to be used together in an emergency, they *should* be compatible.

23.5.7.3 Particular care needs to be taken where there are special *risks*.

The following examples may be helpful in the selection of fire extinguishers for special *risks*.

- Foam extinguishers must be suitable for the *dangerous goods*. In particular, alcohol-*compatible* foam *should* be used for alcohols and other polar (water miscible) solvents.
- Carbon dioxide extinguishers may be effective for the protection of electrical equipment and will minimise clean up and damage to the system, but have a poor 'knock down', short discharge range and may be ineffective where there is significant air movement. Dry powder or vaporising liquid may give more reliable extinguishment.
- Carbon dioxide and acidic extinguishers such as those based on ammonium phosphate *should* not be used where there are cyanides present.
- Carbon dioxide extinguishers *should* not be used on fires involving magnesium or titanium metals.

23.5.7.4 Fire extinguishers *should* be maintained in accordance with the relevant provisions of AS 1851.1.

24. EMERGENCY PREPAREDNESS

24.1 Emergency Procedures and Equipment

Emergency procedures and equipment for dealing with emergencies are required for all *premises* where *dangerous goods* are stored and/or *handled*. In addition, the national standard requires that a formal emergency plan be developed where there are *dangerous goods* in quantities greater than those listed in **NS 24(2)**.

24.1.1 Emergency Procedures

24.1.1.1 Emergency procedures, for safely *handling* all foreseeable emergencies such as fire, spillage, vapour release, uncontrolled reaction and external threats, are required for all *dangerous goods premises* .

- The extent of emergency procedures required will depend on the size and complexity of the *premises*, the types and quantities of *dangerous goods* and the processes involved
- Some of the most effective emergency procedures are simple one page documents in point form, suitable for display on signs or carrying by *employee*s or visitors as a pocket card.
- The occupier *should* ensure that all *employee*s are trained in the emergency procedures and that they are well rehearsed.

24.1.1.2 Emergency procedures will vary in content to suit the requirements of the *premises*, but *should* include:

(a) the means of raising the alarm;

(b) the method for the summoning the primary combat agency for dealing with a *dangerous occurrence,* (and necessary contact details); and

(c) actions to be taken by *employee*s in an emergency to ensure the safety and health of all personnel and to minimise damage to property and the environment.

24.1.1.3 Equipment required to contain and clean up incidents will vary with the types and quantities of *dangerous goods*. Examples of emergency equipment include:

(a) overpacks such as oversized drums for containing leaking *container*s;

(b) absorbent material suitable for the substances likely to be spilled;

(c) booms, plates and/or flexible sheeting for preventing spillage from entering drains and waterways;

(d) neutralising agents such as lime or soda ash;

(e) suitable pumps and hoses for removing spilled material;

(f) hand tools such as mops, buckets, squeegees and bins; and

(g) suitable protective clothing and equipment to protect the safety and health of personnel involved in the clean up.

- Emergency equipment *should* be located so it can be readily accessed in an emergency by anyone who may need it.
- The equipment *should* be regularly checked and maintained to ensure it is effective and in a workable condition.

24.2 Clause 24(2) of this national standard sets out the threshold levels for the Emergency Plan requirements.

24.3 Emergency Plans

24.3.1 Purpose and Scope

24.3.1.1 The purpose of the emergency plan is to plan for, and thus minimise the effects of, any dangerous occurrence or *near miss* at *premises* where larger quantities of *dangerous goods* are stored and *handled*.

24.3.1.2 The emergency plan *should* coordinate all aspects of emergency management on the *premises*.

- While the emergency plan *should* enable the occupier to cope with the worst-case credible scenario, the detailed planning *should* concentrate on the more likely incidents.
- The plan *should* be sufficiently flexible to allow emergency response to be varied according to the severity and type of incident.

24.3.2 Development and Consultation

24.3.2.1 When developing the emergency plan, the *occupier should*, in all cases, consult with *employee*s, *employee* representatives and the relevant emergency services *Authority*.

24.3.2.2 Where it is possible that emergencies may impact beyond the perimeter of the *premises*, consultation *should* also take place with anyone in neighbouring *premises* likely to be affected, and with the local counter disaster organisation.

- For larger installations, consultation may also be required with the *Authority*, other authorities responsible for environment and planning as well as local government, to ensure consistency with legislation and emergency planning in the jurisdictions.
- For example, the plan may need to align with State Emergency Disaster Plans ('Displans').

24.3.2.3 The emergency plan *should* be readily understandable to *employee*s and emergency services.

24.3.3 Content

24.3.3.1 The emergency plan *should* be comprehensive, coordinating all aspects of emergency management, including:

(a) copies of all emergency procedures;

(b) responsibilities of key personnel in managing all types of emergencies;

(c) what circumstances activate the plan;

(d) systems for raising the alarm;

(e) estimating the extent of the emergency;

(f) summoning emergency services authorities in the event the emergency is, or has the potential to become, a dangerous occurrence;

(g) protection of personnel, including detailed evacuation procedures and methods for accounting for all people at the *premises*;

(h) isolation of the emergency area to prevent entry by non-essential personnel;

(i) roles of on-site emergency response teams;

(j) containment of any spillage;

(k) need for fire water retention to ensure that contaminated firewater cannot enter waterways, drains or ground water;

Note that under **NS 20**, all *dangerous goods* spills must be contained on the *premises*

(l) disconnection of power supplies and other energy sources, except where these are required to maintain safety of a critical operation or to run emergency equipment such as fire booster pumps;

(m) prevention of *dangerous goods* or contaminated material of any kind from entering drains or waterways;

(n) provision of relevant information and assistance to the emergency services *Authority*, both in anticipation of emergencies and when they occur;

There are detailed requirements for *dangerous goods manifests* and site plans, in **NS/CoP 38**

(o) maintenance of site security throughout the emergency;

(p) provision for dealing with the public and the press; and

(q) site rehabilitation requirements.

24.3.4 Off-Site Considerations

24.3.4.1 Where any reasonably foreseeable incident may have effects beyond the boundary of the *premises*, the emergency plan *should* also address managing the off-site effects.

24.3.4.2 Where off-site effects may occur, the plan *should* provide for giving necessary warnings or communications to neighbouring *premises*.

- Under emergency services legislation in some jurisdictions, off-site emergency plans must be prepared separately from those covering the *premises*.
- Where there are separate on- and off-site plans, these *should* be consistent and integrated as far as *practicable*.

24.3.4.3 Where emergency plans include agreements with the *occupiers* of neighbouring *premises* to provide mutual aid in emergency situations, these arrangements *should* be formalised, in consultation with the emergency services, to ensure their effectiveness.

24.3.4.4 Where emergency plans include activities that involve persons who reside or work adjacent to the *premises*, the relevant parts of the plan *should* be communicated to those persons.

24.3.5 Implementation

24.3.5.1 The contents of the emergency plan *should* be communicated to all *employee*s and affected neighbours. Copies, or relevant extracts, *should* be provided to emergency services.

