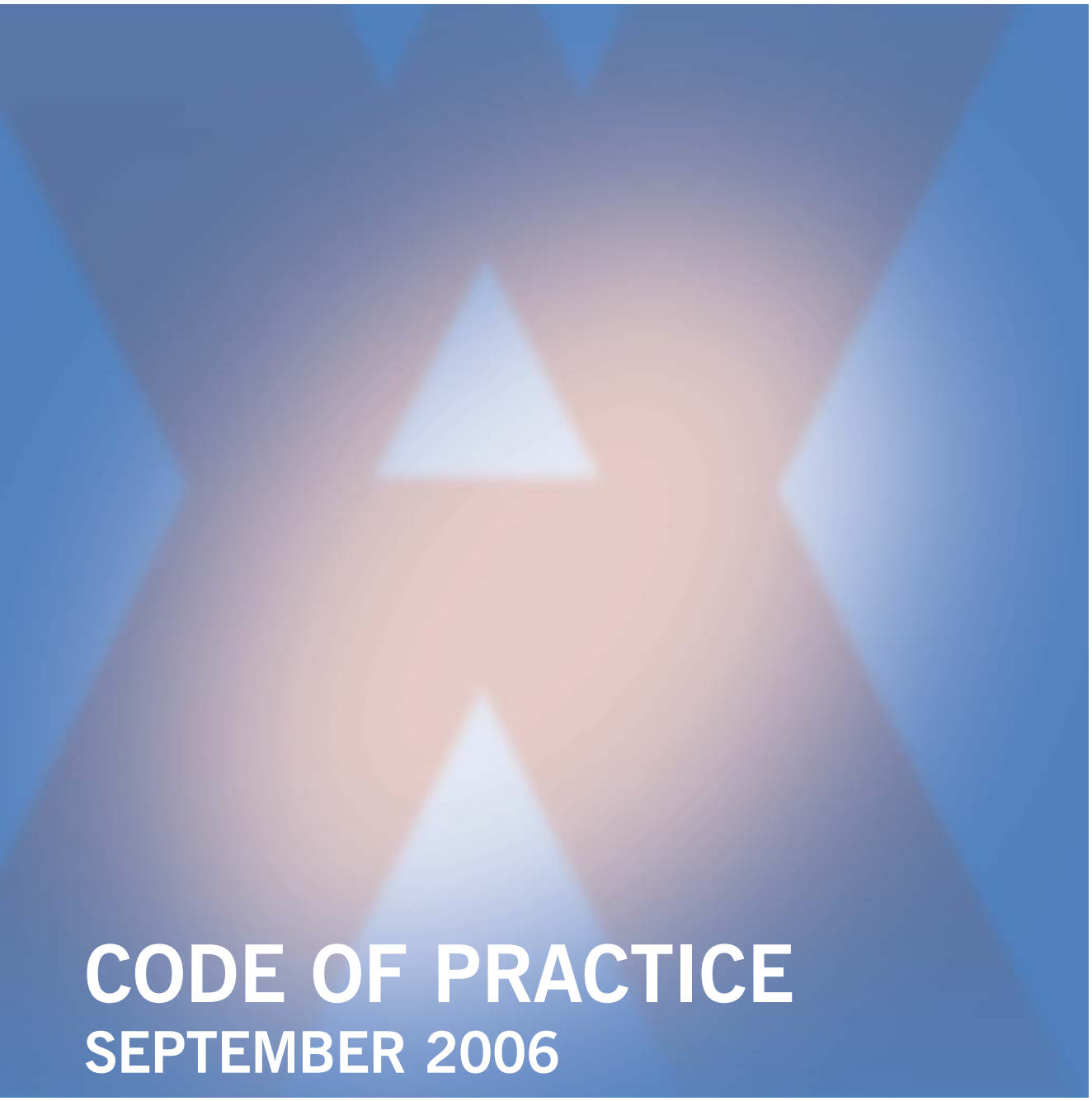
WorkCover
NEW SOUTH WALES

SAFE USE
OF BULK SOLIDS CONTAINERS AND FLATBED STORAGE INCLUDING SILOS, FIELD BINS AND CHASER BINS



CODE OF PRACTICE
SEPTEMBER 2006

WHAT IS AN APPROVED INDUSTRY CODE OF PRACTICE?

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

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

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

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

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

In summary, an approved **industry code of practice:**

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

FOREWORD

Bulk storage containers, such as silos, field bins and chaser bins, and their ancillary bulk handling equipment, are important to operations in a range of industries including agriculture. Bulk containers are used in many industries to store a range of substances such as cement dust, blue metal, plastic pellets, farm products and fertilizer. However they can also be the source of many injuries. Examples are deaths caused by falls, entrapment in grain, asphyxiation, fires and explosions.

This code of practice is intended to help prevent injuries in the use of bulk storage containers and flatbed storage. It outlines typical hazards associated with such storage, and describes means of eliminating or controlling the risks arising from those hazards. Experience has shown that risks are associated with structural collapse, access and entry into a bulk container, lack of fall protection, electrical safety, and the dangerous nature of the stored substance. Risks also arise from the use of ancillary plant, such as augers. The code shows how to deal with these issues through a planned risk management approach, in a manner relevant to each particular work situation.

This will help users of bulk containers comply with their obligations under the *Occupational Health and Safety Act 2000* and the *Occupational Health and Safety Regulation 2001*.

Persons implementing this code of practice should take into account the varying needs for bulk containers and storage areas of different size and construction when applying risk management principles. For example, many on-farm silos are smaller, made of steel and filled by augers, while the concrete silos used at grain terminals are larger, may have several work levels, stairways and bucket conveyors. Risks that vary with the nature of the stored substance will also need to be considered. For example, experience has shown that fires and explosions are a risk in the seed oil and stock feed industry.

This code of practice does not cover health and safety during the actual work of manufacturing, constructing or installing bulk containers, nor the safety and legal requirements when field and chaser bins are towed on public roads.

Advice on safe design is provided in the *Code of practice: Safety aspects in the design of bulk solids containers, including silos, field bins and chaser bins*, which replaces the 1991 *Code of practice: Safety aspects in the design, manufacture and installation of on-farm silos and field bins*, which has been revoked.

CONTENTS

CHAPTER 1 – Establishment

1.1 Title

This is the *Code of practice for the safe use of bulk solids containers and flatbed storage including silos, field bins and chaser bins*.

1.2 Purpose

The purpose of this Code of practice is to prevent injuries by providing practical guidance for the safe use of all types of bulk containers (including silos, field bins, and chaser bins), flatbed storage, and ancillary plant.

1.3 Scope

1.3.1 Matters included

This Code of practice applies to the use of any bulk container, flatbed storage, and ancillary plant, used for the storage or handling of a solid substance (such as an industrial material or product, crop, forage, or stock feed), at all places of work (except mines) in NSW.

This code of practice applies to the following:

- bulk containers exceeding 4 tonne or 4 cubic metre capacity;
- flatbed storage exceeding 40 tonne or 40 cubic metre capacity.

Silos, field bins, chaser bins and hoppers are examples of bulk containers where they exceed the above capacities.

1.3.2 Exclusions

This code of practice does not apply to the following:

- Bulk containers used to contain fluids
- Health and safety during the process of manufacture, construction, installation of a bulk container or making an electrical connection
- Bulk containers used primarily for transport on public roads, by rail, air or sea
- Bulk containers of coal.

1.3.3 Additional relevant standards for dangerous goods storage

Advice for the storage of dangerous goods (other than class 4.2) is provided in Australian Standards specific to the class and type of dangerous goods.

1.4 Authority

This is an industry code of practice, approved by the Minister for Commerce under section 43 of the *Occupational Health and Safety Act 2000,* on the recommendation of the WorkCover Authority.

1.5 Commencement

This code takes effect on 29 December 2006; three months after the day of publication in the *Government Gazette*.

1.6 Repeal of 1991 code of practice

The *Code of practice: Safety aspects in the design, manufacture and installation of on-farm silos and field bins*, published in the Government Gazette on 2 August 1991, and which commenced on 2 August 1992, has been revoked as provided by section 45 of the *Occupational Health and Safety Act 2000*. The design, manufacture and supply of bulk containers is covered by the *Code of practice: Safety aspects in the design of solids bulk containers including silos, field bins and chaser bins*.

1.7 Definitions

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

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

auger means a screw type conveyor.

bulk means more than 4 tonne (net), or more than 4 cubic metre of a substance, not in individual packages.

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

chaser bin means a mobile bulk container that has all of the following features:

- usually towed by a hauling vehicle when being loaded
- primarily used for receiving mechanically harvested crops
- normally unloaded by mechanically tilted means or by an auger.

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

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

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

(a) is not intended or designed primarily as a place of work, and

(b) is at atmospheric pressure while persons are in it, and

(c) may have an atmosphere with potentially harmful contaminants, an unsafe level of oxygen or stored substances that may cause engulfment, and

(d) may (but need not) have restricted means of entry and exit.

Examples of confined spaces are as follows:

(a) storage tanks, tank cars, process vessels, boilers, pressure vessels, silos and other tank like compartments,

(b) open topped spaces such as pits or degreasers,

(c) pipes, sewers, shafts, ducts and similar structures,

(d) shipboard spaces entered through a small hatchway or access point, cargo tanks, cellular double bottom tanks, duct keels, ballast and oil tanks and void spaces (but not including dry cargo holds).

Note: The interiors of other types of bulk containers may be confined spaces depending on the contents and atmosphere.

container means any type of container intended for the storage or handling of a solid substance in bulk (such as an industrial material or product, crop, forage, or stock feed), usually fitted with a discharge outlet; and includes a silo, field bin, or chaser bin, but does not include flatbed storage.

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

conveyor means an apparatus or equipment operated by any power other than manual power, by which loads are raised, lowered, or transported, or capable of being raised, lowered, or transported or continuously driven by:

a) an endless belt, rope or chain or other similar means, or

b) buckets, trays or other containers or fittings moved by an endless belt, rope, chain or other similar means, or

c) a rotating screw, or

d) rollers;

and includes the related supporting structure and auxiliary equipment used in connection with the conveyor.

Note: This includes an auger, and a vibration or walking beam.

dangerous goods has the same meaning as in the *Australian Code for the Transport of Dangerous Goods by Road and Rail* approved by the Australian Transport Council and published by the Australian Government from time to time.

Note: Sections 10.2.4 and 10.2.5 provide more information on relevant dangerous goods classifications.

field bin means a temporarily located bulk container that has all of the following features:

- intended for the storage of substance such as granular crops and stock feed
- equipped with discharge outlets
- capable of being emptied by gravity, mechanical or pneumatic means
- equipped with fixed, retractable or removable wheels for the purpose of towing it from one location to another.

Notes: Field bins are also called relocatable, moveable or portable silos. Tip trucks are excluded by the operation of the scope section 1.3.2, which excludes containers primarily designed for road transport. This definition has been developed for this specific code of practice.

flatbed storage means a single level building or other structure designed for the storage of solids in bulk of more than 40 tonnes.

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

guard means a device that prevents or reduces access to a danger point or area.

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

hatch means a cover or a door over an opening in a bulk container.

individual packages means any form of package or container of less than 4 tonnes and less than 4 cubic metres, and includes bags, cartons and drums.

Note: this definition has been developed for this specific code of practice, for the purpose of defining scope.

manufacture plant includes assemble, install, or erect plant.

manufacturer of plant includes an employer or self-employed person who manufactures plant for his, her or its own use at work.

Note: Importers must ensure that the duties of the manufacturer and designer are met for the containers they import.

manufacturer's instructions means the manufacturer's, designer's or importer's instructions, recommendations and specifications, provided by the supplier.

Note: Where any of these instructions, recommendations or specifications are not available, they should be drawn up by a competent person. Suppliers have a duty to pass this information on to users of plant.

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

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

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

place of work means any place where persons work.

Note: Relevant examples include any premises, any installation on land or any moveable structure where people work.

plant includes any machinery, equipment or appliance.

Note: Relevant examples of plant include silos, field bins, chaser bins, augers, bucket elevators, electrical devices, conveyors, and aerating and drying equipment.

reasonably practicable – see advice in appendix 4, section A4.7.

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

should indicates a recommendation.

Note: Such recommendations are evidence in any proceedings for an offence against the OHS Act or OHS Regulation in accordance with section 46 of the OHS Act.

silo means a container that has all of the following features:

- located in a fixed position
- equipped with discharge outlets
- capable of being emptied by gravity, mechanical or pneumatic means.

Notes: This definition has been developed for this specific Code of practice. Relocatable, moveable or portable silos are referred to as field bins for the purposes of this code of practice.

storage means the containment of any substance in any manner, such as in a container or other form of storage such as flatbed storage.

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

use in relation to a bulk container or flatbed storage, means all aspects of use and storage, and includes (without limitation) to work from, operate, maintain, inspect, clean and use as storage.

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

CHAPTER 2 – Planning to manage risks

A summary of legal duties is provided in Appendix 4, including how the law applies to various parties. This chapter focuses on applying risk management principles and planning to work with containers and in storage areas.

2.1 Risk Management principles with bulk containers and storage

'Risk management' is a way of organising your efforts to determine safe systems of work. Following this procedure will help you identify safety issues unique to the nature of your particular workplace. Checklists are provided in appendix 2 to assist with this process.

2.1.1 Steps in risk management

To carry out risk management, go through the following steps:

1. Identify all hazards associated with work processes, plant, substances, work environment, layout and condition, and any other factors that may affect safety. This includes the dangerous goods classification (if any) of the container contents, and any dust or gas hazards that may arise from the nature of the stored substance.
2. Assess the risks, which is a combination of the likelihood and the severity of any harm that the hazards might give rise to. It helps to prioritise them so that the most serious ones can be addressed first. This should include an evaluation of the existing control measures.
3. Eliminate or reduce the risk(s) identified in step 2, applying the hierarchy of control measures (detailed below in section 2.2).
4. Monitor and review the control measures to ensure they are working, and to respond to changes in work practices or other conditions in the workplace. Supervision is essential to ensure workers follow correct practices.

The first 3 steps must be carried out before work commences – this Code will help you do this. Employers must consult with employees when carrying out these steps – see 2.1.3 below.

Use this approach when applying this code of practice and developing safe systems of work.

