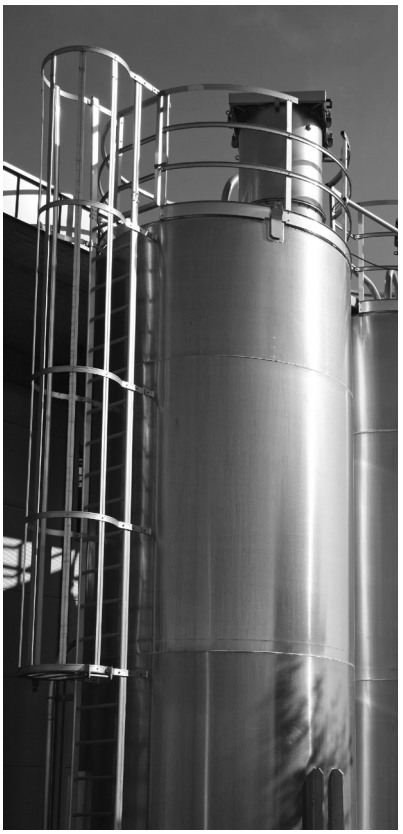
DRAFT

Code of Practice
CONFINED SPACES



safe work australia

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FOREWORD

This Code of Practice on how to manage the risks associated with confined spaces in workplaces is an approved code of practice under section 274 of the *Work Health and Safety Act* (WHS Act).

An approved code of practice is a practical guide to achieving the standards of health, safety and welfare required under the WHS Act and the Work Health and Safety Regulations (the WHS Regulations).

A code of practice applies to anyone who has a duty of care in the circumstances described in the code. In most cases, following an approved code of practice would achieve compliance with the health and safety duties in the WHS Act, in relation to the subject matter of the code. Like regulations, codes of practice deal with particular issues and do not cover all hazards or risks which may arise. The health and safety duties require duty holders to consider all risks associated with work, not only those for which regulations and codes of practice exist.

Codes of practice are admissible in court proceedings under the WHS Act and Regulations. Courts may regard a code of practice as evidence of what is known about a hazard, risk or control and may rely on the code in determining what is reasonably practicable in the circumstances to which the code relates.

The WHS Act and Regulations may be complied with by following another method, such as a technical or an industry standard, if it provides an equivalent or higher standard of work health and safety than the code.

An inspector may refer to an approved code of practice when issuing an improvement or prohibition notice.

This Code of Practice has been developed by Safe Work Australia as a model code of practice under the Council of Australian Governments' *Inter-Governmental Agreement for Regulatory and Operational Reform in Occupational Health and Safety* for adoption by the Commonwealth, state and territory governments.

A draft of this Code of Practice was released for public consultation on 7 December 2010 and was endorsed by the Workplace Relations Ministers Council on [*to be completed*].

How to use this code of practice

This code of practice includes references to both mandatory and non-mandatory actions. The references to legal requirements contained in the WHS Act and Regulations (highlighted in text boxes in this Code) are not exhaustive and are included for context only.

The words 'must', 'requires' or 'mandatory' indicate that legal requirements exist, which must be complied with.

The word 'should' indicates a recommended course of action, while 'may' indicates an optional course of action.

PURPOSE

This Code provides practical guidance on how to meet the requirements under the WHS Regulations in relation to work carried out in a confined space.

SCOPE

This Code covers the identification of hazards, assessment and control of risks associated with confined spaces in workplaces.

1. INTRODUCTION

1.1 Who should use this Code?

You should use this Code if you are a person conducting a business or undertaking and have management or control of a confined space. You should also use this Code if you design, manufacture or supply plant or a structure that includes a confined space.

This Code will help you determine when a space is a 'confined space' for purposes of the WHS Regulations, what the potential hazards are and how to eliminate or minimise the risks when carrying out work in a confined space.

This Code can also be used by workers and their health and safety representatives who need to understand the hazards and risks associated with confined spaces.

1.2 What is a confined space?

A confined space is determined by the hazards associated with a set of specific circumstances and not just because work is performed in a physically restrictive location.

The [draft] WHS Regulations define a confined space as an enclosed or partially enclosed space that:

- is not designed or intended primarily to be occupied or entered by a person; and
- has a restricted means of entry and exit; and
- is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space; and
- presents a risk to health and safety from:
    - an atmosphere that does not have a safe oxygen level, or
    - contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or
    - harmful concentrations of any airborne contaminants, or
    - engulfment.