24.3.5.2 All *employee*s *should* be suitably trained in their roles and expectations under the emergency plan.

24.3.5.3 The emergency plan *should* be tested when first devised, after each modification and at suitable regular intervals. Practice drills and simulated emergencies *should* involve all *employee*s and, as far as *practicable*, emergency services and anyone else likely to be involved in an incident.

24.3.5.4 The emergency plan *should* be reviewed and updated on a regular basis, and whenever there is a change of *risk* on or off the *premises*, updated information becomes available or a possible deficiency is identified.

- Emergency plans *should* be readily accessible at all times.
- The location of the emergency plan *should* be well known to supervisors and *employee*s and discussed with the *emergency services authority* whenever there is a review or update.
- As a rule, it *should* be maintained as hard copy in case computer-based systems are not accessible in an emergency.
- Further guidance on the development of both on-site and off-site emergency plans is contained in the *National Standard for the Control of Major Hazard Facilities* [NOHSC:1014 (1996)] and the *National Code of Practice for the Control of Major Hazard Facilities* [NOHSC:2016 (1996)].

24.4 Clause 24(4) of this national standard requires the *occupier* to provide the *emergency services authority* with a copy of the emergency plan.

25. IGNITION SOURCES IN HAZARDOUS AREAS

25.1 Hazardous Areas

Within a *dangerous goods* storage and *handling* environment, flammable or combustible gases, vapours, dusts and mists may be generated or evolve. These can for explosive mixtures with air in certain proportions.

An area where an explosive atmosphere may occur continuously or intermittently, presenting a *risk* to safety, is described as a '*hazardous area*'.

Hazardous areas include all storage and *handling* areas for:

- *dangerous goods* with a *Class* or *Subsidiary Risk* of 2.1, 3, 4 or 5; and
- goods which may generate combustible dusts.

25.1.1 The rules, for determining and designating different levels of *hazardous area*s, are detailed in AS 2430 Part 1– classification of areas where combustible dusts are or may be present and AS/NZS 61241.3 *Electrical apparatus for use in the presence of combustible dusts* – classification of areas where combustible dusts are or may be present.

25.1.2 AS/NZS 2430, Parts 1 – 9 describes specific situations where *hazardous area*s may occur in practice.

25.2 Ignition Sources

25.2.1 Examples of *ignition source*s that may present a *risk* in areas where *dangerous goods* are stored and *handled* include:

(a) naked flames, such as those associated with blow torches, shrink wrapping equipment, stoves, gas or oil heaters, pilot lights, driers, lighters and matches;

(b) incandescent materials such as glowing coals or lighted cigarettes, cigars and pipes;

(c) arcs from electric welding or arcing contacts on electric motors and switchgear;

(d) static sparks, as further discussed in **CoP 25.4**;

(e) mechanical sparks from grinding, or from objects striking together;

(f) friction from moving parts, for example fan blades rubbing nearby surfaces;

(g) heat from appliances or from chemical or biological reaction vessels;

(h) internal combustion engines and vehicles;

(i) radio transmitters and mobile phones; and

(j) all electrical fittings and equipment (including wiring, power points, switches, lighting, appliances and battery forklift trucks) which are not rated for safe operation in the *hazardous area*.

25.3 Control of Potential Ignition Sources

25.3.1 Controls *should* be in place to ensure that *ignition source*s are not introduced into, or within 3 m of, a *hazardous area*, except under controlled conditions. Within those

areas no one *should* smoke or have in their possession any substance or article with the potential to be an *ignition source*.

25.3.2 When used in a *hazardous area*, all electrical installations, including lighting, *should* meet the provisions of AS 3000 for electrical installations in *hazardous area*s.

25.3.3 Industrial trucks operating in a *hazardous area should* conform with the guidance contained in **Appendix 9**.

25.3.4 Precautions during repairs

25.3.4.1 An *occupier should* not permit the use of a flame or any other source of ignition during repairs on, or adjacent to, a *hazardous area* unless:

(a) the area where the repair work is to be carried out has been freed of possible *hazards*, including toxic or flammable gases and vapours, and combustible dusts;

(b) personnel involved in the operation are given precise, detailed instructions on the precautions to be taken before and while the flame or other *ignition source*s are in the area: and

(c) additional controls are in place to ensure a dangerous situation does not arise.

Additional controls may include:

- atmospheric monitoring;
- isolation of switches, pipework and valves;
- experienced, close supervision;
- additional fire protection measures
- Some Australian Standards, such as AS 1940, provide detailed guidance in relation to authorising and carrying out 'hot work' in areas where *dangerous goods* are stored and *handled*.

25.3.4.2 A formal work permit system is recommended for all except routine work of a non-*hazard*ous nature. A work permit system *should* be a mandatory inclusion in the safe management system of *premises* where more than minor quantities of *dangerous goods* are stored and *handled*. For work involving the introduction of an *ignition source* into a *hazardous area*, this permit is usually referred to as a 'hot work permit'.

25.4 Avoidance of Static Electricity

25.4.1 The *occupier should* ensure that, in all *hazardous area*s, appropriate measures are taken to minimise the generation of static electricity and to safely dissipate any static that does occur from any source.

25.4.2 In all *hazardous area*s:

(a) all *tanks*, *pipework*, *transfer* systems and process *plant should* be earthed, or otherwise protected, in accordance with Australian Standard AS 1020;

(b) liquid *transfer* rates and splashing *should* be minimised;

(c) consideration *should* be given to the use of anti-static additives in non-conductive liquids, and to the wearing of conductive clothing, especially footwear; and

Static electricity may be generated by a wide variety of sources including :

- any movement (such as pouring, pumping, stirring; or high velocity flow) of dry powders and liquids that have a low electrical conductivity;
- moving vehicles, equipment or components of *plant*;
- movements of personnel, especially when wearing clothing and footwear of low conductivity;
- the fitting or removal of clothing, including protective clothing;
- the application or removal of plastic wrap;
- particulate or aerosol spray, including spray painting or the rapid discharge of a carbon dioxide extinguisher;
- the manual carrying of liquids in a non-conductive *container* or one with an insulating *handle*; and
- movement of packages by conveyor or by trolleys with non-conductive wheels.

For further controls on *transfer* of *dangerous goods*, see **NS/CoP 22**.

(d) operating procedures *should* include instructions for avoiding the *risks* associated with static electricity.

26. SAFETY EQUIPMENT

26.1 Safety equipment for use with *dangerous goods should*:

(a) be compatible with, or suitably protected from, the *dangerous goods* with which it may come in contact; and

(b) comply with relevant Australian Standards as listed in **Appendix 3**.

- The equipment required to control *risk should* be determined through the control of *risk* process detailed in NS/Cop 16.
- Absorbent and neutralising materials must be effective with, and not react dangerously with, the *dangerous goods*.
- Clean-up equipment that may be used in hazardous areas *should* be carefully selected to ensure it does not introduce additional *hazards*. For example:
  - non sparking shovels and flame proof pump motors may be required for collecting spilled material; and
  - PPE that introduces additional static *hazards should* be avoided.