2.1.2 Key risks to assess with bulk containers and storage

Experience indicates that the possibility of the following risks should be included in the risk assessment, where relevant to the type of storage:

- falls from heights (including falls into the container)
- engulfment or entrapment by stored substance
- entry into confined spaces
- fires and explosions resulting from the nature of the stored substance
- structural collapse of the container
- electrical shocks (eg from faulty equipment, proximity to overhead power lines)
- ancillary bulk handling facilities, plant and equipment (such as augers or conveyors)
- associated delivery of the substance to be stored in relation to the movement of transport (eg trucks or loaders) and other plant (such as augers or loaders)

- entrapment and other hazards due to the lack of safe isolation procedures for plant and processes
- children playing on or near plant or equipment.

The above list is not exhaustive and all risks must be considered (eg manual handling risks). Note that if the contents are classified as dangerous goods or hazardous substances then specific provisions of the OHS Regulation will also apply.

An analysis of the hazards and risks with the particular type of bulk containers in your workplace will indicate which sections of this code of practice are relevant. For example, some aspects of this code may not be relevant to flatbed storage. A systematic application of risk management should indicate relevant control measures, using this code as a guide.

With flatbed storage, this would include factors relating to:

- wall strength
- self-heating leading to fires
- fire fighting measures
- access to storage areas
- using associated plant such as front end loaders.

If monitoring and reviewing indicates ongoing problems, this could indicate a need to redesign the relevant aspect of the container or storage area.

Hazards and risks as identified and reasons for selecting controls should be written down in a suitable form, including the reasons why it is not reasonably practicable to apply ones higher in the hierarchy of control. The lists in *Appendix 2* are checklists that will help with some common hazards and risks, and the possible control measures. These lists are not exhaustive – you may find other risks that are relevant in your workplace.

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

2.1.3 Consulting with employees about risk management and implementing this code of practice

Whenever employers undertake a risk assessment or consider the control measures that can be adopted to eliminate or minimise risks, they must consult with employees as part of this process and take their views into account.

As examples, consultation should take place when carrying out the following:

- Evaluating the safety issues as part of the process of purchasing and installing a bulk container. This includes such matters as the safety features of the container, its location and compatibility with other plant or equipment in the workplace.
- Developing safe work procedures for related work tasks such as loading, unloading and using bulk handling equipment.
- Developing inspection and maintenance procedures.
- Developing emergency procedures to address risks such as fires, explosions or entrapment.
- Investigating accidents or safety incidents (such as 'near misses') that may arise.
- Considering modifications to the container or ancillary plant.
- Considering any other changes based on implementing this code of practice.
- Assessing training needs.

When undertaking consultation employers should share all relevant safety information with employees, including:

- safety information provided by the manufacturer or supplier
- health and safety issues that may arise from the installation and use of bulk containers
- how you intend to address safety issues.

Employees should be given sufficient time to consider this information and discuss any issues they may have with their employer.

Examples of particular topics to discuss during consultation include the following:

- Selection of suitable Personal Protective Equipment (PPE), when determined to be a control measure.
- Best ways of communicating health and safety information (including providing information to contractors or other workers at the site).
- Effective ways of providing signage.
- Establishing administrative procedures such as hazard and accident reporting.
- Accessing emergency response procedures for the site.
- Coordination with contractors and other workers at the site (eg vehicle drivers loading or unloading).

A suitable method of consultation must be put in place. Further advice on consultation with employees and setting up suitable arrangements is provided in the WorkCover *Code of practice: OHS consultation*. Legal obligations are summarised in appendix 4, section A4.2.

2.2 Preventing injury – elimination of risks and the hierarchy of controls

After identifying the hazards and assessing the risks, the safeguards or work systems that will keep people safe need to be determined. As indicated above, employers must involve employees when making these decisions.

The control measures, including those described in this code of practice, must be considered in terms of the 'hierarchy of control', described in sections 2.2.1 and 2.2.2 below.

2.2.1 Eliminating the risk

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

For example, the electrocution risk associated with overhead power lines can be eliminated by either:

- Locating the storage container to eliminate the need to use mobile augers near overhead power lines.
- Installing fixed conveyors rather than using mobile augers.

Elimination of the risk gives the best level of safety, and must be adopted unless it is not reasonably practicable. If elimination is not practicable, then the following hierarchy of controls must be considered. The term 'reasonably practicable' is explained in appendix 4, section A4.7.

2.2.2 Controlling the risk

In the following 'hierarchy of control', the control measures are listed in the order they must be applied. Work thorough the following sequence, starting with (a) which represents the highest level. Select from the highest level where reasonably practicable and develop each control measure for each risk identified.

(a) Substituting the system of work, substance or plant for something less hazardous (eg installing indicators that show the level of substance stored and that can be observed from ground level).

(b) Isolating the hazard (eg restrict access to an area by the use of barriers or guard rails).

(c) Introducing an engineering control (eg lockable catches to prevent access, guarding on augers, remote control levers).

(d) Administrative controls adopted as part of a safe system of work – examples are:

- modifying the system of work (eg cleaning the container from lower levels rather than from the top);
- developing a safe system of work and written safe working procedures;
- hazard warning signs (eg 'Lower auger before travelling') and specific training and work instructions.

(e) Personal protective equipment (PPE), such as fall arrest devices, eye, respiratory and hearing protection.

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

Administrative measures require frequent monitoring to ensure they are used. Training of workers about each control measure is needed so that workers know how to implement these.

The use of personal protective equipment (PPE) is the least effective measure. PPE should only be used when other control measures are not reasonably practicable, or when after implementing other controls, a residual risk remains. Advice on the selection of PPE is provided in chapter 16.

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

2.3 Site selection, preparation and installation – silos, field bins and flatbed storage

Installation, erection and commissioning (putting into operation) must be undertaken by a competent person at a suitable location (OHS Regulation, subclauses 135 (b) and (c)).

When selecting a site for a silo or field bin consider the following factors when complying with the manufacturer's instructions and guidelines on installation:

(a) Drainage throughout the site – for example, building up silo and field bin sites will help to ensure good drainage.

(b) Ensure that the foundation on which the container or flatbed storage is to be installed is in accordance with the manufacturer's instructions, and is safe and stable, including the capacity of the foundation, footings, plinth or ground to support the loads. Inadvertent movement of plant (including the container) must be prevented (OHS Regulation clause 135(d)).

(c) Truck and wagon access, and the ability to safely load and unload trucks or wagons. Examples are the risk of touching overhead power lines when tipping, and the risk of trucks overturning when tipping or turning if the ground is not sufficiently level and even.

(d) Access to public roads should facilitate safe movement of vehicles and containers such as field bins.

(e) Locate the container, flatbed storage and loading facilities away from overhead power lines, taking into account the possibility of contact from the movement of mobile equipment such as augers and tip trucks, and the use of cleaning and measuring poles or rods (see also chapter 12). Alternatively, locate powerlines under ground. You may need to consult your energy supplier about appropriate clearance distances from overhead and underground services.

(f) For silos with provision for inert gas injection as a fire control measure, provide adequate space for access, including vehicles carrying the gas supply, such as bulk tankers, where necessary.

(g) Provide sufficient space from adjacent buildings, plant, services (eg underground power or gas), roads or rail services, to allow safe work and access, and adequate separation distances for fumigation.

2.4 Preparation for work

If buying or building a new container, check that the manufacturer or supplier of the container confirms that the design is consistent with WorkCover's *Code of practice safety aspects in the design of bulk containers including silos field bins and chaser bins*. Some of the control measures described in this code of practice will have been incorporated by the designer and manufacturer.

Ensure that a suitable manual ('manufacturer's instructions') and all relevant information are provided that clearly describe safety measures, and that the safety measures are incorporated into the design. Ensure that the supplier will provide adequate manufacturer's instructions and guidelines for installation and commissioning.

Preparation should be based on implementing the manufacturer's instructions. Preparation should also include identification and assessment of the following factors:

(a) Climatic and environmental conditions that could affect recommended control measures.

(b) Safe access to and from the work areas, including areas where cleaning or maintenance is required (see also chapters 5, 6 and 7)).

(c) Requirements for regular inspection, cleaning and maintenance (see chapter 3 and preoperational safety checks for structural integrity in section 4.2)).

(d) Specific instructions and training for employees on maintaining health and safety (see chapter 17).

(e) Appropriate signage to display (see section 2.7).

(f) Suitability of plant and equipment for the intended use, and its proper maintenance.

(g) Provision of personal protective equipment, where this has been identified as an appropriate control measure (see chapter 16).

(h) The location of overhead and underground services (eg electric power lines, underground gas pipes) to ensure work is carried out safely with regard to its location.

(i) Establishing emergency, evacuation and rescue procedures in the event of an incident, injury or other emergency, including the means of rescuing people, and arrangements to protect any other people in the vicinity (see section 2.5 below and chapter 7).

(j) The nature of the substance stored, including its dangerous goods classification and the hazardous nature of any dusts or gases that may be evolved, and the size and type of structure of the container (see chapters 7, 9, 10 and 11).

(k) Risks associated with loading and unloading the container and the coordination of safe procedures with the person responsible for receipt or delivery of a load. Plan to ensure safe movements of vehicles such as trucks and wagons.

(l) Any associated handling and storage of dangerous goods, such as solvents (eg hexane), fuels (eg LP Gas), acid or alkali, in terms of the dangerous goods classification, and checking to ensure storage and handling is in accordance with the appropriate Australian Standard.

(m) The need for lightning protection of the container (AS 1768 *Lightning protection* provides advice).

(n) Safe lifting method and lifting points where necessary for lifting plant or bins (eg during maintenance or replacement).

(o) Proper site selection for relocatable containers such as field bins (see chapter 4).

When preparing for filling, discharge, cleaning, or any other work, check that all controls, identified through the risk assessment process, have been put in place.

2.5 Planning to deal with serious incidents – emergency procedures, fires and confined spaces

The need for emergency procedures, such as rescue from a confined space and fire fighting, must be identified and effective measures planned.

The fire risks of combustible substances should be identified, especially those related to the dangerous goods classification of the contents (further advice is provided in chapter 10). All confined spaces should be identified and have signs – see section 2.7.

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

(a) developing a site emergency plan, including procedures for alerting the fire brigade and cooperation with the fire brigade;

(b) provision of injection points on the container for inert gases to control fires, and access to these where provided;

(c) fire, heat and smoke detection systems;

(d) appropriate location of fire fighting equipment;

(e) maintenance of fire fighting equipment and provision of an adequate water supply;

(f) safe isolation and emergency stop procedures;

(g) control of access to the container and work areas during the emergency;

(h) extra equipment and procedures for entry into a confined space, for rescue or other purposes (see chapter 7);

(i) procedures and means for rescue of persons trapped in containers, confined spaces or hanging on fall arrest devices.

The above measures need to be included in staff training and instruction (see chapter 17).

2.6 Control of contractors and other persons working at the site

In order to adequately ensure both the protection of contractors or other visitors who occasionally work at the site, and to ensure contractors protect others, it is important to adopt procedures such as the following:

(a) permit to work systems, for example for entry into hazardous areas, entry into confined spaces, or hot work permits (for work creating an ignition source such as cutting, welding or grinding);

(b) isolation and tagging procedures to prevent inadvertent starting or energising of plant;

(c) providing adequate information and training about working with the container, ancillary plant and equipment; and the relevant hazards and risks, and emergency systems established (such as fire alarms);

(d) providing induction training for contractors, including safe working procedures.

2.7 Information and signage

Signage is an important way of providing health and safety information.

2.7.1 Mandatory signage

The OHS Regulation requires signage for the following risks:

(a) Where there is a risk of an unsafe atmosphere or atmospheric contaminants, the area must be isolated and appropriate warning signs put in place (Clause 54 of the OHS Regulation). Chapters 9 and 11 give further information on atmospheric contaminants such as dusts or gases. If PPE is selected as a control measure, areas where it must be used are to be clearly identified (OHS Regulation, clause 15(1)(g)).

(b) Clause 75 of the OHS Regulation requires that appropriate signs are displayed at the entry points to confined spaces. The following warning signs are suggested as examples of administrative controls to be applied, where relevant to the safe system of work and control measures applied:

- Adjacent to access openings: DANGER – CONFINED SPACE ENTER ONLY WHEN CONTAINER EMPTY – CONFINED SPACES SAFETY PROCEDURE MUST BE FOLLOWED
- or alternatively, where controls to prevent discharge are in place: DANGER – RESTRICTED ENTRY – CONFINED SPACES SAFETY PROCEDURES MUST BE FOLLOWED
- At all other openings not designed for access but where a person could enter: DANGER – CONFINED SPACE– DO NOT ENTER (or DO NOT ENTER UNLESS AUTHORISED)

(c) If the contents are dangerous goods, signs relating to the classification must be displayed.

(d) All relevant information on emergency procedures relating to plant must be displayed in a manner that can be readily observed by persons who may be exposed to risks arising from the operation of the plant (OHS Regulation, clause 144(2)).

(e) A legible notice specifying the rated capacity (safe working load) of any lifting machinery, including conveyors, must be affixed in a conspicuous place on the lifting machinery. The rated capacity must be specified in appropriate metric units (OHS Regulation, clause 142(1)).

2.7.2 Other risks that may need signage

Other signs that may be appropriate for controlling risks include the following:

(a) The allowable loads on ladders.

(b) A visible sign at each outward opening door or hatch (if applicable), displaying the warning: DANGER OF STREAMING MATERIAL – OPEN WITH CAUTION.

(c) Warning signs for fire fighters, including information concerning the proper fire extinguishing techniques, visible from a safe fire fighting position; such as a warning prohibiting directing water or foam to extinguish the fire through the top openings, where relevant to the contents.

(d) Include information on the nature of the contents so fire fighters are aware of the particular hazards, if the contents are combustible.

(e) Indication of the nature of the type of container (eg whether it is a sealed container or an oxygen limiting silo) so fire fighters can use appropriate methods.

(f) Signs warning of a fumigation process and the danger of presence of toxic gas following fumigation.

CHAPTER 3 – Regular safety checks, cleaning and maintenance of containers and plant

3.1 Risk reduction

Risks can be reduced through regular safety checks, inspection, maintenance and cleaning programs. All plant must be subject to appropriate checks, tests and inspections necessary to minimise risks to health and safety (OHS Regulation clause 136(3)(m)).