Confined spaces include spaces such as those in a vat, tank, pit, pipe, duct, flue, oven, chimney, silo, container, pressure vessel, underground sewer, wet or dry well, shaft, trench, tunnel or other similar enclosed or partially enclosed structure, which meet the definition of a confined space in the WHS Regulations.

A confined space does not include a mine or the workings of a mine.

1.3 What are the health and safety duties in relation to a confined space?

Confined spaces pose dangers because they usually have poor ventilation which allows hazardous atmospheres to develop quickly, especially if the space is small. The hazards are not always obvious and may change from one entry to the next.

Workers may enter confined spaces to carry out work unaware that they are entering a potentially hazardous work environment. The risks of working in confined spaces include:

- loss of consciousness, injury or death due to the immediate effects of airborne contaminants
- fire or explosion from the ignition of flammable contaminants
- difficulty rescuing and treating an injured or unconscious person, and

- asphyxiation resulting from oxygen deficiency or immersion in stored material, such as grain, sand, flour or fertiliser.

The WHS Regulations include specific obligations in relation to confined spaces, summarised below:

Duty holder	Responsibilities
Person conducting a business or undertaking	• Must, so far as is reasonably practicable, identify all hazards and assess all risks associated with work in a confined space • Minimise risks to health and safety associated with work in a confined space where it is not reasonably practicable to eliminate risks • Ensure a worker does not enter a confined space until all duties in relation to the confined space have been complied with including entry permit requirements • Establish first aid and rescue procedures to be followed in the event of an emergency in the confined space; and ensure emergency procedures are practiced so they are efficient and effective • Ensure that relevant workers are provided with suitable and adequate information, training and instruction in relation to hazards, risk control measures, the contents of any confined space entry permit and emergency procedures • Review, and if necessary, revise risk control measures (including underlying hazard identifications and risk assessments) if there is evidence that the controls no longer adequately address the relevant hazards • Keep certain records relating to work in confined spaces
Designers, manufacturers and suppliers of a confined space	• Eliminate the need for workers to enter a confined space or, if this is not reasonably practicable, ensure safe means of entry and exit and minimise risks to the health and safety of any person who enters the confined space.

Deciding what is ‘reasonably practicable’ to protect people from harm requires weighing up certain matters, including the likelihood of a hazard or risk occurring and the degree of harm that would result, and then making a judgement about what is reasonable in the circumstances.

Workers must take reasonable care for their own health and safety and that their work does not adversely affect the health and safety of other persons. Workers must comply with any reasonable instructions given relating to confined space entry permits, risk control measures and emergency procedures, and should carry out work in a confined space in accordance with any relevant information and training provided to them.

Emergency service workers are not required to comply with some requirements for entering confined spaces when either rescuing a person or providing first aid to a person in a confined space.

The WHS Regulations also set out requirements for specific risk controls including: communication and safety monitoring, signs, isolation of connected plant and services and controls to maintain a safe atmosphere within the confined space.

1.4 What is involved in managing the risks?

A step-by-step process

You must identify all hazards associated with work in a confined space and understand the level of risk so that you can make the right decisions about how to eliminate or minimise risks to health and safety, before a worker enters the confined space.

This process is known as *risk management* and involves the following four steps set out in this Code:

- identify hazards
- assess the risks associated with the hazards
- control the risks, and
- review control measures to ensure they are working as planned.

Further guidance on the risk management process generally is available in the *Code of Practice: How to Manage Work Health and Safety Risks.*

Consulting your workers

The WHS Act requires that you consult, so far as is reasonably practicable, with workers who carry out work for you who are (or are likely to be) directly affected by a work health and safety matter.

If the workers are represented by a health and safety representative, the consultation must involve that representative.

Consultation with your workers and their health and safety representatives is a critical part of managing work health and safety risks.

You must consult your workers who are involved in carrying out work in or near a confined space during the process of identifying hazards, assessing risks and implementing control measures.

It is often more effective to involve a team of people in the risk management process to draw on a range of knowledge and experience, such as:

- knowledge of the particular confined space under assessment
- any work methods that will be used in or on the confined space, and
- confined space hazards and control measures.

Consulting, co-operating and co-ordinating activities with other duty holders

The WHS Act requires that you consult, co-operate and co-ordinate activities with all other persons who have a work health or safety duty in relation to the same matter, so far as is reasonably practicable.