27. CONTROL OF HAZARDOUS ATMOSPHERE

A hazardous atmosphere is one in which:

- there is not a safe oxygen level for breathing; or
- concentrations of hazardous gases, vapours, mists, fumes and dusts are at or above relevant exposure standards; or
- the concentration of flammable gases, vapours, mists, fumes and dusts is at or above 5 per cent of the lower explosion limit.

27.1 The control of *risk* arising from a *hazard*ous atmosphere may be achieved by:

(a) preventing the entry of contaminants into the atmosphere by the use of totally enclosed systems, or by blanketing an exposed surface with an inert atmosphere;

(b) extracting the contaminants from their sources through extraction ventilation;

(c) reducing the concentrations of contaminants by introducing uncontaminated air, either through general ventilation or by purging;

(d) limiting the introduction of processes and equipment into the area where the *hazard*ous atmosphere may exist to those which will not constitute a *risk* in that atmosphere;

(e) ensuring appropriate personal protective clothing and equipment is worn by all personnel entering the area; or

(f) a combination of any of the above.

27.2 Where the possibility of a *hazard*ous atmosphere has been identified by the *risk* assessment process, atmospheric testing and monitoring may need to be carried out to ensure a safe atmosphere is maintained.

27.3 Ventilation Considerations

27.3.1 Local exhaust ventilation from each significant source of contamination is usually a more effective means of preventing build-up of a harmful atmosphere than is an increase in general ventilation.

27.3.2 Where a storage area for closed *containers* of *dangerous goods* has adequate openings to the open air, natural ventilation may be sufficient. In other circumstances, a mechanical ventilation system may be required.

27.3.3 General ventilation *should* provide enough entry and exhaust registers of sufficient *capacity* to provide air flow throughout the area, and to prevent pockets of harmful atmosphere from developing.

27.3.4 Where there are *dangerous goods* with vapours heavier than air, exhaust air *should* be removed from the lowest point above any spill containment while fresh air is introduced from above.

- The use of cross-flow ventilation with closely spaced registers is usually effective at eliminating pockets of hazardous atmosphere.
- As far as practicable, a ventilation system for a *dangerous goods* area *should* be exclusive to the particular building, room or space. Linking of ventilation systems *should* only be allowed where:
  - this will not facilitate fire spread; and
  - there will not be any other increased *risk* such as that which might arise from mingling of incompatible vapours.
- Most of the Australian Standards covering individual and mixed *Class* storage and *handling*, and some of the other documents referenced in **Appendix 2,** provide detailed instructions on the provision of ventilation. The requirements of the relevant document *should* be followed unless otherwise indicated by *risk* assessment.

27.3.5 Fresh air *should* always be drawn from a source uncontaminated by exhaust air or other pollutants. The exhaust *should* be discharged where it will not cause other *risks*, and in compliance with environmental legislation concerning discharges to atmosphere.

27.4 Purging

27.4.1 Purging involves introducing air or an inert gas into a confined space to displace oxygen and/or flammable, toxic or corrosive fumes.

27.4.2 Purging with inert gas is most commonly used above the liquid surface of reaction, mixing or *bulk* storage vessels to prevent surface oxidation or the formation of an explosive atmosphere.

27.4.3 Empty vessels that have contained *dangerous goods* may require purging with air prior to entry by personnel, or carrying out maintenance activities.

- Because purging may reduce oxygen levels or there may be residual contamination, safe entry procedures *should* be developed and enforced.
- Entry to confined spaces must be in accordance with state legislation. Guidance is provided in AS 2865.

28. LIGHTING

The *occupier should* ensure that whenever people are at the *occupier's premises*, adequate natural or artificial lighting is provided to all work areas and access ways they may be required to use, including internal roads, pathways and corridors that lead to and from areas, rooms or buildings where *dangerous goods* are stored or *handled.*

28.1 The *occupier should* ensure that:

(a) the only artificial lighting used in a room or space where *dangerous goods* are stored or *handled* is electric lighting:

(b) when used in a *hazardous area*, electric lighting *should* meet the provisions of AS 3000 for electrical installations in *hazardous areas*. –see **NS/CoP 23**.

28.2 Internal lighting *should* meet the relevant parts of AS 1680.

28.3 Consideration *should* be given to the need for emergency egress lighting and exit signing.

29. Clause 29 of this national standard requires the *occupier* to provide access to and from and within the *premises* to the areas where *dangerous goods* are stored and *handled*.

30. SECURITY

In view of the *hazards* associated with the storage and *handling* of *dangerous goods*, access to *premises* and work areas must be restricted to those having a legitimate purpose.

30.1 When developing security systems and procedures, the *occupier should* consider:

(a) the need to ensure the security of personnel, product, processes, equipment, *plant*, buildings, documentation, information systems and any areas of special *risk*;

(b) the nature of the *hazards* and the levels of *risk*;

(c) the location of the *premises*, including the nature of the surrounding community and environment;

(d) the likelihood of mischief or sabotage;

(e) the integrity and reliability of the security system hardware and design; and

(f) what back-up support is required for security systems and personnel;

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

(a) the means to identify the extent of access to be permitted for each person;

(b) the means to account for everyone on site at any given time; and

(c) the issue of restricted access passes to visitors, or prohibiting unaccompanied access.

30.3 Depending on the size and *hazards* of the particular *premises*, examples of security measures might include:

(a) fencing or enclosing areas where the *dangerous goods* are kept;

(b) providing locks on doors, windows and other openings to buildings, rooms, compartments or *container*s in which *dangerous goods* are kept;

(c) continuously supervising areas where the *dangerous goods* are kept;

(d) performing security checks on all vehicles entering or leaving the *premises*; and

(e) limiting access by visitors, contractors and *employee*s to authorised areas.

30.4 *Employees should* receive training to ensure that they understand security measures and security signs.

31. DECOMMISSIONING / ABANDONING / DISPOSAL

31.1 Prior to commencing the decommissioning, abandoning or disposal of *plant* used for *dangerous goods*, the *occupier should* identify the *hazards*, and assess and control the *risks* involved in the process.

31.2 Used *dangerous goods containers*, such as drums *should* be cleaned free of *dangerous goods* prior to disposal, unless they are:

(a) intended to be refilled;

(b) being sent for refurbishment; or

(c) otherwise made safe by measures that will prevent adverse health effects to people and damage to property and the environment.

Disposal of containers that have not been cleaned free of *dangerous goods* may be subject to environmental legislation.

31.3 Used packagings, which have not been made free of *dangerous goods*, *should* retain labelling that properly identifies the residual *hazard*. When they are free of *dangerous goods*, the labelling *must* be removed.

31.4 *Plant* and equipment that have been made safe, but may present immediate or future residual or resultant *hazards*, need to be subject to precautions, including:

(a) identification of possible residual or resultant *hazards*;

(b) provision of appropriate fire protection, where required;

(c) ventilation to prevent build up of a *hazard*ous atmosphere; and

(d) containment of any effluent.

31.5 Specified advice may be found in relevant parts of Australian Standards, for example AS 1940. Industry codes, for example the Australian Institute for Petroleum's CP 22 *The Removal and Disposal of Underground Petroleum Storage Tanks*, specify alternative means to the above for making a *dangerous goods storage and handling system* safe for abandonment or disposal.