Ensure that inspection and maintenance schedules recommended by the manufacturer are kept, or a schedule is developed by a competent person where necessary (OHS Regulation, clause 137(1)(b)). Keeping records of maintenance, inspections, cleaning and repairs will help to ensure the maintenance and cleaning programs are carried out regularly.

It is recommended that a visual safety inspection is carried out on all containers at least once every three months if in continuous use, or at the beginning of each season or work period if the container is not in continuous use.

Arrange for a comprehensive and detailed examination of the container by a competent person at intervals recommended by the manufacturer, or more frequently in harsh environments such as near seawater, or where factors such as the corrosive nature of the stored substance could cause corrosion, to ensure that it is safe for use. If the container or any other item of plant is not safe for use, it must not be used (OHS Regulation clause 136(3)(n)). This examination should be carried out by a competent person at least every 10 years. An inspection report should be kept until the next inspection.

Faults that could cause heat or sparks, such as over heated bearings or slipping drive belts need immediate attention if the stored substance is combustible.

3.2 Key areas for inspection and maintenance

Examine the container and all ancillary equipment in accordance with the manufacturer's instructions (operator's manual), or instructions developed by a competent person if the manufacturer's instructions are not available, to ensure it is in safe operating condition. This should be done prior to first using it and on a regular basis. If the container is used only on a seasonal or periodic basis, an inspection should take place at the beginning of each season or work period. Intervals for comprehensive inspection will also be determined by the type of product stored and any external environmental factors.

The following areas should be considered in an inspection and maintenance program, where relevant to each particular container:

(a) structural integrity of the container and ancillary plant – see the list in 3.3 below;

(b) filling devices, unloading and discharge equipment (eg augers and conveyors), including guarding;

(c) guarding of platforms, ladders and other means of access;

(d) safety devices, including a safety line or harness if used as a control measure (see section 5.3);

(e) where pneumatic transfer or dust suppression is used – air or dust filters, and dust control system for operation, cleanliness and integrity (including dust tightness), pressure relief valves for correct operation; operation of any warning devices and high level detection systems;

(f) visual inspection of electrical equipment, including leads and cables for damage;

(g) warning signs and labels for wear and fading;

(h) operation of hatches and control mechanisms;

(i) sealing devices and pressure testing a sealed silo in accordance with the manufacturer's instructions to ensure integrity and efficiency of fumigation.

A preoperational safety check is outlined in section 4.2.

3.3 Structural integrity

Structural integrity checks should include a visual inspection of the following:

(a) metalwork, such as damage, surface corrosion, integrity of bolts or welds;

(b) damage to support struts;

(c) footings, foundations, slab or exposed plinths – problems may be indicated by evidence such as settlement, cracking, spalling or other damage to concrete;

(d) ladders, stairs, handles, platforms and other access points, including the attachment points, for corrosion and integrity;

(e) hatches and latches;

(f) dust tightness of any relevant items and the integrity of dust control systems;

(g) fall prevention barriers or attachment points;

(h) bulging of the container such as the barrel of a silo or field bin.

Note that paint could hide defects such as corrosion or cracking.

A checklist is provided (number 4 in Appendix 2). Arrange for remedial work to be carried out by a competent person if any fault is observed (see below).

3.4 Remedial work

All maintenance and repair work must be carried out by a competent person, having regard to the manufacturer's instructions, including the time periods for inspection and maintenance (OHS Regulation clause 137). Ensure that all electrical work is carried out only by qualified and licensed persons. Repairs carried out must keep the container within its design limits – if modified see section 3.6 below.

3.5 Cleaning

Cleaning reduces hazards and risks arising from dusts, moulds and corrosion. Risks also arise if the substance being stored deteriorates with time, or tends to stick to or corrode the walls of the container.

A regular cleaning program should include the following:

- removing dust deposits from any exposed surfaces (starting equipment may release accumulated dust and create an inhalation or explosion hazard)
- internal cleaning, if accumulated substance presents a hazard inside the container, such as corrosion, fire or explosion hazard, affecting proper discharge of the contents, or changes to the structural load
- general 'housekeeping' to ensure the workplace is clean and free of additional hazards, such as obstructions that could cause slips, trips and falls.

Dust hazards and explosion risks may arise during cleaning, and any equipment used should be suitable for use in such an atmosphere (see chapter 9 on dusts and moulds and chapter 10 on dust hazards and controls).

When plant or equipment is being cleaned, it must be isolated to prevent operation, unless this is not reasonably practicable (OHS Regulation clause 137(2)). A 'tag out' system may be necessary to provide signage to others that the plant cannot be started. Safe work procedures should be established for cleaning or clearing any attached conveyor or auger.

3.6 Modifications to the container

Consult the manufacturer or supplier, or an appropriately qualified engineer, before carrying out structural modifications to a container. A record of modification should be kept for the life of the container.

If you modify a design, you take on the legal obligations of a designer and manufacturer. Further advice is provided in the *Code of practice for safety aspects in the design of bulk containers including silos, field bins and chaser bins*.

CHAPTER 4 – Structural collapse

4.1 Hazards and risks

Structural collapses have sometimes resulted in fatalities. People must be kept safe from risks associated with such a collapse.

Different stored substances have different densities, internal angles of friction and corrosive behaviour. For example, a container that is designed for low density substance is likely to become overloaded if a higher density substance is stored. Manufacturers and suppliers will usually impose restrictions on the manner of loading and unloading substance, and the characteristics of and limitations on, the type of substance that can be stored.

A container may collapse when the stored substance, such as crusted grain, falls internally to the base, creating a vacuum that causes the container to implode (fold in and collapse).

Uneven settlement of foundation or footings is another cause of failures (see maintenance checks in Chapter 3 and remedial work in section 3.4).

Wind forces and the potential for a vacuum to be formed inside the container when doors or hatches are opened should be considered.

4.2 Control measures

When in use, a daily preoperational safety check should be carried out before filling, emptying, climbing or using the container, and in the case of a field or chaser bin, before towing or transporting. Consult the manufacturer's instructions and implement the following measures where relevant to minimise the risks of structural collapses:

(a) Check that the stored substances are within the manufacturer's or supplier's specification.

(b) Avoid overloading. Do not impose additional loads on it (eg supporting other equipment) unless specifically allowed by the manufacturer, supplier, or a competent person such as a qualified engineer.

(c) Load and unload at rates within the specifications of the manufacturer or supplier. Off centre loading or unloading can produce uneven loads on the structure.

(d) Where vehicle movements present a risk, protect the container or structure and support struts or legs from damage by moving equipment and vehicles by providing suitable barriers or vehicle stops.

(e) Before placing a field bin for filling, the site should be assessed to ensure that it is structurally adequate to support the full load of the bin, and that the bin is supported on level surfaces.

(f) Field bins should only be transported or towed on firm and even ground, and only when they are empty and within towing limits of the towing vehicle, and with a rigid linkage. When stationary, secure the bin from unintended movement.

(g) Where high winds may create a hazard, keep hatches closed.

(h) Do not use rails, ladders or other points as an anchorage point for a fall arrest system unless approved by the manufacturer of the container or structure, or determined to be suitable by a competent person.

CHAPTER 5 – Falls from heights

5.1 Hazards and risks

Falls from a container roof or ladder, or from a surrounding work area or platform, can result in serious injuries or death. Risks of falling must be eliminated or controlled to protect people working at any height. This includes the risk of falling into the container.

The OHS Regulation in subclause 56(1) provides that:

> An employer must ensure that risks associated with falls from a height are controlled by the use of the following measures:
>
> (a) provision and maintenance of:
>
> (i) a stable and securely fenced work platform (such as scaffolding or other form of portable work platform), or
>
> (ii) if compliance with subparagraph (i) is not reasonable practicable – secure perimeter screens, fencing handrails or other forms of physical barriers that are capable of preventing the fall of a person, or
>
> (iii) if compliance with subparagraph (ii) is not reasonably practicable – other forms of physical restraints that are capable of arresting the fall of a person from a height of more than 2 metres,
>
> (b) provision of a safe means of movement between different levels at the place of work.

Consider the risks of gaining access to the roof of a container, or surrounds of a below ground container, for work such as:

- opening and closing the roof hatch or cover, or access for loading or unloading;
- fumigating, inspecting, sampling, temperature measurement or servicing;
- determining the amount of substance stored;
- maintenance and cleaning;
- work near pits such as boot pits.

The more frequent the need for access, the higher the risk. This risk can be aggravated by fatigue from frequent climbing of stairs or ladders.

5.2 Control measures for work at heights – applying the hierarchy of control

A safe method of working at heights and moving between different levels must be determined.

Reducing the need for access to heights is the key to implementing control measures. Examine the methods of access and consider applying the following measures where reasonably practicable to control the risk of falls:

(a) Minimising the need to gain access to elevated areas such as the roof by providing and using measures such as the following:

- a system that conveys substances to the container that is accessible from ground level, such as through a filler pipe or a bucket elevator;
- a remote lever to open and close the roof filling cover, operated from ground level;
- sight gauges or weight indicators visible from ground level to show the storage level;

- ground level access hatches (eg to allow cleaning);
- extension poles to clean the inside of the container.

(c) Substitute a less hazardous means of access. For example, using an inclined ladder (at a gradient between 70^{o} and 75^{o} to the horizontal) instead of a vertical ladder where access is necessary, if reasonably practicable.

(d) Use fall protection such as barriers, guardrails and ladder safety cages, where reasonably practicable. AS 1657 *Fixed platforms, walkways, stairways and ladders – design construction and installation* provides further advice.

(e) Use a safety harness and fall arrest equipment, in conjunction with structurally adequate anchorage points (see section 5.3 below). This option should be considered only if all other means (b, c and d above) are not reasonably practicable.

(f) Prevent unauthorised access to ladders by either:

- blocking the base of the ladder safety cage with a lockable or fixed barrier;
- adding a lockable cover to the access ladder up to a height of 2 metres;
- folding up or sliding up the lower two metres of the ladder;
- using a detachable ladder up to a height of 2.5m. When not in use, such a ladder should be secured away from the container to prevent access by unauthorised persons.

(g) Where a ladder is used as a means of access, it should not be used as a work platform. The narrow rungs do not provide adequate ergonomic support for prolonged use.

(h) Provide warning signs about the hazards associated with access.

Further advice on applying the hierarchy of control to falls is provided in section 1.5, figs 1.1 and 1.2, of AS 1891.4 – 2000 *Industrial fall-arrest systems and devices – Part 4: Selection, use and maintenance*.

5.3 Use of fall arrest devices

5.3.1 Legal requirements

If a fall arrest devise is provided, the OHS Regulation in subclause 56(2) has the following requirements:

(a) all anchorage points must be inspected by a competent person before first use and on a regular basis so they are capable of supporting the design loads;

(b) if the load bearing capacity of an anchorage point is impaired, the anchorage is immediately made inoperable so as to prevent its use;

(c) any harness, safety line or other component of the device that shows wear or weakness to the extent it may cause the device to fail is not used;

(d) all persons using the device have received training in the selection, assembly and use of the system; and

(e) adequate provision is made for the rescue of a person whose fall is arrested by a fall arrest device.

5.3.2 Practical guidance on fall arrest devices and anchorage points

Practical guidance is provided in AS/NZS 1891.4 – 2000 *Industrial fall-arrest systems and devices – Part 4: Selection, use and maintenance.* This standard is an approved industry code of practice in NSW.

This part also provides advice on anchorage points for fall arrest devices. Anchorage points must be sufficiently strong to withstand potential forces. The force exerted on an anchorage point when arresting a person is considerable. It is as much as 110kN, which is the equivalent to suspending a large station wagon from the anchor. Fall arrest devices are not appropriate if suitable attachment points are not available. For example, existing ladders may not have sufficient strength.

When using a fall arrest device, a person should not work alone or unmonitored. Serious health problems, or even death, can result from a person left suspended in a harness for as little as 20 minutes.

When selecting a system, confirm with the supplier that it complies with AS/NZS 1891 *Industrial fall-arrest systems and devices* (all parts of this standard are approved industry codes of practice in NSW).

5.4 Infrequent, occasional or temporary access to heights

Occasional access to heights may be necessary for infrequent tasks such as inspection or maintenance. Consider using a stable and securely fenced work platform, such as scaffolding or a boom-type elevated work platform.

CHAPTER 6 – Entrapment in grain or other flowable substances

6.1 Hazards and risks

One common cause of death is suffocation as a result of engulfment in a flowing substance such as grain. Often the victim has entered a silo of flowing grain unaware of the dangers.

Flowing grain is hazardous because it acts like quicksand. It can take four to five seconds to be trapped up to knee level and less than 20 seconds to become submerged. Once trapped knee deep in the grain, a person is helpless to escape due to the immense force the flowing grain exerts on the body.

For example, to rescue a 25kg child caught in knee deep grain, an adult would have to be able to lift 32 kg. If the same child were shoulder deep in grain, it would require a force of 110 kg.

Sometimes appearances can be deceiving. Grain may crust over and look solid, but a cavity can develop underneath the crust. Someone walking on top of the crust can break through and become submerged in the grain.

The collapse of vertically crusted grain usually occurs in a partially emptied grain silo when spoiled grain remains stuck against the wall. As the worker attempts to dislodge it at the base, the wall of grain can give way and bury the worker.

Emergency rescue of a trapped person may be necessary. Because of the danger of engulfment and other hazards, a silo is classified as a confined space and special entry procedures are required (see chapter 7).

Examine the need to enter containers and eliminate or minimise the occasions when entry is necessary.

Consider applying the measures in sections 6.2 and 6.3 below where reasonably practicable, applying the principles of the 'hierarchy of control' (as explained in section 2.2).

6.2 Eliminating risks

Prevent entry unless it is absolutely necessary (for entry procedures see chapter 7). Instead, observe procedures such as the following:

(a) Break up crusted grain or substance from the outside of the container by either:

- Using a long pole inserted through the roof door or hatch. If there is any risk of the pole coming into contact with or within proximity of overhead power lines use non-conductive poles (such as wood or plastic)
- Using a weighted line thrown from the roof door or hatch
- Using rotating flails operated from outside the container.

(b) Do not enter a container from the bottom if the grain or substance is vertically crusted. Vibrate the sides of the container to break the crust.