Sometimes you may share responsibility for health and safety in relation to a confined space with other business operators who are involved in carrying out work in the confined space, for example common service pits. In these situations, effective communication, co-operation and co-ordination of activities between duty holders is essential to ensure that risks associated with the confined space are eliminated or minimised as far as is reasonably practicable.

Similarly, if you engage a contractor to carry out work in a confined space at your workplace, then both of you will have duties under the WHS Regulations. You must work together with the contractor to plan the job, discuss any safety issues that may arise and how duties will be discharged, such as preparing confined space entry permits and providing information, instruction and training to workers.

Further guidance on consultation is available in the *Code of Practice: How to consult on work health and safety.*

1.5 How to determine whether a space is a confined space

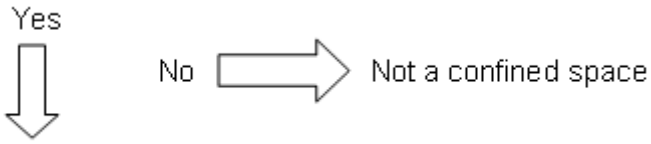
Asking the following questions will help you determine whether a space is a 'confined space' for purposes of the WHS Regulations.

A. Is the space enclosed or partially enclosed and not designed to be primarily occupied or entered by a person?

Places such as offices and workshops are intended for human occupancy and generally have adequate ventilation, lighting and safe means of entry and exit. This means that these kinds of workplaces are not confined spaces for purposes of the WHS Regulations.

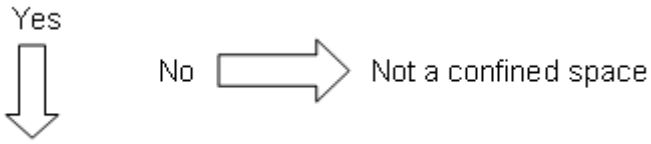
Some enclosed or partially enclosed spaces may have atmospheric contaminants that are harmful to persons but are designed for a person to occupy, for example abrasive blasting or spray painting booths. These would also generally not be confined spaces.

The size of the space is not relevant when working out whether a space is a confined space for purposes of the WHS Regulations.



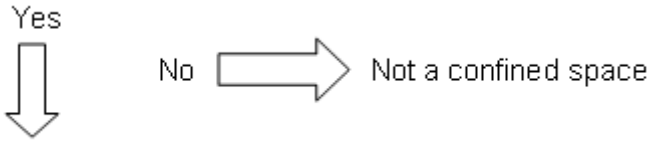
B. Is it likely to be entered and is it at normal atmospheric pressure while a person is in the space?

Entry to a confined space is considered to have occurred when a person's head or upper body enters the space, or if the person is close enough to the opening that there is a risk that they could accidentally enter the confined space (for example, if they are overcome by harmful gases).



C. Does the space have a restricted means of entry and exit?

The entry or exit to the space may be restricted by the size of the opening and/or its location. This may affect whether the space is physically difficult to get in or out of and whether it would be difficult to remove an injured or unconscious person from the space.



D. Does the space present a risk from a dangerous atmosphere or a risk of engulfment?

A space is a confined space if it meets all of the other criteria for confined spaces (if the answer is 'yes' to A, B and C above) and it presents a risk to health and safety from one or more of the following:

- an atmosphere that does not have a safe oxygen level (a safe oxygen level means an oxygen content in air of between 19.5% – 23.5%), or

- contaminants, including airborne gases, vapours and dusts, that may cause injury from fire or explosion, or
- harmful concentrations of any airborne contaminants, or
- engulfment from any substance, for example:
    - any liquid such as oil or water in which a person can drown
    - any solid such as fly ash, grain, sawdust and sand that can flow and form a temporary cavity or bridge, which may collapse and surround a person, cutting off their air supply.

Airborne contaminants are considered to be harmful if they are present at a concentration above the allowable exposure standard for the contaminant, or if the airborne contaminant is likely to have an adverse health effect.

A space may become a confined space if work that is to be carried out in the space would generate harmful concentrations of airborne contaminants. Temporary control measures such as providing temporary ventilation or achieving a satisfactory pre-entry gas test will not cause a confined space to be declassified.

Appendix A provides examples to illustrate how a confined space is determined.