PROVISION OF INFORMATION (General)

32. DANGEROUS GOODS INFORMATION

32.1 The *occupier should* obtain relevant health and safety information for *dangerous goods* stored and *handled* on the *premises* that will allow health and safety procedures to be developed and adopted in order to:

(a) ensure the safety and health of persons who may be affected by those goods;

(b) enable them to take appropriate action in case of emergency arising from the storage and *handling* of those goods; and

People who may be affected by *dangerous goods* include:

- supervisors and *employee*s
- visitors and contractors
- residents of the *premises*
- emergency personnel

There are corresponding obligations on the manufacturer or *importer* to provide suitable information under **NS 10 & 11**.

(c) prevent damage to property and the environment from the *hazards* arising from those goods.

32.2 Where an *occupier* develop and adopts a health and safety procedures in accordance with **NS 32**, the *occupier* is *should* communicate those procedures to the relevant persons. The *occupier should* ensure that the information provided is understood by all concerned, taking into account language and other communication difficulties.

32.3 The information may include:

(a) *MSDS*, or relevant information extracted from, or based on, *MSDS*;

(b) information included on labels, safety signs, placards, registers, *manifest*s, and emergency procedure guides;

(c) extracts from chemical safety texts or proprietary databases;

(d) specific purpose guides prepared by industry groups; and/or.

(e) other guides relevant to the *hazards* associated with the particular *dangerous goods*.

Possible information sources include:

- the manufacturer or supplier;
- industry associations;
- professional associations;
- other manufacturers
- trade unions
- academic institutions and publications;
- regulatory authorities
- emergency services;
- consultants
- proprietary databases; and
- Standards Australia

32.4 Form of Information

Depending upon the situation, the information may best be provided:

(a) in writing, for example in the form of written procedures, signs or instructions;

(b) verbally, as in some forms of training;

(c) in electronic format; or

(d) as a combination of any of the above.

33. PLANT AND STRUCTURES USED FOR STORAGE AND HANDLING

33.1 Purpose of Information

NS 33 requires that information be provided about the *plant* and structures to anyone who has reason to operate, access, maintain, repair, inspect or test them. They *should* be provided with sufficient knowledge and understanding of the *plant* and structures and their associated *hazards* and *risks* to:

(a) enable them to perform their intended activity efficiently and safely; and

(b) guard against the *plant* and structures being in any way compromised or damaged.

33.2 Information to be provided

Information *should* be relevant to the activity to be performed by the person and commensurate with the extent of contact with the *plant* or structures. Relevant information may include:

(a) the purpose for which the relevant *plant* and structures are designed;

(b) testing or inspections to be carried out prior to, during, and on completion of, the intended activity;

(c) concise operating procedures and systems of work necessary for the safe use of the *plant*;

(d) warnings about particular *hazards*;

(e) details about installation, commissioning, testing, operation, maintenance, cleaning, transport, storage and/or dismantling, as appropriate;

(f) particular *hazards* associated with the structures, *plant* and their contents;

(g) site specific and external *risks* which may impact on the *plant* and structures; and

(h) emergency operating procedures.

33.3 Sources of Information

33.3.1 The primary source of information may be the information provided to the *occupier* by the supplier or installer in compliance with **NS 12**.

33.3.2 Additional information may be obtained from a variety of sources including designers, manufacturers, suppliers, statutory authorities, emergency service authorities, other users of similar systems, safety engineering consultants and relevant texts.

33.4 Form of Information

33.4.1 The *occupier should* ensure that the information provided is understood by all concerned, taking into account language and other communication difficulties.

33.4.2 Depending upon the situation, the information may best be provided:

(a) in writing, for example in the form of written procedures, safety signs or instructions;

(b) verbally, as in some forms of training;

(c) in electronic format; or

(d) as a combination of any of the above.

33.5 Use of Safety Signs

33.5.1 In addition to the placarding and labelling requirements of **NS 34–39**, safety signs *should* be used where the *risk* assessment process identifies a need to provide prominent instructions and/or warnings. Safety signs may be used to highlight or reinforce such matters as:

(a) the proximity of *hazards*;

(b) the nature of *hazards*;

(c) the control of *risk* factors;

(d) the protection of *risk* control mechanisms;

AS 1319 *Safety Signs for the Occupational Environment* provides numerous examples of safety signs which may be applicable.

To ensure uniformity and assist recognition, where safety signs are of a type included in AS 1319, they *should* comply with that Standard.

(e) operating instructions and procedures;

(f) the location of emergency equipment and materials; and

(g) emergency instructions and procedures.

33.5.2 **Table 3** gives examples of some common types of safety signs.

33.6 Identification of Dangerous Goods in an Enclosed System

33.6.1 *Occupiers should* ensure that any *dangerous goods* in an enclosed system such as any storage *container*, spill containment system, *pipework*, fittings or *plant* are clearly identified to anyone who may be affected.

33.6.2 Methods for identifying *dangerous goods* in enclosed systems include:

(a) special signs alerting people to specific *hazards* and responsibilities;

(b) other forms of marking that serve the purpose, such as colour coding on *pipework*; or

(c) schematic layouts displayed prominently.

Table 3. Examples of Common Types of Safety Signs

Types of Signs	Examples
Regulatory signs	WARNING – RESTRICTED AREA AUTHORISED PERSONNEL ONLY
	SELF SERVE NOT PERMITTED
Hazard warning signs	FLAMMABLE GAS
Precautionary signs	HIGH PRESSURE OUTLET
	NO SMOKING – STOP ENGINE
	ATTACH EARTH CLIP BEFORE PUMPING
Emergency information signs	EMERGENCY STOP BUTTON
	WATER DELUGE ANY SPILLS

PROVISION OF INFORMATION (Specific)

34. IDENTIFICATION

In the context of the national standard, the primary purpose of labels on containers of *dangerous goods* is to provide clear warning of the *hazards* of the contents. Labelling is one area where the national standard is essentially prescriptive. Uniformity in the ways in which *dangerous goods* are labelled leads to increased recognition and improved safety.

34.1 Labelling Requirements

34.1.1 Where an *occupier* refuses to accept any *dangerous goods* because they are unlabelled or if there is reason to suspect the *dangerous goods* are labelled incorrectly, the *occupier should*:

(a) arrange for the immediate removal of those goods from the *premises* back to the supplier; and

(b) identify the goods that are labelled incorrectly; and;

(c) ensure they are stored and *handled* in a safe manner until they are removed from the *premises*.

34.1.2 Where an *occupier* accepts any *dangerous goods* that are unlabelled or if there is reason to suspect the *dangerous goods* are labelled incorrectly, the *occupier must* label them in accordance with **NS 9(4).**

34.1.3 Where a *dangerous goods* label is defaced or damaged the *occupier should* ensure that the label is replaced.

34.1.4 Portable *tank*s and *IBC*s *must* be placarded with Emergency Information Panels carrying specified information.

NOHSC:2012(1994) recommends that labels on *containers* of hazardous substances, with a *capacity* greater than 500 g or 500 mL also include:

- *Class label* and *Subsidiary Risk label*, where the substance is a *dangerous goods*;
- Identification information eg (*UN Number*)
- *Risk* Phrase(s);
- Safety Phrase(s);
- first-aid procedures;
- emergency procedures;
- details of manufacturer or *importer*;
- expiry date (where relevant); and
- reference to *MSDS*.