(c) When unloading flatbed storage, persons should not enter the areas of overhang left after loaders have removed the stored substance.

6.3 Minimizing risks

To minimise risks, consider applying the following precautions:

(a) Make sure no one is inside the container before operating the loading or unloading equipment (unless the presence of a person is essential for the operation and adequate safety procedures are in place).

(b) Prevent people from entering openings above the maximum height of stored substance. This may be done by any of the following means:

- Ensuring openings do not exceed an area the equivalent of 150 mm diameter;
- Providing hatches with fixed guards that require tools to dismantle or keys to unlock. Such guards should not have openings that exceed an area the equivalent of 150 mm diameter, or
- Cover hatches with permanent steel mesh.

(c) Lock access doors and covers and store the keys in a secure place to prevent unauthorized access.

(d) Collect samples from outside the container.

(e) Place safety signs by the access points such as ladders, so other persons will be aware of the dangers of entrapment.

(f) Adopt safe working procedures where entry is essential for operation, including confined spaces procedures – see Chapter 7 below.

(g) Plan for emergency procedures should a person become entrapped in substance (see sections 7.2(g) to (i)). Further advice on rescue is provided in Appendix 3.

CHAPTER 7 – Entry into a container – confined spaces procedures

7.1 Hazards and risks of confined spaces

A confined space is described in the definition (see section 1.7). Containers, such as bins and silos, are potentially confined spaces due to the risks such as an unsafe atmosphere, engulfment by the stored substance or entrapment in an auger. Flatbed storage is not usually a confined space if sufficiently open to the atmosphere. All confined spaces at the workplace should be identified so that appropriate work procedures and control measures can be implemented.

Work procedures should avoid the need for entry. Entry of unauthorised persons into a confined space must be prevented by appropriate barriers and signs (OHS Regulation, clauses 54, 69 and 75).

Control measures are needed if the need to enter a confined space cannot be entirely eliminated under all circumstances. Entry is governed by the safety requirements specified in clauses 66–78 of the OHS Regulation. An entry permit system is required (clause 72). If a person enters a confined space, the employer must prevent the introduction of any harmful materials, contaminants, agents or conditions, and prevent the activation or energising of equipment or services that may pose a risk (eg floor augers that could entangle).

If the atmosphere is flammable or combustible, then potential ignition sources need to be controlled.

The risk assessment may need to include an evaluation of oxygen deficiency, the evolution of toxic or flammable gases, the presence of dusts, or the presence of fumigants – see advice in chapters 9, 10 and 14 to identify these hazards. Exposure to atmospheric contaminants or an unsafe level of oxygen must be controlled (OHS Regulation clauses 50–55). Grain dust is classified as hazardous. Spoiled grain gives off carbon dioxide, which may displace the oxygen in the container – see chapter 11.

When planning for each entry, make sure emergency contact phone numbers are made readily available to workers.

7.2 Procedures for entry into a confined space

Before a person enters a container, including for emergency rescue, the following precautions should be observed:

(a) Make sure that all ancillary equipment (eg augers) has been locked out and tagged to prevent unintentional starting. Do not permit any person to enter the container if loading or unloading equipment is running.

(b) To ensure that the atmosphere within the container is safe, it may need to be tested for the presence of combustible gases, vapours, dusts, toxic agents, fumigants and for oxygen content. Testing may be done with suitably calibrated chemical detector tubes or portable electronic meters, and test results should be recorded. Ventilation of the container may be necessary to remove contaminants and establish the normal level of oxygen. Ongoing ventilation may be necessary to ensure the atmosphere remains safe.

(c) If the oxygen level is less than 19.5% or more than 23.5%, if a flammable gas, combustible vapour or dust, or a toxic agent is present, ensure that the container is ventilated until safe levels of oxygen, or lower levels of gas, dusts or other contaminants are below exposure limits or explosive limits. However, respiratory protection may still be needed – see (e) below.

(d) Continue the ventilation as long as there is a possibility that the unsafe condition may recur while someone is in the container, and ensure that the ventilation provides enough oxygen for the worker inside. Pure oxygen, or air with a concentration of over 21% oxygen, must not be used for purging ventilation.

(e) If toxicity or oxygen deficiency cannot be eliminated by ventilation, anyone entering the container must wear a self-contained breathing apparatus. This is essential if there is an oxygen deficiency and/or to control toxicity. This will be necessary if gas continues to be evolved or if dusts are disturbed by the entry or work in the container.

(f) Airborne particles may cause difficulty in breathing. Anyone working in a container, especially for the purpose of cleaning the container, may need to wear an appropriate respirator or breathing apparatus. Further advice on dusts and exposure standards is provided in chapter 9.

(g) Workers should wear properly attached safety harnesses and lanyards equipped with properly fastened lines that will arrest falls, and keep them above the stored substance in case of a fall. Such harness and lines will also be necessary for rescue purposes (see point (i) below). This equipment needs to be appropriate for the task undertaken.

(h) Position at least one standby person, appropriately trained, outside the container to initiate in rescue if someone becomes trapped or overcome by toxic gas or lack of oxygen (OHS Regulation, clause 73). These people must be trained in rescue procedures and in safety procedures for confined spaces. Effective communications systems and procedures must be in place for these circumstances.

(i) Ensure that lifting equipment and a harness lifeline arrangement is conveniently available at all times for emergency rescue, and suitable attachment points are available.

(j) Where explosive atmospheres may be present, ensure that adequate measures are taken to prevent fires and explosions (the hazards are described in section 10.2 on Dust and Gas Explosions). Ignition sources should not be introduced. For example, during entry, ensure appropriate protective clothing is used, such as anti-static and anti-sparking shoes. Special procedures may be necessary if potential ignition sources are to be used, such as mobile phones, two-way radios, flashlights, electrical tools or lighters, for example during maintenance.

Further guidance on working in confined spaces can be found in Australian Standard AS 2865 *Safe working in confined spaces.*

CHAPTER 8 – Children and other visitors

8.1 Hazards and risks

The potential presence of children and other visitors should be taken into account and the risks assessed.

Children are naturally attracted to bright, noisy equipment and to areas where adults are working, even when the equipment is not in use. This is an important risk factor on farms. Accident reports show that children have been killed or maimed in augers, or have suffocated in containers when flowing grain has trapped them.

The best way to protect children and others is to anticipate potential problems and put measures into place to ensure that they will be safe. Simply telling a child to keep out of the area doesn't guarantee that a curious child won't enter – adults should make sure that children are protected.

8.2 Control measures

Consider the likely or possible movements of visitors and children at the workplace and the need for fencing and guarding. Entry to confined spaces must be restricted (see chapter 7 above).

Keep children away from grain handling areas and ancillary equipment such as augers and conveyors. Educate children about the hazards. Supervise them at all times they are near an area of risk. On farms, if children may be present this may be achieved by using safe play areas – guidance is available from Farmsafe Australia www.farmsafe.org.au or phone 02 6752 8210).

Consider the following additional measures to protect children and others:

(a) In locations where the risk assessment indicates a risk due to relatively large numbers of children or visitors, to guard against unauthorised access to the work area and storage area, fence off the work (eg with railing at least 1.2 metre high and a childproof gate with a latch over 1.5 m height).

(b) Prevent unauthorised access to ladders, using one of the options described in section 5.2 (f).

(c) Prevent access to hatches by the means described in sections 6.3 (b) and (c).

CHAPTER 9 – Dust and Moulds

9.1 Health hazards and risks from dusts or moulds

Many tasks, such as shovelling grain or cleaning out structures, have the risks of exposing workers to airborne dust and to moulds from spoiled organic products (such as grain or fibres), especially when working in an enclosed area.

When inhaled through the nose and mouth, mould spores can produce irritation of sensitive tissue. If significant quantities of bacterial or fungal spores, and related byproducts such as endotoxins, are inhaled they can induce respiratory reactions. This is similar to that caused by inhalation of grain dusts ('grain fever' and 'farmers lung').

The symptoms are easily mistaken for bronchitis or pneumonia, and may not be noticed for several hours after exposure to the dust. Irreversible lung damage and sometimes death can result when the disease is not diagnosed and treated in the early stages. A symptom of the disease is shortness of breath, which requires the worker to take frequent rest periods and severely limits the amount of work that can be accomplished. If the symptoms persist, medical advice should be sought.

The nature of the substance stored should be assessed to determine its health risks arising from dusts. Grain dust is classified as a hazardous substance and worker exposure to airborne concentrations of grain dust must not exceed 4 mg per cubic metre (over an 8 hour period). Protection may be also needed from other dusts, which should be identified from the classification of the contents of the container. Maximum exposure limits for some other substances, provided in the NOHSC standard *Exposure Standards for Atmospheric Contaminants in the Occupational Environment,* must not be exceeded (OHS Regulation, clause 51).

Gas risks are covered in Chapter 11. The fire and explosion hazards of dusts are covered in Chapter 10.

9.2 Controlling dust and mould risks

If there is a risk of respiratory problems from dusts or moulds, control measures may include the following:

(a) Store only dry grain and dry well cured forages and hay to prevent the development of moulds.

(b) Use aerating equipment to dry moist grain.

(c) Adopt techniques that prevent aeroionization and inhalation of micro-organisms from stored fodder such as wetting down the top layer of silage when container caps are removed.

(d) Handle dusty substances mechanically if this creates less dust or reduces people's contact with the dust.

(e) Reduce the amount of dust by enclosing conveyer belts, installing dust collectors and making sure the ventilation system is maintained in good working order.

(f) Remove accumulated dusts in a safe manner (eg with an industrial vacuum cleaner where practicable and where dust removal would generate dust hazards)

(g) Use an appropriate breathing apparatus. Select respirators that conform to AS/NZS 1716:1994 – *Respiratory Protective Devices*. Such equipment should be selected and used in accordance with AS/NZS1715: 1994 – *Selection, use and maintenance of respiratory protective devices.*

Health risks from gases evolved during storage are covered in chapter 11.

CHAPTER 10 – Fires and explosions

10.1 Severity

Fires and explosions can cause severe injuries and deaths, as well as structural collapse of the container. This is a serious risk that needs to be assessed and controlled. The first step is the identification of risks associated with the stored substance, including combustible dust hazards. Advice is provided below and appropriate controls indicated. Health hazards are covered in chapters 9 and 11.

Clause 62 of the OHS Regulation requires employers and self-employed persons to eliminate or control the risks of fire and explosion, and to remove accumulated waste substances such as dust (for details of clause 62 see appendix 4, section 4.8).

10.2 Explosion hazards and risks

10.2.1 Identifying the hazards

The nature of the stored substance should be assessed, including any likely combustible dusts and any dangerous goods classification that may apply.

Because of the substantial risks of fires or explosions under certain conditions or with certain substances, identification and prevention of such conditions in bulk storage are critical. Loading and unloading areas, processing areas and associated storage (eg flatbed) need to be included in the risk assessment, especially as these could provide sources of ignition. Fire fighting risks are covered in section 10.5.

Fire and explosion risks of any associated plant or substances also need to be assessed. Consider the risks from the use and storage of solvents (eg for seed oil extraction), fuels, (eg LP Gas for heating and drying) and gas or electrical fuelled appliances (eg dryers) where relevant. .

10.2.2 Causes of fires and explosions

Grain and organic dusts, metal dusts and other substances can become explosion hazards. Examples where combustible dusts may occur include the following:

- food processing such as flour milling, dried powder production, sugar processing and the spray drying of milk or coffee, has an explosion risk due to the small particle size of the product
- metals (eg in the form of dross, such as aluminium, magnesium, zinc, iron)
- natural organic material (eg cotton lint, grain)
- synthetic organic substances (eg plastics, pigments, pesticides).

Examples of the way explosive atmospheres can be created are:

- Gases generated within containers (including those generated by rotting or decomposition);
- Airborne dust generated during loading or unloading;
- Dust deposits on surfaces can be stirred by mechanical action or air drafts and become airborne;
- Certain bulk solids emit flammable gases during storage, creating a potential fuel for gas explosions.

Visible dust clouds during loading or unloading may indicate a risk.

The identification of potential dust hazards generated by the stored substance is essential. Dust layers can smoulder creating an ignition source for a subsequent explosion. Explosions can occur through ignition of either a layer of dust or a dust cloud. Dust deposits on surfaces can be stirred by mechanical action or air drafts creating an explosive mixture. Consequently dust deposits need to be controlled (see also section 3.5 on cleaning).

Explosions can occur when an ignition source comes into contact with a combination of air and fuel, so it is important to ensure that dust cannot come into contact with an ignition source. Consequently, potential sources of ignition must be identified and controlled (OHS Regulation clause 62). Common ignition sources are: flames, welding, cutting operations, electrical arcing, mechanical arcing, static electricity, heat from friction, and equipment for heating or drying.

Self-heating is also a risk. For example, bacterial action in silage causes heating, and if oxygen is available then spontaneous ignition is possible. Oily substances are prone to self-heating and combustion (see 10.2.4 below).

10.2.3 Sealed and oxygen limiting containers

Sealed containers can be designed to have all their openings sealed to prevent oxygen from entering or to allow fumigation. The top and bottom openings are normally sealed with rubber gasket hatches. When the hatches are tightly closed and the container is filled, the oxygen concentration should be insufficient to support a fire. However, if the container is not properly sealed or is not operating as designed, enough air may enter to allow a fire to smoulder causing combustible gases to accumulate due to incomplete combustion. Any increase in air can create an explosive atmosphere. These risks may also apply to other types of oxygen limiting containers or semi-sealed containers.

10.2.4 Dangerous goods classification of oily substances (Class 4.2)

This is particularly relevant to operations where oil is extracted from seeds and the resulting 'seed cake' is produced.

Substances containing unsaturated oils, such as cotton meal, and oil seed cake, or fodder mixed with these substances, can produce heat due to microbial activity – a process known as self-heating or spontaneous heating. Damp cotton and hay are also prone to self-heating. This can lead to fires or ignition of the explosive atmosphere within the container.