It is expected that NOHSC:2012 will be extended and retitled to incorporate *dangerous goods* labelling.

34.2 Labelling Dangerous Goods Used in the Workplace

34.2.1 For *dangerous goods* used in the *workplace*, the *occupier should* ensure that those goods are also appropriately labelled in accordance with the National Code of Practice for the Labelling of Workplace Substances [NOHSC:2012(1994)].

34.2.2 The *occupier* has the responsibility to ensure that *container* labelling is accurate and not misleading.

34.2.3 Where labelling of a small *container* is not *practicable*, the *occupier should* ensure that the necessary health and safety information is provided in another effective manner. This could be achieved, for example, by attaching the information to the shelf on which the *container* is stored.

34.2.4 When the contents of the *container* have been consumed and the *container* is *free from dangerous goods*, the label that indicates the presence of *dangerous goods should* be obscured or removed.

34.2.5 Particular care *should* be taken with unlabelled *container*s with unknown contents. It is good practice to isolate such a *container* until its contents can be identified and it is appropriately labelled. If the contents cannot be identified by the *occupier*, expert assistance *should* be obtained. *Container*s *should* not be disposed of until the *hazards* are known, and then only in an acceptable manner, in consultation with the relevant waste management *Authority*.

35. IMMEDIATE USE CONTAINERS

35.1 **NS 35** provides an exemption from the labelling of immediate use *container*s. To be considered for exemption under this clause, it would normally be expected that the complete task, including rendering the *container* free of *dangerous goods*, would be completed within a single shift.

35.2 Anyone who may have reason to *handle* the unlabelled *container should* have access to health and safety information from other sources such as the labelling of the original *container* and the *MSDS*.

This exemption from labelling *should* only be applied if every person who may have reason to *handle* the *container* will know with absolute certainty what the contents are or have been. *Should* the person using the *container* be unable to complete the task for any reason, the person completing the task *must* be in no doubt as to the contents

Examples:

- A bucket used to *transfer dangerous goods* from A to B and cleaned immediately after use could be exempt from labelling.
- Where the same bucket is regularly used for the purpose, labelling that clearly identifies the contents, as required by **NS 33(b),** would apply.
- Larger *transfer* vessels *should* also be labelled to comply with **NS 33(b).**

36. PLACARDS

36.1 Placards are required to provide visual warning of the *hazards* associated with the *dangerous goods* and/or *combustible liquids* at the *premises* and at each building or other facility where *dangerous goods* are stored or *handled*.

36.2 When calculating quantities for placarding, the guidance in **CoP 36.2.1–4** *should* be taken into account.

36.2.1 All *container*s other than those that are *free from dangerous goods should* be included in the calculation.

Minor quantities of *dangerous goods* that are components of installed fire protection equipment may be excluded from the calculation.

36.2.2 All *dangerous goods container*s *should* be assumed to be full, even if they are not.

36.2.3 Some quantities of *dangerous goods* in *package*s may be expressed on labels as a volume (e.g. as litres or millilitres) and others as mass (e.g. grams or kilograms). When determining the aggregate, as is required for mixed *Class* storage, convert all volumes to litres and all mass measurements to kilograms. Then add the number of litres to the number of kilograms to arrive at the aggregate.

36.2.4 The quantity of gas is always based on the *capacity* of the cylinder, whether full or nominally empty. However, the labelling usually indicates the mass of gas they are intended to hold. To determine the volume of a gas cylinder, look for the stamp on the cylinder neck or foot ring.

36.2.5 Clause 36.3 of this national standard provides for an arrangement between the *occupier* and emergency service *Authority* to determine the placement of placard(s).

37. OUTER WARNING PLACARDS

37.1.1 Outer warning placards are required as soon as any one of the "Placarding Quantities" from Schedule 1, as referenced by **NS 37(a)–(e)**, is exceeded.

For examples of when outer warning placards are required, see **CoP 39.6**.

37.1.2 Except where agreed with the emergency services under **NS 36(3)**, outer warning placards are required at all entrances that the emergency services may need to access. This may include:

(a) the main entrance off the street;

(b) all other street entrances, including side and back streets; and

(c) if emergency access may be via a neighbouring property, at the entrance from that property.

- Depending on the quantities of *dangerous goods* on the *premises*, under some circumstances the outer warning placard may be the only *dangerous goods* placarding required.
- If the *premises* consists of a building set back from the street, placarding at the street entrance might be ineffective and/or impracticable. In such cases outer warning placards *should* be displayed at each entrance to the building which may be used by the emergency services.
- At large *premises*, such as a port facility, rail yard or large manufacturing facility, outer warning placards may be more effective if they are duplicated on the approaches to the particular buildings or areas where the *dangerous goods* are located.

38. PLACARDS FOR BULK

38.1 It *should* be noted that the minimum placarding quantities based on **Schedule 1** do not apply to the placarding of *bulk* storage of *dangerous goods*. If it is *bulk*, it *must* be placarded. It is *bulk* if the *dangerous goods container*:

(a) has a *capacity* of 450 L or more;

(b) is holding 400 kg or more of *dangerous goods*; or,

(c) if containing *Class* 2, has a *capacity* of more than 500 L.

- Placards for *bulk* storage of *dangerous goods* are essentially the same as the full-size Emergency Information Panel required by the *ADG Code* for *bulk* transport, with the emergency contact detail removed.
- *Bulk containers* placarded in accordance with the *ADG Code* meet the requirements of **NS 38**.
- *Bulk containers must* be placarded at all times unless they are free of *dangerous goods*.

38.2 Placarding for *bulk dangerous goods* or *combustible liquids should* be located so that:

(a) where there are multiple *bulk* storages, there can be no confusion as to the application of the placard; and

(b) the placard would be immediately visible to emergency services personnel approaching the storage from the most likely direction.

39. PLACARDS FOR PACKAGED DANGEROUS GOODS

39.1— 39.5 Clause 39.1 – 39.5 of this national standard provides the threshold levels for placading *packaged dangerous goods*.

- While labels are required to be grouped into one placard [**NS 39(1)(b)**], there is no particular requirement for them to be grouped vertically or horizontally.
- For those areas where there is regular variation in the types of *dangerous goods*, for example in areas where *dangerous goods* in transit are held, it may be more convenient to use magnetic labels, or frames with slip-in/slip-out labels that are commonly used on vehicles transporting *dangerous goods*.
- In locations where the public may have access to the placards, labels that attach more permanently will be required
- Where there is some doubt as to whether to placard in particular circumstances, it is better to err on the side of safety. If, by following the rules in **NS 39**, a reasonable case can be made for applying a particular label, that label *should* be applied.