Such oily substances are classified as dangerous goods of Class 4.2. Identification of the dangerous goods classification (if any) of bulk substance is essential. Specific types of dangerous goods are categorised by UN numbers. The following list shows the dangerous goods classification of typical agricultural and fish products. Class 4.2 *Substances liable to spontaneous combustion* includes:

- UN 1364 Oily cotton waste, including cotton hulls and lint from cotton gins.
- UN 1363 Copra (dried coconut kernels).
- UN 1373 Fibres, animal or vegetable with oil.
- UN 1374 Fish meal (fish scrap) unstabilized (Class 9, UN 2216, if stabilized).
- UN 1386 Seed cake (more than 1.5% oil and up to 5%, and not more than 11% moisture) (classified as UN 1373 if more than 5% oil content).
- UN 2217 Seed cake (not more than 1.5% oil, and not more than 11% moisture).
- UN 3088 Self-heating solid, organic, not elsewhere specified.

'Seed cake' (UN 1386) is derived from a number of crops including coconut, cotton seed, peanut, linseed, maize, soy, rice and sunflowers. This could be in the form of pellets, flakes, meal, or cake.

Wet cotton is classified as a dangerous goods (UN 1365). UN 1373 (Fibres, animal or vegetable with oil) also includes fabrics and synthetic fibres if they contain oil.

Solvent extracted soybean meal containing not more than 1.5% oil and 11% moisture, and which is substantially free of flammable solvent, is not classified.

If you have more than 10,000 kg of Class 4.2, contact WorkCover NSW regarding the requirements for notification of storage.

10.2.5 Other dangerous goods

Ammonium nitrate fertiliser is Class 5.1 (Oxidising Substances) or Class 9 (Miscellaneous) depending on the exact classification. Persons using and storing ammonium nitrate must be licensed under the *Explosives Act 2003* (see details on the WorkCover internet site: www.workcover.nsw.gov.au).

Beads used in plastic manufacture may be Class 9 (UN 2211 Polymeric beads, expandable, evolving flammable vapour).

The dangerous goods classification must be determined by the manufacturer or importer. This information about the dangerous goods classification must be obtained from the supplier of the Goods who must provide it.

Further advice on Class 9 dangerous goods is provided in AS/NZS 4681: *The storage and handling of class 9 (miscellaneous) dangerous goods and articles*.

For other dangerous goods, the relevant Class specific or substance specific Australian Standard should be consulted.

10.3 Controlling fire and explosion risks

Classify the stored substance to determine the fire, combustion and dust explosion risks, using the advice in 10.2 as a guide.

Classify the hazardous areas in relation to combustible dusts and flammable atmospheres where relevant. For advice see AS/NZS 61241 series*, Electrical apparatus for use in presence of combustible dust*, particularly *Part 3 – Classification of areas*. To make decisions about the level of protection required for flammable gases, determine the area classification using Australian Standard AS 2430.3 – *Classification of hazardous areas.* Note that AS 2430.3 will also need to be observed if the container is associated with a solvent extraction process.

For stored substances with such risks, control measures focus on reducing the concentration of dusts and eliminating ignition sources.

Consider applying the following control measures:

(a) Do not introduce electrical equipment without an evaluation. Ensure electrical equipment (eg motors, control stations, switches, motor starters, lighting fixtures, plugs and socket outlets) is located away from the hazardous area. If that is not practicable, ensure adequate protection (see points (c) and (d) below).

(b) Avoid the use of mechanical equipment that can produce sparks inside the container.

(c) Check that any electrical equipment used is designed to reduce the risk of dust explosion from use near containers. See AS/NZS 61241 series*, Electrical apparatus for use in presence of combustible dust*.

(d) If a flammable atmosphere may be present, check that electrical equipment conforms with Australian Standard AS 2381 – *Electrical equipment for explosive atmospheres – Selection, installation and maintenance*. To make decisions about the level of protection required, determine the area classification using Australian Standard AS 2430.3 – *Classification of hazardous areas.*

(e) Minimise creation of dust clouds (see section 9.2, items d, e and f).

(f) Control static electricity (for advice consult Australian/New Zealand Standard AS/NZS 1020 *The control of undesirable static electricity*). During pneumatic transfer of combustible substance, ensure electrical bonding and earthing of tanker vehicles to prevent static electricity.

(g) Eliminate or control all potential ignition sources, including eliminating naked flames. Display 'no smoking' and 'no naked flame' signs, and provide supervision to ensure compliance.

(h) Control the moisture content and the type of cut of stored crops and feed in a way that will reduce the possibility of spontaneous heating. Proper preparation, curing and aeration of the substance being stored are particularly important with chopped crops – consult the manufacturer's instructions.

(i) Follow the filling and discharge rates recommended in the manufacturer's instructions to reduce the possibility of spontaneous heating of the stored substance.

(j) Maintenance and cleaning must be sufficient to prevent hazards created by dust buildup.

(k) Lightning protection may be necessary to eliminate this as a source of ignition – advice on is provided in AS 1768 *Lightning protection*.

(l) For sealed containers, maintain the container to ensure the integrity of any sealing features or ventilation, in accordance with the operating and maintenance instructions provided by the manufacture or supplier.

(m) Where combustible dusts are present or handled, further advice is provided in AS 4745 *Code of practice for handling combustible dusts.*

(n) Plant used with the container such as heating and drying apparatus should be assessed and maintained to ensure it is suitable and does not introduce an ignition source.

When installing or undertaking maintenance or repairs on electrical equipment in hazardous areas, engage a licensed electrician who is familiar with the relevant standards indicated in items (c) and (d) above.

10.4 Fire fighting and explosion risks

Workers and fire fighters have been killed as a result of fires and explosions in containers storing organic substance. This is particularly hazardous in sealed or partly sealed containers, such as oxygen limiting designs. While entry of oxygen from the air may be restricted, incomplete combustion during smouldering fires can generate combustible gases. During a fire, opening a hatch of the container, or applying water or foam by hose stream could allow enough air to enter the container to create an explosion. Water can also create additional reactions, generating flammable gases with consequent fire or explosion risks.

10.5 Extinguishing fires and controlling risks for fire fighters

As a general rule, no attempt should be made to extinguish a fire in a container, except by inert gas injection. There is nothing to be gained by conventional methods, and fire fighters lives are placed at a considerable risk. Dust explosions could occur if dust inside the container becomes suspended as a result of a water hose stream, and is ignited by the heat of the smouldering fire. Generally the fire should be allowed to burn itself out, unless means are available to allow the injection of inert gas from ground level into the container.

Should it be deemed necessary to extinguish the fire, *only trained fire fighters should attempt to do so*, and in accordance with the container manufacturer's instructions.

Fire fighters should observe the following measures and precautions:

(a) Personnel should stay off the structure of containers if smoke or steam is observed coming out of the roof openings, or if the structure is rumbling and vibrating.

(b) Do not direct water or foam onto the fire through any opening, since this may allow oxygen to enter the container and also cause the suspension of explosive dust clouds.

(c) Do not spray water on the structure, as this will damage the structure itself and possibly draw in air that could initiate an explosion.

(d) If the roof hatches are open and emitting smoke or steam, or if the container is vibrating, do not try to close or secure the hatches.

(e) Do not open any hatches or openings, as an in-rush of air into the container may cause an explosion.

(f) If the contents of the container are to be unloaded ensure that no air enters the container. This may require partially unloading the container while ensuring that the level of the remaining contents is sufficient to act as a seal against the in-rush of air from the bottom.

(g) Large quantities of carbon dioxide or nitrogen should be injected into the container to extinguish the fire. Hazards associated with the use of such gases include cold burns and asphyxiation. Provision should be made for connection points for the injection of inert gas into the container for high risk substances such as seed cake. Sufficient space should be provided adjacent to the storage area for vehicle access to supply gas (such as a bulk tanker).

CHAPTER 11 – Gas health risks in the storage of crops and fodder

11.1 Hazards and risks

Health risks arising from the stored substance need to be assessed. Some crops and fodder can generate gases hazardous to health. In particular, consider the risks of carbon dioxide, hydrogen sulphide and nitrogen dioxide. Concentrations are likely to be higher in sealed silos compared to open silos. Fermentation of moist waste can also create atmospheric hazards, especially if a small amount r emains in a container that has been empty for a period.

A worker should seek medical advice immediately if adverse exposure to silo gas is suspected.

If entry or rescue in an oxygen deficient or gas rich atmosphere is necessary, a self-contained breathing apparatus should be used, and the confined spaces procedures in chapter 7 must be followed.

Advice on fumigation is provided in chapter 14 of this code of practice.

11.1.1 Carbon dioxide

Carbon dioxide (CO_2) is a gas evolved in grain containers. When grain is stored wet, it ferments and produces this colourless, odourless gas, which displaces oxygen in the container. If enough gas has collected to decrease the oxygen concentration from the normal 21% to less than 19.5%, workers will think less clearly, become drowsy, lose consciousness, and even die. Carbon dioxide (and carbon monoxide) is produced by internal combustion engines or incomplete combustion of burners in heaters. Exhaust fumes present a risk if engines are used in enclosed or confined spaces, such as where loaders are used in flatbed storage.

11.1.2 Hydrogen sulphide

Hydrogen sulphide is a very toxic gas that may be produced by bacterial action (decay) on substances containing protein, such as grains, meat or blood material. It can be detected by its characteristic ‘rotten eggs’ smell, although at high concentrations this is an unreliable indicator due to an anaesthetic effect on nasal cells. This is risk may be present if workers are cleaning containers that have held protein containing material.

11.1.3 Nitrogen dioxide

Nitrogen dioxide (NO_2) is a gas that can cause death or permanent lung damage. It forms as a result of chemical reactions that begin almost immediately after chopped plant crop is placed in a container (eg making silage), and can remain present for up to three weeks.

Nitrogen dioxide is heavier than air and can flow out and settle near the ground. It may be visible as a reddish to yellowish-brown haze around the base of a recently filled silage container. It has a characteristic bleach-like odour and leaves a burning sensation in the nose, throat and chest. Be alert for bleach-like odours and/or yellowish brown fumes at the base of the container. Both are telltale signs of nitrogen dioxide gas.

11.1.4 Flammable gases

Flammable gases such as carbon monoxide (which is also toxic) and methane may also be produced, especially by the fermentation of moist wastes. The risks of flammability and control measures are covered in chapter 10. These gases also act as asphyxiants.

11.2 Control measures

11.2.1 Asphyxiant or toxic gases including carbon dioxide and hydrogen sulphide

Measures to control risks arising from asphyxiant or toxic gases, such as carbon dioxide and hydrogen sulphide include the following:

- Staying out of containers.
- If workers need to enter the container they should wear a self-contained breathing apparatus and take the precautionary measures outlined in chapter 7.
- Internal combustion engines should not be used inside bulk containers unless exhaust fumes are completely removed (eg by the use of sealed piping), or adequate ventilation is ensured.

11.2.2 Nitrogen dioxide

To avoid exposure to nitrogen dioxide, take the following precautions:

- Stay out of containers for at least three weeks following the filling a container with chopped plant substance. Keep children and visitors away from the container during the danger period.
- If entry into the container is necessary, take the precautions outlined in chapter 7, including the use of a self-contained breathing apparatus.
- Ventilate the base of the container, especially if it opens into a feed shed.
- Ventilate feed sheds associated with the container by the use of open windows and fans during the three week enclosed space danger period.
- Keep the door between the container and any attached structure, such as a feed shed, tightly sealed to protect livestock and humans from contamination of the shed.

11.2.3 Fumigants

Controls should be adopted to restrict entry into containers following fumigation, to allow time for the dispersal of fumigants prior to unloading or to entry into the container (eg lock the container during the dispersion period). Engineering controls include forced ventilation where the container is designed for this. The use of fumigants is covered in chapter 14.

CHAPTER 12 – Electrical hazards

12.1 Hazards and risks

Many persons have been killed by electrocution when the metal parts of mobile bulk handling equipment (such as augers, field bins, harvesters or tip trailers) have come into contact with or close to overhead powerlines. Such accidents usually occur when the operator has not lowered the equipment before moving it.

Damaged or faulty electrical equipment, switchgear and wiring have also contributed to a number of electrocutions. Regular inspection and testing of electrical equipment is required (OHS Regulation clause 64). For situations where damage and hazards may occur, due to movement, abrasion, water or dust, further advice is provided in AS/NZS 3760 *In-service safety inspection and testing of electrical equipment.* This is an approved industry code of practice in NSW. Consult the WorkCover publication *Electrical equipment checklist* for further advice.

12.2 Control measures

Examine the work situation and consider applying the following measures, where relevant and practicable, to eliminate or control risks arising from power lines and other electrical hazards.

Note: You should consider all conductors alive unless it is positively known they have been de-energised, isolated and earthed by the local electricity distributor.

(a) Identify the location and voltage of overhead power lines.

(b) Locate containers away from overhead power lines, or relocate power lines underground. Alternatively, where required, use a system in which the power supply authority arranges for the powerlines to be isolated and raised in a safe manner.

(c) Use fixed equipment to fill the container and remote controls (see section 5.2), instead of moving augers.

(d) Develop work procedures and travel routes for equipment and vehicles that ensure workers, their equipment and containers such as field bins, do not come into close proximity with overhead power lines (see advice in section 12.3 below).

(e) Have the relevant electricity supply authority switch off the power.

(f) Lower augers before transporting to eliminate the risk of contacting overhead lines. This also stabilises the unit and reduces the risk of the auger rocking to the side and tipping over.

(g) When a pole is used to break crusted grain, ensure that it does not touch power lines. If such a possibility exists consider alternative ways of breaking the crust – see section 6.2 (a).

(h) Check that all bulk handling equipment in use is electrically safe.

(i) Install residual current devices (RCDs) to power outlets and power supply to provide protection.

(j) Electrical cords (power leads) should be located off the ground. Ensure that electrical cords are not subject to water immersion or mechanical damage.

12.3 Safe working distances from power lines

Work, or any part of an item of plant, should not come closer to overhead powerlines than the distances in the following table:

Voltage of cable	Safe working distance
Up to 132,000 v	3 metres
Above 132,000 up to 330,000 v	6 metres
Over 330,000 v	8 metres

When estimating these distances, include allowance for the following factors:

- the sag of the cables;
- any swing or sway of loads or plant;
- the effect of wind forces on plant or cables; and
- the height of the plant (such as the harvester, field bin, silo on a truck, chaser bin or auger).

You may need to contact the local electricity supplier to ascertain the line voltage and obtain advice on suitable distances, and safety procedures.

12.4 Emergency procedures following contact with power lines

If, in spite of your best efforts to control risks, a vehicle or plant does contact a power line, the following points could help save a life:

(a) Machinery operators should stay in their cabins until the power has been switched off, and the 'all clear' has been given (unless the machine has caught fire).

(b) Other persons should stay at least eight metres away from the machinery and damaged powerlines.

(c) If immediate evacuation of the cabin is necessary (for example, in case of fire), drivers should jump well clear, and avoid touching the machinery, and then hop away from the machine, keeping both feet together at all times (to avoid differences in ground voltage).

(d) People should not attempt to rescue someone receiving an electric shock without proper training and equipment. Secondary deaths too often occur when untrained, ill-equipped people get electrocuted trying to help earlier victims.

(e) If necessary, contact the local electricity distributor, and request them to switch off the power supply.

CHAPTER 13 – Loading, unloading and bulk handling equipment

13.1 Hazards and risks

Bulk handling equipment, such as augers, bucket elevators, belt conveyors and pneumatic transfer, can cause serious injuries and fatalities if not properly used.

The hazards and risks associated with bulk handling equipment include the following:

(a) Moving parts (such as the flighting of an auger or a power take off shaft) that can catch people and drag them into the mechanism.

(b) Electrocution resulting from contact with overhead power lines or defective electrical equipment (see chapter 12).

(c) Uneven terrain or unstable siting leading to tipping of mobile conveyors and augers.

(d) Noise and hearing loss (see chapter 15).

(e) Over pressuring the container and filter system during pneumatic (air pressurised) transfer.

(f) Risks from vehicle or wagon movements.

(g) Generation of dust (see chapters 9 and 10).

(h) Excessive discharge rates outside the manufacturer's specifications.

(i) Sparks or heating from friction, or hot parts of engines.

(j) mechanical failure and structural collapse.

(k) manual handling (eg moving augers).

13.2 Control measures

A number of control measures are specified by clause 136 of the OHS Regulation, and the following advice will help implement these.

Examine the plant and equipment in use and consider applying the following measures where relevant to eliminate or control the risk:

(a) Select equipment that complies with statutory requirements. Advice on conveyors is provided in Australian Standard AS 1755 – 2000 *Conveyors – safety requirements*, which is an approved industry code of practice in NSW.

(b) Select equipment and implement ways of working that eliminate or minimise risks.
For example, using:

- fixed rather than mobile equipment, or
- an industrial vacuum cleaner or pneumatically operated equipment, in preference to a sweep auger with exposed flights.

(c) Guard all moving parts of machinery. Ensure that guards and shields are secured, and always replaced on completion of cleaning, repair and maintenance work. Guidance is found in Australian Standard AS 4024.1: *Safeguarding of machinery Part 1: General principles*. Guarding or grates must prevent any part of the human body reaching or touching a moving component.

(d) Ensure that the power supply has been isolated, locked off and tagged prior to carrying out any work on the equipment, including clearing of blockages, cleaning, lubrication, maintenance or repair work.

(e) Keep people from going underneath a mobile conveyor or auger. If work needs to be performed below such equipment, secure raised conveyors or augers against movement before anyone starts working there.

(f) Avoid sharp turns when pulling portable bulk handling equipment with a tractor. Raise conveyors and augers only to the minimum necessary height, to reduce the chance of overturning.

(g) Locate mobile equipment on firm, preferably flat, ground.

(h) Where bulk handling equipment is hidden from the operator's view, ensure the area is clear from people before the operator starts the equipment. Safe work procedures are necessary. Suitable administrative controls include pre-start warning systems such as audible and/or visible signals.

(i) Wear close fitting clothing when working near running equipment such as augers or conveyors.

(j) If water is used for cleaning, any electrical equipment should be protected against penetration by water. Minimum protection is IP65 to Australian Standard AS 1939 *Degrees of protection provided by enclosures for electrical equipment.*

(k) If using pneumatic transfer, procedures should be adopted to ensure that:

i. recommended transfer rates, and flow are not exceeded;

ii. maximum pressure is not exceeded (especially at the end of delivery when the tanker is empty);

iii. warning indicators are used to indicate over pressure and high level;

iv. automatic shut down occurs if the container is over pressure or over full;

v. filtration is adequate to prevent escape of dust;

vi. tanker operators have adopted adequate procedures to ensure the container is not over pressured.

(l) Discharge within the rates recommended by the manufacturer.

(m) Persons should not stand or be on the roof of a container while loading or unloading in case of structural collapse during filling or discharge.

(n) If emergency unloading is necessary, avoid asymmetric discharge (eg, open two or more hatches).

(o) If entry into a field bin is required for cleaning purposes, secure the lid when in the raised position to reduce the risk of crush injury or entrapment.

13.3 Field bin wheel extension and retraction

Fatal injuries have resulted from persons being struck by spring loaded levers used for wheel extension and retraction on field bins. In one case, the wheel was removed and not replaced before the spring tension forced the lever to move in an uncontrolled way.

Poor adjustment of the spring tension and incomplete emptying of the bin are other situations where the force on the lever can be greater than the force the operator can control.

Care is necessary when operating such levers due to the stored energy. Operating instructions should be followed, and unusual operations such as wheel changing should be planned and done with care.

Persons other than the lever operator should stand well clear during operation of the device.

When purchasing new field bins, evaluate the requirements for the strength and size of persons who might operate the mechanism, such as adolescents. Alternative methods of raising bins are available that allow movement to be controlled at all stages by most people, and reversed easily. Also consider what provision is made for wheel changing and if any unusual tools are required and need to be available to the operator (eg to allow warning signs to be complied with).

CHAPTER 14 – Fumigation and pest control

14.1 Hazards and risks

Fumigation is typically carried out for grain and other products, such as using methyl bromide, phosphine or carbon disulphide. Fumigants present health risks, both during and after fumigation of a container. Fumigants are toxic to humans when inhaled, swallowed, or absorbed through the skin. Residual fumigant can be hazardous when unloading containers such as silos, field bins and flatbed storage.

Examine the use of fumigants, and the risks arising from hazardous residues when loading or unloading, to determine the need for precautions.

14.2 Exposure controls in general

Consider the following control measures to eliminate or minimise the risks of worker exposure to fumigants:

(a) Reduce the risks of insects and mould by:

- cleaning to reduce cross infection by insects in new grain;
- using fumigants only in sealed silos and field bins;
- storing grain for a relatively short time (say less than two months);
- using 'inert dust', abrasive dust or desiccant dust treatments instead of pesticides.

(b) Follow the instructions on the label and the advice in any leaflets before using the fumigant, including the type of PPE to use. Additional information is provided in the Material Safety Data Sheet, available from the supplier (a copy must be kept at the workplace).

(c) Clearly mark areas under fumigation with signs such as 'DANGER – UNDER FUMIGATION'.

(d) For non-farm, large silo installations, ensuring that people carrying out fumigation follow the procedures in *AS 2476 General Fumigation Procedures*, including posting of warning notices. Fumigation must be done by a licensed fumigator (OHS Regulation, clause 266).

(e) A person applying fumigants or any other pesticide must have the training qualification prescribed by the relevant legislation. See also chapter 17.

(f) Any pressure testing of a sealed container should be done according to the container manufacturer's instructions or according to procedures developed by a competent person. Pressure limiting devices should be used to limit pressure.

(g) If entry into a container is required, observe the confined spaces procedures described in chapter 7.

14.3 Storage and handling of fumigants and other pesticides

If in a quantity over one tonne of any one type, those agricultural chemicals classified as dangerous goods should be stored and handled in accordance with Australian Standard AS 2507 *The storage and handling of agricultural and veterinary chemicals*. Dangerous goods can be identified by the prominent 'diamond' label on the container.

For less than one tonne of any type in on-farm use, follow the advice on the storage and use of chemicals in the *Code of practice for the safe use and storage of chemicals (including pesticides and herbicides) in agriculture.*

For less than one tonne in total of all types in non-farm use, follow the advice on the storage and use of pesticides in the *Code of practice for the safe use of pesticides including herbicides in non-agricultural workplaces.*

14.4 Aluminium phosphide fumigation

Open phosphide containers outdoors and not while in a shed or silo. Place the phosphine tablets (or strips) into the silo from the outside (such as through the roof using a tube).

14.5 Carbon disulphide fumigation

Carbon disulphide is flammable and readily combustible. Because it is easily ignited extra care is required to eliminate any source of ignition (including static from clothing or containers) or heat. It is also toxic, so special procedures are required, as advised by the label, Material Safety Data Sheet and other information provided by the supplier.

CHAPTER 15 – Noise

15.1 Hazards and risks

Exposure to excessive noise levels produced by bulk handling equipment, grain drying equipment, tractors and other plant may lead to hearing damage.

A dull feeling or ringing sensation in the ears after a day of working in a noisy area is generally an indication that safe noise levels have been exceeded. This ringing is frequently accompanied with a slight loss of hearing, making it difficult to hear faint sounds that could normally be detected. Overnight rest may restore hearing, but repeated, prolonged exposure to loud noise can result in permanent hearing loss. The noise emission from a typical farm auger exceeds permissible exposure levels.

The risk of causing *permanent* hearing damage is related to both loudness of the noise and the length of exposure. For example two minutes working in high noise levels may cause the same damage as eight hours of working in lower noise levels.

15.2 Control measures

Consider applying the following measures:

(a) Select and use plant that produces low noise levels whenever possible.

(b) Isolate or enclose noisy plant.

(c) Properly maintain plant. A faulty muffler, a worn out bearing, or a slack belt or chain are examples of sources that can dramatically increase noise levels.

(d) Implement administrative controls, such as operator rotation away from noisy work to reduce exposure time.

(e) Wearing suitable hearing protectors during exposure to noise that could cause any hearing loss symptoms (see advice below). This would be necessary when operating a typical farm auger.

15.3 Personal hearing protection

Personal hearing protection should be used in the following circumstances:

- when it is not possible to eliminate or control noise through engineering or other means
- as an interim measure until engineering or other control measures are implemented
- in addition to other control measures to minimise the risk of hearing loss in noisy environments.

Obtain personal hearing protection conforming to AS 1270:2002 – *Acoustics – Hearing protectors*, and maintain in accordance with the manufacturer's instructions.

15.4 Noise assessments

Clause 49 of the OHS Regulation 2001 requires employers and self-employed to ensure that appropriate control measures are taken if a person is exposed to noise levels that either:

- exceed an 8 hour noise level equivalent to 85 dB(A), or
- peak at more than 140 dB(C).

Reducing exposure by adopting control measures outlined above in section 15.2 and using the PPE as described in section 15.3 would normally mean that an assessment is not necessary.

Additional guidance is provided in the WorkCover *Code of practice for noise management and protection of hearing at work*.

Noise assessments, carried out in accordance with Australian/New Zealand Standard AS/NZS 1269.1 *Occupational noise management Part 1: Measurement and assessment of noise immission and exposure*, can determine the levels of noise workers to which are actually exposed.

CHAPTER 16 – Selection of personal protective equipment (PPE)

16.1 Provision of PPE

Depending on the task, additional personal protective equipment (PPE) may be required to protect eyes, respiratory system or hands. Hearing protection is covered in chapter 15.

The selection of PPE depends of the risks assessed and the control measures chosen. PPE is the lowest form of control and can only be used if it is not reasonably practicable to apply other controls, or if the application of other controls still leaves some risk outstanding (see section 2.2). Where PPE is chosen as a control, employers and self-employed persons must ensure that workers use the PPE correctly. Careful supervision and monitoring are needed to ensure that workers use and maintain PPE properly.

If control measures include PPE, then clause 15 of the OHS Regulation provides that the employer (or self-employed person) must provide each person at risk with PPE, and ensure that the following points are observed:

(a) the equipment provided is appropriate for the person and controls the risk for that person;

(b) the person is informed of any limitations of the equipment;

(c) the person is provided with the instruction and training necessary to ensure that the equipment controls the risk;

(d) the equipment is properly maintained and is repaired or replaced as frequently as is necessary to control the risk;

(e) the equipment is provided in a clean and hygienic condition

(f) the equipment is stored in a place provided by the employer or self-employed person; and

(g) areas where PPE must be used are clearly identified (eg by signage).

If in doubt, seek the advice of the PPE supplier on suitability, using sections 16.3 and 16.4 as a guide.

16.2 Eye protection

Eye damage can occur due to dust and in the course of maintenance, such as cutting, grinding, chipping, welding and other work tasks.

Employers should provide workers who may be at risk with eye protection conforming to AS/NZS 1337: *Eye protection for industrial applications*.

16.3 Respiratory protective equipment

Where workers could be exposed to atmospheric contaminants (see chapters 9 and 11), the employer or self-employed person should provide these workers with respiratory protective equipment, and ensure that it is used. Select respirators that conform to AS/NZS 1716:1994 – *Respiratory Protective Devices*. Such equipment should be selected and used in accordance with AS/NZS1715: 1994 – *Selection, use and maintenance of respiratory protective devices.*

16.4 Safety gloves

Where there is a risk of hand injury due to exposure to a hazardous substance or to a mechanical device, the employer or self-employed person should select and provide hand protection that conforms to AS/NZS 2161 – *Occupational protective gloves*.

16.5 Fall arrest devices

When selecting a system, confirm with the supplier that it complies with AS/NZS 1891 *Industrial fall-arrest systems and devices* (all parts of this standard are approved industry codes of practice in NSW).

CHAPTER 17 – Training and instruction

17.1 Legal obligation

Employers and self-employed persons must provide suitable training, instruction, information and supervision, to ensure worker's health and safety (OHS Regulation, clauses 13 and 14). Information can be included in training.

All workers should be trained to follow systems of work and work practices that enable them to perform their work safely. Make sure that only those who have had adequate training and instruction are permitted to carry out the work. Training needs should be assessed through the risk assessment process and through consultation with employees.

17.2 Induction training

All new employees must receive induction training covering the following points (OHS Regulation clause 13(1)):

(a) arrangements for the management of occupational health and safety, including arrangements for reporting hazards to management;

(b) health and safety procedures relevant to the work of the employee, including the use and maintenance of risk control measures;

(c) how to access any health and safety information that the employer is required to make available to each employee;

(d) any other induction training relevant to the place of work, having regard to the competence, experience and age of the new employee (the Regulation specifies training in relation to confined spaces entry).