40. MANIFEST AND SITE PLAN OF THE PREMISES

40.1 Provision of Manifest

40.1.1 The principal purpose of the *manifest* is to provide the emergency services *Authority* with information about the quantity, type and location of *dangerous goods* stored and *handled* on a *premises*. This enables them to respond appropriately if called to an incident.

40.1.2 The *manifest should* be housed in a receptacle that is capable of holding the *manifest*, emergency plans, scale-drawings and any other relevant information. Its housing *should* be:

(a) of substantial weather-proof construction, if located outdoors; and

(b) located near the Outer Warning Placard at the front of the *premises*; or

(c) where this is not *practicable*, as at a shop, immediately inside the door.

- Emergency services must be able to quickly access the manifest when called to an emergency at unattended *premises*.
- The location needs to be obvious to the emergency services arriving at the incident.
- If required for security reasons and agreed with the emergency services, the receptacle may have a locking mechanism that can be opened by them in an emergency

Where, there is more than one external entry point that might be used by emergency services, for example at larger *premises*, the *manifest should* be located at the main entrance, except by agreement with the emergency services.

40.1.3 The *dangerous goods manifest should* be reviewed when there is a significant change in the type or quantity of *dangerous goods* or *combustible liquids* that are stored and *handled* on the *premises*. A significant change is one where a new *hazard* is introduced, there is a substantive change in the *risk*, or the emergency services may need to respond differently to an incident. Significant changes could include:

(a) the introduction or removal of a storage area;

(b) a substantial change in the quantity of *dangerous goods* in an area, for example $\pm$ 20%;

(c) any change in the *Classes* of *dangerous goods* stored;

(d) any change in the types of *dangerous goods* stored in *bulk*;

(e) the introduction of higher *risk dangerous goods*. –For example, if *Packing Group* I goods are introduced where there were previously only *Packing Group* II or III.

40.2 Manifest Content

The information to be contained in the *manifest* is prescribed in **NS 40(2)**. A sample *manifest* is provided at **Appendix 12**.

40.3 Site Plan of the Premises

40.3.1 The site plan of the *premises should* be on a scale that adequately illustrates the details required by the national standard. The detailed information to be provided on the plan is prescribed in **NS 40(3)**.

- The purpose of the plan of the *premises* is to identify the major structures on the site and where the *dangerous goods* are located.
- The plan *should* be easy for *emergency services* personnel to read under difficult conditions.
- Plans with too much detail may be confusing.
- A sample plan is provided at **Appendix 12**.

40.3.2 Where relevant, additional information may also be included, such as:

(a) the location of emergency plans;

(b) the location and uses of all buildings, amenities, structures and internal roadways on the *premises*;

(c) distances between *dangerous goods* operations and other facilities;

(d) the location of fire mains, hydrants, automatic sprinkler systems, hose reels, portable fire extinguishers and other protective devices;

(e) evacuation routes;

(f) the location and nature of any fences; and

(g) areas of public access adjacent to the site and parking (if any).

40.4 Dangerous Goods In Transit

40.4.1 The *manifest* at a transport depot *should* be kept up to date as far as *practicable*, as minimum once a day.

40.4.2 For *dangerous goods* in transit the running list of shipping documents can serve as the *manifest*.

- In a transport depot, the nature and quantities of *dangerous goods* can vary wildly throughout the day as freight *containers*, trucks and/or trains come and go.
- *ADG Code* shipping documents provide the most up to date information for the *manifest* about the *dangerous goods* in transit.

41. DANGEROUS OCCURRENCES

41.1 Investigation and Recording Systems

NS 41 requires the investigation, recording, reporting and safe management of *dangerous occurrences* and *near misses*. A *near miss* may include:

- a deviation from operating standards beyond a nominated safe range;
- breakdown or failure of safety-critical equipment; or
- spillage or uncontrolled release of *dangerous goods*.

Examples of incidents which would not be considered *near misses* include:

- malfunctioning of non-critical instruments or equipment;
- variations in operating conditions within a nominated safe range;
- spillage or release of non-hazardous materials; and
- failure to meet product specifications.

In order to minimise the likelihood and magnitude of further incidents, it is essential that all dangerous occurrences and *near miss*es be investigated expeditiously, in an orderly manner and with rigour. At all *premises*, except those where only minor quantities of *dangerous goods* are stored and *handled*, this will necessitate a formal incident investigation and *record*ing system. This system *should*:

- Where the necessary expertise to rigorously conduct investigations is not available in house, the system *should* identify capable external people to do so on the *occupier's* behalf.
- Prior arrangements *should* be in place to ensure these external investigators will be available if required.

(a) be prepared in consultation with *employees* and any *employee representative*s;

(b) establish guidelines for carrying out accident and incident investigation;

(c) ensure that properly trained investigation officers are expeditiously appointed to carry out investigations;

(d) provide sufficient *Authority* to the investigating officers to ensure the causes and corrective actions are fully identified;

(e) provide for implementing the recommendations arising from the investigation; and

(f) be documented so that it is readily understood by anyone who may be affected.

41.2 Investigating and Recording Dangerous Occurrences and Near Misses

41.2.1 The aim of the investigation is to prevent further incidents by:

(a) identifying all the immediate and underlying causes;

(b) formulating corrective action plans (short term and long term) to deal with the causes;

(c) assigning individual responsibility for, and reasonable time limits to complete, the corrective action plans; and

(d) monitoring the completion of the corrective action plans.

41.2.2 The following questions may assist in investigating and recording a *near miss*:

(a) Were the on-site or off-site emergency plans activated?

(b) Did the leak or spill have the potential to escalate into fire, explosion or release of toxic materials?

(c) Did the leak or spill have the potential to result in:

- acute or chronic human health effects?
- serious environmental harm?
- damage to property?

(d) Would the leak or spill affect the quantity or quality of effluent discharged into sewers?

(e) Did the leak or spill need to be reported to the State or Territory Environment Protection Authority (under other legislation or a site leak or spill reporting plan)?

41.2.3 Managing Dangerous Occurrences and Near Misses

Dangerous occurrences and *near misses should* be managed in accordance with **NS 41(d)** and the emergency procedures and plans required by **NS/CoP 27**. This *must* be achieved in such as way that damage to life, health, property and the environment is minimised.

42. – 44. REPORTING Clause 42 – 44 of this national standard outline the requirements for reporting a dangerous occurrence or *near miss*.

No further explanation is considered necessary for the incident reporting requirements of the national standard.

43. – 46. NOTIFICATION CLAUSE 45 – 46 OF THIS NATIONAL STANDARD OUTLINE THE REQUIREMENTS FOR NOTIFICATION.

The *Authority* is to be notified prior to the storage and *handling* at any *premises* of *dangerous goods* in quantities indicated in **NS 45**.

DUTIES OF PERSONS IN A WORKPLACE

Employers

47. CONSULTATION

Techniques for organising consultation

Effective consultation depends on communication –that is, understanding the people being consulted and providing them with adequate information in a format appropriate to their needs, to enable them to have informed views. The process used for consultation *should* consider the needs of *employee*s and *employee* representatives from a non-English speaking background. Guidance on techniques for consultation in multilingual workplaces is provided in the Code of Practice for Provision of Occupational Health and Safety Information in Languages other than English. The *employer should* also have regard to the literacy needs of the *employee*s in the *workplace*.