17.3 Training topics

Training should draw on knowledge of the known hazards and risks in your operations, including matters described in this code of practice. The source of risks should be pointed out and the adverse outcomes that have been experienced by others should be used to stress the importance of safety.

Training should include the following, where relevant to the job:

(a) safe work methods to be used on the job, including matters described in this code of practice;

(b) the safe use of any tools, plant and associated equipment, and hazardous substances to be used on the job, including fire protection measures such as eliminating sources of ignition;

(c) users of fumigants will need training to the appropriate level in line with National Competency Standards, and as indicated by the pesticides legislation (or in non-farm use, a certificate of competency under clause 266 of the OHS Regulation);

(d) procedures for controlling risks, such as ensuring correct moisture content of the stored substance, cleaning and maintenance;

(e) the correct use, care and storage of personal protective equipment (PPE) including fall arrest equipment;

(f) dust, gas and fire risks that may be present and the controls adopted, including procedures to follow if equipment such as dust extraction fails;

(g) emergency and evacuation procedures, including: recognising the fire alarm, fire fighting measures, the location of fire fighting equipment and other emergency equipment, the use of fall arrest equipment, confined spaces entry procedures and rescue of entrapped persons;

(h) how to observe any administrative controls, such as restrictions on entry into containers, hot work permits, and warning signs including signs attached to the container;

(i) the dangerous goods classification or hazardous substances classification (if any) of container contents, and any other relevant dust or health risks arising from the contents;

(j) the dangers of the containers as confined spaces, and the confined spaces entry procedures (if entry into containers is planned, or required for emergency rescue – OHS Regulation clause 77);

(k) Use of fall arrest devices when used as a control measure.

(l) methods of consultation between the employer and employees (eg by OHS representative or OHS committee).

(m) risk management and implementation of the relevant control measures, including those described in this code of practice.

APPENDIX 1 – Relevant acts, regulations and health and safety guidance

ACTS AND REGULATIONS

Occupational Health and Safety Act 2000

Occupational Health and Safety Regulation 2001

Pesticides Act 1999

Pesticides Regulation 1995

NATIONAL STANDARDS

Exposure Standards for Atmospheric Contaminants in the Occupational Environment National Occupational Health and Safety Commission, 1995 (updated by notices in the *Chemical Gazette*). Note: clause 51 of the OHS Regulation makes these exposure standards mandatory.

APPROVED INDUSTRY CODES OF PRACTICE

Code of practice: Noise management and protection of hearing at work

Code of practice for the safe use and storage of chemicals (includes pesticides and herbicides) in agriculture

Code of practice for the safe use of pesticides including herbicides in non-agricultural workplaces

Code of practice for the design of safe bulk solids containers, including silos, field and chaser bins. (While not normally for users, this code provides advice if selecting a new container.)

AS 1657 – 1992 *Fixed platforms, walkways, stairways and ladders – design, construction and installation*

AS 1758 *Conveyors – Safety requirements*

AS/NZS 1891.2 – 2001 *Industrial fall-arrest systems and devices*

AS/NZS 1891.4: 2000 *Industrial fall arrest systems and devices – Part 4: Selection, use and maintenance*

AS/NZS 3760 *In-service safety inspection and testing of electrical equipment*

AS 4745 *Code of practice for handling combustible dusts.*

OTHER RELEVANT WORKCOVER GUIDES

Summary of the OHS Act 2000

Summary of the OHS Regulation 2001

Electrical equipment checklist

Hazpak! Making your workplace safer

Plant guide 2001

Plant hire and lease

Toxic gas in confined spaces

Your guide to rural safety

Do I have a noise problem?

Noise at work

Portable ladders

APPENDIX 2 – Check lists

This Appendix contains checklists to assist in identifying the common hazards and risks associated with bulk storage and handling.

The checklists are not meant to be comprehensive, as circumstances will vary from site to site. There could be other risks you need to assess.

Use the basic checklist below to see if any areas are relevant to your operation and need more detailed examination. Go through the basic checklist below – if an answer is 'no', then go to the detailed checklist indicated in the right hand column. This needs more investigation with a view to adopting appropriate control measures.

Basic checklist – start here

Check that procedures are in place	Yes or not applicable	No
1. Site selection and location • Is the ground area safe for the installation? • Has the container been installed and located in accordance with the manufacturer's instructions?		See checklist # 1 on page
2. Emergency procedures? • Are there emergency procedures in place for the site where the container or storage is installed?		See checklist # 2 on page
3. Signs • Are there appropriate signs in place to warn of hazards?		See checklist # 3 on page
4. Inspection and maintenance • Are regular inspections carried out? • Is there regular maintenance of the container and supports? • Is the container or walls of flatbed storage structurally sound?		See checklist # 4 on page
5. Structural safety and loading • Can the container support a full load of product?		See checklist # 5 on page
6. Ladders and access to heights • Are there methods in place to prevent unauthorised access to ladders? • Are there barriers to prevent persons falling from ladders or the roof, or are fall arrest device attachment points fitted?		See checklist # 6 on page
7. Access to inside the container • Are there barriers to prevent unauthorised entry? • Are there proper confined spaces procedures in place when people need to enter?		See checklist # 7 on page
8. Dust and gas health hazards • Have the likelihood of health hazards from dusts or gases generated been checked? • Have all ignition sources that could ignite a dust explosion been identified?		See checklist # 8 on page
9 Fire and explosion risk • Has the stored substance been checked to determine if it is classified as dangerous goods? • Are controls in place to prevent dust explosions or fires?		See checklist # 9 on page

10. Electricity • Are there safe working distances from overhead power lines? • Are electrical equipment and leads regularly checked? • Is electrical equipment protected from water and dust?		See checklist # 10 on page
11. Bulk handling plant for loading and unloading • Are augers and nip points guarded? • Are guards always replaced after clearing blockages or maintenance?		See checklist # 11 on page
12. PPE (Personal Protective Equipment) • Is PPE such as a dust mask, hearing protector or gloves provided where necessary?		See checklist # 12 on page
13. Training • Is a training program in place? • Have all workers been trained in safe working procedures with the container, storage area and associated equipment (such as augers)?		See checklist # 13 on page

Checklist 1.

Site – selection, preparation and installation

If the answer to a question is 'no' see the control measures in chapter 4

Has the proposed location of the container been evaluated?

Factors to consider	Yes	No	Not applicable
Can the ground or surface support the loads?			
Is drainage adequate to prevent flooding or subsidence of the foundations or land surface?			
Have foundations been installed in accordance with the container manufacturer's instructions?			
Are distances from overhead power lines sufficient for safe work procedures (eg using rods from the top hatch)?			
Can augers or other conveyors operate at a safe distance from overhead power lines?			
• Is access to load and unload trucks and chaser bins safe? (eg no danger of contact with power lines, level ground when tipping) • Is movement of mobile plant safe?			
Is access by vehicles to and from public roads safe?			
Are distances from other buildings and facilities sufficient to allow safe access and egress from work areas?			

Checklist 2

Emergency planning

If the answer to a question is 'no' see the control measures in section 2.5

Have all relevant factors been considered when developing emergency plans?

Factors to consider	Yes	No	Not applicable
Site emergency plan developed and communicated to workers?			
Site emergency plan includes procedure for alerting fire brigade?			
Means of rescue of a person trapped inside container available?			
Means to rescue a person suspended from a fall arrest system available?			
Procedures established for confined spaces entry?			
Evacuation procedure in event of fire established?			
Injection points for inert gas and availability of an adequate number of gas cylinders provided where necessary?			
Detectors for heat, smoke or fire fitted where necessary?			
Adequate fire fighting equipment and emergency equipment provided and regularly maintained?			
Procedure of not fighting fires inside silos and not opening hatches during fires or overheating adopted?			
Isolation, lockout and emergency stops procedure established for ancillary plant such as augers and conveyors (eg when clearing blockages or for operational maintenance)?			
Rescue procedures adopted, including preventing access by unauthorised persons during an emergency?			

Checklist 3

Signs displayed on each container

If the answer to a question is 'no' see the control measures in see section 2.7

Are suitable signs displayed warning of hazards and advising procedures?

Signage to consider	**Yes**	**No**	**Not applicable**
Confined space identified, with a warning at openings such as hatches?			
Signs at entry points and ladders to restrict entry – eg prohibiting entry by unauthorised persons?			
Allowable loads on conveyors or augers displayed?			
Allowable loads on ladders displayed?			
Outward opening hatches marked with a warning of streaming substance?			
Operating procedures for controls on equipment and plant, such as augers?			
Need for fall arrest device when climbing ladders or accessing elevated areas marked?			

Checklist 4

Inspection and maintenance

If the answer to a question is 'no' see the control measures in chapter 3

Do you have a procedure to regularly examine the container and ancillary plant for the following possible defects?

Factors to consider	Yes	No	Not applicable
Manufacturer's or supplier's operating manual consulted to determine inspection procedure, and frequency of inspection and maintenance?			
Metalwork – visual examination for damage, surface corrosion, bolts or welds?			
Damage to support struts (eg from vehicle collision)?			
Footings, foundations, slab or exposed plinths – visual check for settlement, cracking, damage to concrete?			
Access points – ladders, stairs, handles, platforms and other access points – visual inspection for corrosion and integrity (including fixing at attachment points)?			
Visual and operational checks for damage to hatches and latches, operation of hatches and control mechanisms?			
Visual checks for bulging of the container barrel or sides?			
Filling devices, unloading and discharge equipment (eg augers or conveyors), including guarding?			
Guarding of ladders and access maintained (eg locks in position)?			
Safety device attachments, safety line, harness or anchor points for integrity?			
Visual check of electrical equipment, including leads and cables for obvious damage? (see also check list 10 for electrical safety)			
Integrity of any seals or sealing devices checked?			
If pneumatic loading or unloading, or dust suppression is used have you checked: • air or dust filters, and dust control system for operation; cleanliness, integrity and dust tightness; • pressure relief valves for correct operation; • operation of any warning devices and high level detection systems?			
Warning signs and labels checked for wear and fading?			

Checklist 5

Structural safety and loading

If the answer to a question is 'no' see the control measures in chapter 4.

Are procedures in place to ensure loads and methods specified by the manufacturer are not exceeded?

Factors to consider	Yes	No	Not applicable
Is stored substance within specification (eg chop size, dryness)?			
Are loading and unloading rates within the manufacturer's specifications?			
Is off centre loading permissible, or does off centre loading need to be prevented?			
Are legs or supports protected from vehicle collision?			
Are field bins placed on a level surface?			
Is a policy in place to tow field bins only when empty and only with a rigid linkage?			
Are hatches kept closed during high winds to prevent collapse through low air pressure inside the container?			
• Have suitable anchorage points on the structure been identified for use as attachment points for fall arrest? • Are these anchorage points in suitable condition for safe use?			

Checklist 6

Ladders, access to top hatches and falls from heights

If the answer to a question is 'no' see the control measures in chapter 5.

Is there a risk of a person falling from an elevated position (either inside or outside of the container)?

If Yes: Go to factors to be considered below.

Factors to consider	Yes	No	Not applicable or not necessary
Can the need for access to heights and ladders be eliminated or reduced?			
Can the elevated position be accessed by a less hazardous means (eg can an inclined ladder be used instead of a vertical ladder)?			
Are there fall protection means such as guard railing and safety cages?			
Has the need to use a fall arrest device and harness been eliminated? (Fall arrest may not be necessary if other measures such as an inclined ladder and barriers are in place.)			
Are suitable attachment points available for fall arrest devices?			
Are suitable attachment points available for rescue devices?			
Has access to ladders been made inaccessible to unauthorised people including children?			

Checklist 7

Access to container interior – confined space and risk of entrapment in grain or other substances

- Is entry to the interior of the container necessary, or
- is there a risk of a person being entrapped in flowable substance such as grain?

If yes: Go to the factors to be considered below.

If the answer to a question below is 'no' see the control measures in chapters 6, 7 and 8.

Factors to be considered	Yes	No
Can some work tasks be carried out without entering the container?		
Are the access doors or barriers to the container locked to prevent unauthorised access?		
Are unauthorised people denied access to the inside of the container via ladders (eg by locking ladder covers)?		
Are children kept away from areas where machinery such as an auger is being used?		
Have provisions been made to prevent workers from entering the container through openings above the maximum level of stored substance?		
If a person needs to enter the container: • Has the potential for engulfment by the stored substance been identified? • Has the potential for atmospheric contamination or an unsafe atmosphere been identified? • Are checks made prior to entering the container from the bottom to ensure that there is no vertically crusted substance (eg grain) that can engulf a person? • Has an emergency procedure been put into place should a person become trapped? • Are there people outside the container who can help if the person becomes trapped? • Has a lifting equipment, harness and lifeline arrangement been provided for rescuing purposes? • Has the atmosphere within the container been tested for the presence of combustible gases, vapours, dusts and toxic agents? • Is the oxygen level in the container adequate (i.e. not less than 19.5%)? • Is there a possibility of recurrence of unsafe atmospheric conditions while the person is inside the container? • Has all associated equipment and plant been locked out and tagged prior to a person entering the container or bin? • Do workers wear safety harnesses equipped with properly fastened lines that will keep them above the stored substance in case of a fall? • Will the person be wearing an appropriate respirator with dust filter or self-contained breathing apparatus? • Are checks made to ensure that no one is in the container or bin prior to operating the loading or unloading equipment? • See also checklist 8 – Dust and gas health hazards.		

Checklist 8

Dust and gas health hazards

If the answer to a question is 'no' see the control measures in chapters 9 and 11.

Have potential dusts, moulds and gases generated by crops been identified?

Note that grain dust is classified as hazardous.

Factors to consider	Yes	No	Not applicable
Are there risks of dust generation during loading or unloading?			
Is dryness of crops or other contents monitored to prevent growth of moulds? Has water leaked in; is there a risk of rotting material creating hydrogen sulphide gas?			
Are procedures adopted to reduce dust generation?			
Are augers or conveyors covered to prevent dust release?			
Can mechanical handling be used to reduce dust generation?			
Are appropriate respirators available and used conforming to AS 1716?			
Is entry into containers and related areas restricted and the use of PPE adopted?			
Are accumulations of dust on equipment or in the container removed regularly (eg by cleaning)?			
Are stock feed sheds adequately ventilated to prevent nitrogen dioxide buildup (eg by using open windows and fans)?			
Is access between the container and feed shed sealed to prevent gas entering the feed room?			
Are administrative procedures adopted such as not opening or entering containers for at least three weeks after filling with chopped plant substance?			

Checklist 9

Fire and explosions risk

If the answer to a question is 'no' see the control measures in chapter 10

Have the fire and explosion risks been identified for the container contents, associated plant and any gases that may be generated?

Factors to consider	Yes	No	Not applicable
Has the stored substance been classified using the dangerous goods criteria?			
Are dangerous goods used in an associated process (eg hexane for solvent extraction of see oil or LP Gas for fuel)?			
Dust fire or explosion hazard possible? For example, is a dust cloud visible during loading or unloading?			
Is the stored substance likely to produce toxic or flammable gas?			
Have hazardous areas been classified: • Are explosive dusts possible? • Are flammable atmospheres possible?			
Have potential ignition sources been identified and controlled?			
Is protection or separation of electrical equipment adequate?			
Is the moisture content of the stored substance regularly checked to ensure it is within specification?			
Administrative procedures – is ventilation of work areas, or restrictions on entry necessary?			
Does the cleaning and maintenance program remove accumulated dust deposits?			
Is the filtration system regularly cleaned?			
For sealed or oxygen limiting containers – are seals maintained to ensure the risk of oxygen entering is minimised and that fumigant is contained?			
Has the policy of not fighting fires been adopted and workers informed?			
Is lighting protection necessary (to prevent lightning being an ignition source)?			
Are appropriate warning signs in place (eg dangerous goods diamond, 'no smoking', 'no naked flame')?			

Checklist 10

Electrical safety

If the answer to a question is 'no' see the control measures in chapter 12

Examine two key areas:

(i) location and distances from overhead power lines; and

(ii) electrically powered equipment and leads used.

Factors to consider	Yes	No	Not applicable
Has the position of overhead power lines been identified, voltage determined and safe working distances possible? See distances below.			
If poles are used to break crusted grain, are distances from power lines safe?			
Do travel routes of bins, trucks and augers avoid low power lines?			
Are augers always lowered when moved or towed?			
Have residual current devices (RCDs) been fitted to all power outlets?			
Is regular inspection of electrical equipment and leads (cords) carried out?			
Have all high risks with electrical equipment been identified – eg areas where it could be damaged or unsafe due to water penetration, abrasion, dust penetration?			
Is regular testing of high risk electrical equipment necessary due to potential damage?			
Safe working distances from power lines Work, or any part of an item of plant, should not come closer to overhead powerlines than the distances in the following table: **Voltage of cable** — **Safe working distance** Up to 132,000 v — 3 metre Above 132,000 up to 330,000 v — 6 metre Over 330,000 v — 8 metre When estimating these distances, include allowance for the following factors: the sag of the cables; any swing or sway of loads or plant; the effect of wind forces on plant or cables; and the height of the item of plant. You may need to contact the local electricity supplier to ascertain the line voltage and obtain advice on suitable distances and safety procedures.			

Checklist 11

Bulk handling plant and equipment for loading and unloading

If the answer to a question is 'no' see the control measures in chapter 13.

Have the risks of using plant for loading and unloading the container been identified and controlled?

Factors to consider	Yes	No	Not applicable
Are moving parts of augers or other conveyors adequately guarded to prevent human contact?			
Are guards always replaced after maintenance or clearing blockages?			
Have distances from overhead powerlines been checked before moving or using an auger? (See distances in check list 10 Electrical safety.)			
Are augers always lowered when moved?			
Is the terrain level and stable to avoid the plant (eg auger or conveyor) tipping over?			
Has the potential for noise and hearing loss when using the auger or other plant been identified and controlled?			
Is PPE necessary to protect against hearing loss when using the auger or other plant?			
If a pneumatic transfer system is used, has the potential for over pressure been identified and suitable controls in place?			
Have the risks from vehicle movements been identified and controls adopted?			
Do methods ensure that auger or conveyor discharge rates are within the manufacturer's specifications?			
Are procedures or guards in place to minimise dust generation from augers?			
Are lock out and tagging procedures used to prevent inadvertent starting of augers or conveyors (eg during clearing of blockages or operational maintenance)?			
Have augers or conveyors been selected that conform to AS 1755 *Conveyors – safety requirements*?			

Checklist 12

Personal protective equipment (PPE)

If the answer to a question is 'no' see the advice in chapter 16.

Check that suppliers provide you with PPE that conforms to appropriate Australian Standards listed below, to ensure that it is effective.

Relevant design Standards for protection	**Yes**	**No**	**Not applicable**
Breathing: AS/NZS 1716 *Respiratory protective devices*			
Hearing: AS/NZS 1270 *Acoustics – Hearing protectors*			
Eyes: AS/NZS 1337 *Eye protection for industrial applications*			
Hands: AS/NZS 2161 *Occupational protective gloves*			
Fall protection: AS/NZS 1891 *Industrial fall-arrest systems and devices*			

Checklist 13

Training

For further advice see chapter 17.

Have relevant training needs been identified?

Factors to consider in training where relevant. Has training included:	**Yes**	**No**	**Not applicable**
Safe work methods (including those identified in the manufacturers operating manual or instructions)?			
Training in the use of: • tools • plant (eg augers) • substances • fumigants (eg appropriate certificate of competency)?			
Moisture content of stored grain or fodder?			
Care, use, storage and maintenance of personal protective equipment (PPE)?			
Emergency procedures, first aid and injury reporting?			
Observing restrictions on entry into the container?			
Observing warning signs (including those on the container)?			
Observing hot work permit systems for maintenance involving cutting, welding or grinding?			
The hazardous nature of the contents, risks from dusts and the control measures to be adopted (eg PPE)?			
Containers as confined spaces and confined spaces entry procedure?			
Use of fall arrest devices in relation to access (including use when climbing ladders)?			

APPENDIX 3 – Emergency procedures if a person is accidentally trapped in flowing grain

Persons should not enter or walk on grain in a container. However, if a person has entered and become trapped, the following advice may assist rescue. This involves risks and rescues often fail. Rescuers could also become victims.

Successful rescues have involved the following procedures:

(a) If the grain should start to flow, the trapped person should stay near the outer wall of the container and keep walking.

(b) A person covered by flowing grain should cup their hands over the mouth and take short breaths.

(c) Rescuing a person trapped in moving grain is dangerous for both the rescuer and victim. Several precautions should be taken before beginning any rescue attempt. A lifeline should be passed to the victim to prevent them further sinking into the grain. Always assume that the entrapped victim is alive. Never start an unloading auger or open a gravity flow gate. The victim could be drawn into the auger or become wedged in the opening. If the rescuer must enter the container, the rescuer should wear a body harness with a safety rope tied to at least two other rescuers on the roof of the container.

(d) When rescuing a person partially submerged in grain, it may be possible for another person to enter the container and rescue the victim. Lower a rescue squad member into the container to reassure the victim and attach a body harness or lifeline to the victim. Do not try to pull the victim free with the lifeline because it could cause more injuries. Check the victim's airway for grain and try to keep the victim calm.

(e) Use a shield to prevent greater entrapment if there is danger of further grain collapse. A steel drum with both ends removed, plywood or pieces of sheet metal formed into a circle and shored to resist pressure have all been used successfully. Once the shield is in place, it may be possible to free the victim by scooping grain from inside the shielded area.

APPENDIX 4 – Legal duties relating to health, safety and welfare at work

A4.1 Duties of employers

Section 8 of the NSW *Occupational Health and Safety Act 2000* (OHS Act) places an absolute obligation on employers to ensure the health, safety and welfare of employees, and must also ensure that other people at the place of work are not exposed to risks to their health and safety arising from the employer's undertaking.

Employers must:

- Ensure the work premises and means of accessing and exiting the workplace are safe and without risks to health.
- Ensure that all plant and substances workers use or are exposed to are safe and will not expose them to risks to their health when properly used.
- Ensure that the work practices and procedures and the working environment are safe and without risks to health.
- Provide such information, instruction, training and supervision as may be necessary to ensure the employees health and safety at work.
- Provide adequate facilities for the welfare of employees while they are at work.

Under the NSW *Occupational Health and Safety Regulation 2001* (OHS Regulation), employers and self-employed persons must:

- identify foreseeable hazards that may arise from their undertaking and have the potential to harm health and safety at the place of work,
- assess the risks (that is, the likelihood and severity of any risk that someone might be hurt from the hazards),
- eliminate (or if this is not reasonably practicable) control the risks, and
- review the risk assessment when necessary and any measures adopted to control the risk.

This process is known as OHS Risk Management. Employers must do this in consultation with employees.

A4.2 Consultation

The OHS Act requires employers to consult with their employees to enable the employees to contribute to the making of decisions affecting their health, safety and welfare at work. This is particularly important when assessing risks, choosing control measures and when making changes to the work.

Consultation must occur when:

- Changes that may affect health, safety or welfare are proposed to the:
    - work premises;
    - systems or methods of work; or
    - plant or substances used for work.
- Risks to health and safety arising from work are assessed or reviewed.
- Decisions are made about the measures to be taken to eliminate or control those risks.
- Introducing or altering the procedures for monitoring those risks.

- Decisions are made about the adequacy of facilities for employee welfare.
- Decisions are made about the procedures for consultation.

For guidance on the consultation process refer to the WorkCover Code of practice: *Occupational Health and Safety Consultation*.

A4.3 Duties of self-employed persons

Section 9 of the OHS Act requires persons who are self-employed to ensure that people are not exposed to risks to their health and safety arising from the self-employed person's undertakings while they are at the place of work.

Under the OHS Regulation, self-employed persons have similar duties to employers in relation to other persons at the place of work.

Examples of self–employed persons involved in farm bulk storage and handling include farmers, contractors and truck drivers.

While self-employed persons do not have a duty to protect their own health and safety, following the recommendations in codes of practice and guides will assist.

A4.4 Duties of controllers of work premises, plant or substance

Section 10 of the OHS Act sets out the duties of persons who have control of work premises, plant or substances as follows:

- A person who has control of premises used by people, as a place of work must ensure that the premises are safe and without risks to health.
- A person who has control of any plant or substance used by people at work must ensure that the plant or substance is safe and without risks to health when properly used.

A place of work is essentially any place where persons work. Examples of places of work include any premises, any installation on land or any moveable structure.

Examples of persons who have control of work premises, plant or substances related to farm bulk handling and storage include:

- owners who lease bulk handling facilities, premises, farms or equipment
- persons who have, under any contract or lease, an obligation to maintain containers, augers, conveyors and other bulk handling equipment.

A4.5 Duties of employees

A person who works under a contract of employment or apprenticeship is an 'employee'.

Section 20 of the OHS Act requires employees to:

- Take reasonable care for the health and safety of people at the employee's workplace and who may be affected by the employee's acts or omissions at work; and
- Cooperate with the employer or other person so far as is necessary to enable them to comply with any obligations imposed on them under the OHS Act or the regulations.

The OHS Regulation requires employees to notify the employer of any matter that may effect compliance with the Regulation.

A4.6 Coordination of duties and multiple responsibilities

Note that a responsibility may fall on more than one person, in which case the parties need to ensure that their responsibilities are discharged in a coordinated manner (OHS Regulation, clause 8).

Similarly, one person may have several of the responsibilities described above.

A4.7 The meaning of 'reasonably practicable'

NSW legislation requires employers to do certain things when it is 'practicable' or 'reasonably practicable'. This code of practice also uses these words. This term is not defined in legislation, but has been considered in case law.

Deciding what is 'reasonably practicable' means having regard, as the context permits, to:

- the risk, including the likelihood and severity of the hazard or risk,
- the state of knowledge about the hazard or risk and ways of eliminating or controlling these,
- the availability and suitability of ways of averting, eliminating or controlling the hazard or risk,
- the cost of implementing the ways of averting, eliminating or controlling the hazard or risk.

These factors need to be weighed up against one another and applied to the circumstances of each case. This is an objective test, depending on the actual circumstances in each case.

While the advice given in this publication is for your guidance in weighing these factors, you may need legal advice on applying the obligations under the Act and Regulation to your particular situation and circumstances.

A4.8 Fires and explosions – prescribed risk control measures

The OHS Regulation, in clause 62 specifies the following measures. Note that in this clause, a reference to an employer is also a reference to the duty of a self-employed person.

(1) An employer must ensure that risks associated with fire or explosion at a place of work are controlled by:

  (a) eliminating activities that have the potential to generate flammable or explosive atmospheres from the work process or, if elimination is not possible, minimising the potential for flammable or explosive atmospheres by providing adequate ventilation, and

  (b) eliminating potential ignition sources, including naked flame, hot work and electrical equipment, and sources of static electricity, including friction, welding and slipping belts, from proximity to flammable substances, combustible dusts or waste substances, and

  (c) enclosing work areas containing flammable or explosive atmospheres, and

  (d) removing waste substances and accumulated dust on a regular basis, and

  (e) providing for adequate storage, transportation and disposal of flammable substances, and

  (f) any other measures necessary to control the risks.

(2) If flammable substances, combustible dusts or waste substances are present at a place of work, an employer must monitor the place regularly to ensure:

(a) the removal, on a regular basis, of waste substance, including dust, that could pose a fire or explosion hazard, and

(b) the continued effectiveness of control measures taken with respect to potential ignition sources.

A4.9 Manual handling

Clause 81 of the OHS Regulation requires that and employer in carrying out a risk assessment must take into consideration (where relevant) the following factors:

- actions and movements (including repetitive actions and movements)
- workplace and workstation layout
- working posture and position
- duration and frequency of manual handling
- location of loads and distances moved
- weights and forces
- characteristics of loads and equipment
- work organisation
- work environment
- skills and experience
- age
- clothing
- special needs (temporary or permanent)
- any other factors considered relevant by the employer, the employees or their representatives on health and safety issues.

Disclaimer

This appendix is intended to provide advice only and is not to be construed as waiving or modifying any legal obligation. To ensure compliance with legal obligations, refer to the *Occupational Health and Safety Act 2000* and the *Occupational Health and Safety Regulation 2001*.

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