Examples of consultation mechanisms may include direct discussion, toolbox meetings, quality circles, health and safety committee meetings or combinations of these. Other forms of consultation already existing in the workplace such as quality reports, *hazard* inspections or special working parties may also be useful.

47.1 NS 47, in relation to the storage and *handling* of *dangerous goods* in a *workplace*, requires the *employer* to consult with *employee*s and any other people engaged to carry out work at the *premises* who are likely to be affected by the *dangerous goods*. Consultation *should* also take place with the *employee* representatives.

47.2 Consultation is required on:

(a) *hazard* identification;

(b) *risk* assessment;

(c) *risk* control; and

(d) any proposed changes likely to affect the *employee*s' health or safety arising from the *dangerous goods*.

A positive approach to prevention of incidents is enhanced by consultation.

Occupiers who consult on health and safety issues and the implications of proposed changes at the planning stage, are more likely to gain relevant information to help reduce *risks* and avoid harmful consequences to *employee*s' health and safety.

Consultation is likely to be more effective when it involves provision of timely, accurate and relevant information.

47.3 Training programmes are to be developed, implemented, evaluated and revised in consultation with the target groups of *employee*s and their *employee* representatives.

47.4 Consultation *should* take place as early as possible in planning the introduction of new or modified tasks or procedures associated with the storage and *handling* of *dangerous goods* to allow for changes arising from consultation to be incorporated. Consultative procedures *should* allow enough time for the *employee* representatives to consult with their designated work group *employee*s and discuss the issue among them and with the *employer*.

48. INDUCTION, INFORMATION, TRAINING AND SUPERVISION

Under **NS 48**, the *employer must* provide appropriate induction, information, training and supervision to all people involved with the storage and handing of *dangerous goods*. Induction, information and training *should* provide *employee*s with the skills and knowledge they need to perform their jobs safely. It *should* help them to understand:

- the *hazards* and *risks* associated with the storage and *handling* of *dangerous goods*;
- how to follow health and safety procedures;
- the reasons *risk* controls have been set in place and how to use them; and
- emergency plans.

It is important to remember, however, that while training can be effective, it is not a substitute for effective *risk* control measures.

48.1 Induction

Depending on the complexity of the operation, the *employer should* consider the use of a formal induction program. Such a system would seek to ensure that each person who may be involved with the storage and *handling* of *dangerous goods* achieves the appropriate knowledge and competencies and is effectively supervised until that occurs.

48.2 Training

48.2.1 Who should receive training?

The *employer should* provide training to *employee*s and anyone else under their control who may be affected by *dangerous goods*, for example, contractors or consultants. In particular, training *should* be provided for all those who:

(a) purchase, distribute, operate, commission, test, inspect, assess damage to, maintain, repair, clean, alter and/or adjust *dangerous goods*, *plant*, equipment or personal protective and safety equipment, or manage or supervise other *employees* in these tasks; or

(b) work in areas where *dangerous goods* are stored and *handled* or where *plant* used with *dangerous goods is* being operated, commissioned, tested, inspected, maintained, repaired, altered and adjusted.

48.2.2 Content of Training for Employees

Training for *employee*s *should*, to the extent necessary to enable them to perform their tasks safely in accordance with the national standard, include:

(a) the relevant provisions of the national standard and this national code of practice;

(b) the implementation of *risk* control measures determined in accordance with **NS 15**;

(c) a working knowledge of the *dangerous goods* and/or *combustible liquids* at the *premises*, including:

- an understanding of the *dangerous goods* classification system;
- types and quantities of *dangerous goods* and *combustible liquids* at the *premises* or in the work area;

- any peculiar *hazards* associated with those goods;
- how to read and understand the labels and *MSDS* for those goods; and
- where to obtain further health and safety information on those goods;

(d) issues relating to the operation, commissioning, testing, inspection, maintenance, repair, adjustment or alteration of *plant* and equipment, including:

- safe working methods and procedures;
- all associated *hazards*, whether mechanical, chemical or other;
- the working of all controls, including emergency controls;
- operating characteristics and indications of system failure;
- the purpose, operation and use of protection systems, including guards and safety procedures; and
- relevant manufacturer's specifications and maintenance requirements;

(e) any specific controls which are required around *dangerous goods* installations, including:

- control of *ignition source*s; and
- access and movement controls for personnel, materials and equipment;

(f) personal protection issues including:

- the availability, selection, fitting and use of personal protective equipment;
- relevant hygiene issues; and
- the avoidance of all *hazards* on the *premises*; and

(g) emergency management issues including emergency plans and procedures.

48.2.3 Training Outcome

The required outcomes of training for *employee*s includes their ability to demonstrate:

(a) safe work practices relating to the storage and *handling* of *dangerous goods*;

(b) a working knowledge of the *hazards* of the *dangerous goods* in the *workplace*; and

(c) knowledge of the provisions of the national standard as they relate to the storage and *handling* of *dangerous goods* in the *workplace*.

48.2.4 Review of Training

The *employer should* systematically review the training provided, identify the need for further training and provide such training whenever changes occur in the *workplace* which are likely to affect safety and health related to the storage and *handling* of *dangerous goods*. Such changes may include:

Training review *should* include the ongoing monitoring of work practices to ensure that safe practices are maintained.

CoP 47.3 discusses consultation on training.

(a) the introduction of new *dangerous goods* to the work area;

(b) the introduction of new *plant* or equipment;

(c) a change in operating procedures; and

(d) changes in the layout of the *workplace,* or to work practices or control measures.

Refresher training *should* be provided on a regular basis.

48.2.5 Records of Training

The national standard requires the *employer* to keep *records* of all training provided to *employees*. Training *records should* include:

(a) the names of the *employees* or other trainees;

(b) dates of attendance;

(c) the title and content of the training course;

(d) the duration of training; and

(e) the name of the training provider.

Limitations of training

Although training plays an important part in ensuring effective *risk* control, it is not part of the hierarchy of *risk* control. People who are likely to be affected by the *dangerous goods* at the *premises should* be aware of the nature of the *risk* and the role that specific control measures play in *risk* prevention. However, the *employer should* not rely on safe worker behaviour alone. High levels of training and instruction cannot substitute for effective and proper measures to control the *risk*.

48.3 Provision of Information

For more detail of the type of information to be provided by the *employer*, see **CoP 32 and 33**.

48.4 Supervision

The *employer should* only employ persons in any role with influence over how another, such as an *employee* or contractor, carries out any task associated with the storage and *handling* of *dangerous goods*, if the person has sufficient knowledge of the *dangerous goods* and task that instructions or advice given will always lead to safe outcomes.

49.

Clause 49 of this national standard ensures that the *risk* assessment *record* is available to *employees* who are likely to be affected by the *dangerous goods* on the *premises*.

50. VISITORS

Where there is a perceived *risk* to the visitor, or where the presence of the visitor may constitute a *risk*, the *occupier should* ensure that before visitors are permitted to enter parts of the *premises* where *dangerous goods* are stored and *handled*, they are properly informed about:

(a) the *hazards* to which they may be exposed while on the *premises*;

(b) appropriate safety measures to be applied while on the *premises*; and

(c) what actions to take if any emergency procedure or plan is activated while they are on the *premises*.

- The activities of visitors may lead to increased *risk* to themselves, *employee*s, the storage and *handling* system and the *dangerous goods* being stored and *handled*. The *employer* can guard against this by providing appropriate information and supervision.
- Notwithstanding the provision of information, *employer*s may consider keeping visitors under constant supervision, or at least observation while they are on the *premises*.

50.1 The need for a formal system of providing safety information will depend on a number of factors including the:

(a) nature and severity of *hazards* on the *premises*;

(b) extent of the *premises* and the degree of access provided; and

(c) degree of supervision which will be provided.

50.2 Methods for supplying visitors with safety information, concerning those parts of the *premises* where *dangerous goods* are stored and *handled*, may include:

(a) strategically placed signs;

(b) giving instructions;

(c) providing a safety information card;

(d) showing a safety video; or

(e) other appropriate information.

51. MATERIAL SAFETY DATA SHEETS

51.1 Provision of MSDS

51.1.1 The *employer* may provide *MSDS* in a number of ways, including:

(a) paper copies;

(b) microfiche copies with reader; or

(c) computerised databases (local or on-line).

A *MSDS* for *dangerous goods should* be obtained from the manufacturer or *importer*.

51.1.2 In each instance:

(a) *MSDS must* be readily available to persons in the *workplace* who may need them; and

(b) the means of obtaining a paper copy *should* be made available.

51.1.3 Where goods are manufactured and subsequently stored on the *premises*, the *employer* has the same obligation, as the manufacturer or supplier under NS 10, to produce *MSDS*.

51.2 Provision of Information:
- **Retailers**
- **Dangerous Goods in Transit**

51.2.1 A *retailer* is not required to obtain a *MSDS* from the supplier for *dangerous goods* that are in consumer *package*s intended for retail sale. However, this exemption does not apply if:

(a) it is intended that the *container* be opened on the *premises* (except for sampling or tinting paint); or

(b) the *dangerous goods* are provided for trade use via a wholesale or trade supply counter or section.

51.2.2 While *employer*s are not required to have *MSDS* for *dangerous goods* in transit, they are required to have safety and health information concerning those *dangerous goods* accessible and available for their *employee*s and any other person who may be affected by the *dangerous goods*.

For safety and health information to be accessible and available does not necessarily require hard copy. Alternatives include using:

- Microfiche and reader
- Information on computer data base
- Availability through computer links with supplier or through web pages.

51.2.3 Safety and health information required by **NS 51(3)** *should* enable people who may be affected by the *dangerous goods* and personnel of the emergency service *Authority* to:

(a) identify the *dangerous goods* on the *premises*;

(b) recognise the *risks* involved in loss of containment or uncontrolled reaction of the *dangerous goods*;

(c) respond appropriately in an emergency; and

(d) comply with relevant legislation.

51.2.4 Basic initial emergency response information may be found in a number of sources, including:

(a) Standards Australia SAA/SNZ HB76 *Dangerous Goods Initial Emergency Response Guide*;

(b) other emergency response guides;

(c) industry codes of practice;

(d) emergency procedures guides;

(e) *MSDS*; and

(f) computer data systems used by transport operators for the management of *dangerous goods* transport.

51.2.5 An *employer* is required to have *MSDS* available for *dangerous goods* that are stored and *handled* on the *premises* other than *dangerous goods* in transit or consumer *package*s intended for retail sale. *MSDS* are required for all *dangerous goods* used on the *premises* such as cleaning chemicals, fuels and protective coatings.

51.2.6 All *employer*s *must* obtain and provide *MSDS* to an *employee* or *employee* representative when requested to do so.

52. REGISTER FOR DANGEROUS GOODS

52.1 Where the *employer* finds it convenient, the list of *dangerous goods* required by **NS 52** for inclusion in the register may be identical to or in the same form as the *manifest* where one is required by **NS 40**.

52.2 Clause 52(2) exempts *dangerous goods* in *package*s of a size below the marking levels of the *ADG Code*.

- For security reasons, especially where the manifest is in an outdoor holder, a separate list of *dangerous goods should* normally be provided for the register, even if identical in content.
- *Package* sizes that are exempt from *ADG Code* marking may be determined from **Appendix 10**.

52.3 Dangerous Goods in Transit

While under **NS 52(3)**, the *employer* is exempt from providing a list of *dangerous goods* and *MSDS* for *dangerous goods* that are in transit, there are remaining requirements to:

(a) provide relevant safety and health information (as detailed in **CoP 51.3**); and

(b) keep a *register* for all other *dangerous goods* that are stored and *handled* on the *premises,* including consumer items for use on the *premises*.

53. Clause 53 of the national standard specifies the duties of *Employee*s.

54. Clause 54 of the national standard specifies the duties of All Persons

DUTIES OF OWNERS OF PIPELINES

55. GENERAL

A *pipeline*, by definition in the national standard, extends beyond the boundary of the *premises*.

55.1 **NS 55(1)** effectively applies the control of *risk* requirements that apply to *occupiers* in **NS 15(4)(a) & (b)** to the owners of *pipeline*s

55.2 **NS 55(2)** applies the control of *risk* requirements that apply to *occupiers* in **NS 15(4)(c)** to the operators of *pipeline*s.

55.3 To ensure that *pipeline*s are located and operated in the safest *practicable* manner, owners and operators of *pipeline*s are strongly advised to apply all other relevant clauses of the national standard which apply to the *occupier*, including, but not limited to clauses:

NS 13. Hazard Identification;
NS 14. Risk Assessment;
NS 15. Control of Risk;
NS 16. Separation by Physical Means;
NS 18. Stability of Dangerous Goods;
NS 20. Spills and Containment;
NS 21. Impact Protection;
NS 22. Transfer of Dangerous Goods;
NS 23. Fire Protection;
NS 24. Emergency Preparedness;
NS 25. Ignition Sources in Hazardous Areas;
NS 26. Safety Equipment;
NS 30. Security;
NS 31. Decommissioning/Abandoning/Disposal;
NS 41. Dangerous Occurrences.

55.4 Identification of Pipelines

55.4.1 *Pipeline*s used for the conveyance of *dangerous goods should* be identified. Suitable systems for identification may be found in:

(a) AS 1345 *Rules for the Identification of Piping, Conduits, and Ducts*;

(b) Australian Institute of Petroleum's CP5 *Code of Practice for Pipeline and Underground Tank Identification*; or

(c) other relevant codes of practice.

56. Clause 56 of this national standard specifies the notification requirements for the owner of a *pipeline*.

57. Clause 57 of this national standard specifies the requirement for the *Authority* to acknowledge a notification from the owner of a *pipeline*.