Status of a space may change

Whether or not a particular space is a confined space, for purposes of the WHS Regulations, may change.

For example, a brand-new road tanker that is clean and has never held any substances is not a confined space for purposes of the WHS Regulations, even if a person enters it. That is because there is no risk from a dangerous atmosphere as the tanker has never held any dangerous substances. It becomes a confined space, however, once it has held dangerous substances and entry is required to carry out maintenance work.

Just because a space is not a confined space for purposes of the WHS Regulations doesn't mean that it is safe to enter. For example using an LPG forklift in a cool room can be dangerous if it generates harmful levels of carbon monoxide gas in the cool room. The cool room itself is not a confined space, but the duty to ensure health and safety under the WHS Act means that steps must be taken to eliminate or minimise risks to health or safety.

2. ROLE OF DESIGNERS, MANUFACTURERS AND SUPPLIERS

The design, manufacture or modification of any plant or structure that includes a confined space is critical. Thoughtful design can eliminate the need to enter a confined space and will therefore eliminate the associated risks. The design stage should consider the whole life cycle of the plant or structure, from manufacture and use through to demolition and disposal.

2.1 Eliminating or minimising the need to enter a confined space

Under the [draft] WHS Regulations, designers, manufacturers and suppliers of plant or structures must eliminate the need to enter a confined space. If this is not reasonably practicable, then:

- the need to enter the space must be minimised so far as is reasonably practicable
- the space must be designed with a safe means of entry and exit, and
- the risk to the health and safety of any person who enters the space must be eliminated or minimised as far as is reasonably practicable.

The following features should be incorporated in the design and manufacturing stages:

- provision of outlets and facilities for cleaning, to eliminate the need for entry
- use of lining materials that are durable, require minimal cleaning and do not react with materials contained in the confined space, and
- design of the structure and mechanical parts to provide for safe and easy maintenance, to reduce the need for persons to enter.

2.2 Entry and exit

If it is not reasonably practicable to eliminate the need to enter the confined space, then any risk associated with entry to and exit from the space must be minimised. Entry to and exit from a confined space is safer when openings (access points) are large enough for persons and equipment to pass easily through them. Where relevant, the following features should be incorporated at the design, manufacture and installation stages:

- Access points (including those within the confined space, through divisions, partitions or obstructions) should be large enough to allow people wearing the necessary protective clothing and equipment to pass through, and to permit the rescue of all people who may enter the confined space.
- A safe means of access to and within the confined space, such as fixed ladders, platforms and walkways should be provided. Further guidance is available in *AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation*.
- Access points should be unobstructed by fittings or equipment that could impede rescue and should also be kept free of any obstructions during work in the confined space. If equipment such as electrical cables, leads, hoses and ventilation ducts are required to pass through an access hole, a second access point may be needed.
- There should be enough access points to provide safe entry to and exit from the confined space. For example, the spacing of access holes on sewers (or in the case of large gas mains, the absence of such access holes over considerable lengths) may affect both the degree of natural ventilation and the ease with which persons can be rescued.

3. HOW TO IDENTIFY THE HAZARDS

Identifying hazards involves finding all of the things and situations that could potentially cause harm to people. The types of substances previously stored in a confined space (however briefly) will indicate the sorts of hazards that may be present. Substances stored in a confined space may result in a lack of oxygen, airborne contaminants or a flammable atmosphere within the confined space. Other hazards may arise from work activities, products or by-products in or around the confined space.

3.1 What hazards are associated with a confined space?

Restricted entry or exit

Small entrances and exits make it very difficult to rescue injured workers or to get equipment in or out of the space, especially personal protective equipment (such as respirators needed in spaces with hazardous atmospheres) or life-saving equipment when rescue is needed. In some cases, entrances and exits may be very large but difficult to access. Access to pits or openings high up in silos may require the use of ladders, hoists or other devices, and escape and rescue from such spaces may be very difficult in emergency situations.

Harmful airborne contaminants

The following table illustrates the kinds of harmful atmospheres that may be present in a confined space, and how they may be created.

Source	Examples
Substance stored in the confined space or its by-product(s)	—build-up of hydrogen sulphide in sewers and pits —release of toxic substances such as hydrogen sulphide in tanks of decomposing organic material, especially when the material is disturbed
Work performed in the confined space	—use of paints, adhesives, solvents or cleaning solutions —welding or brazing with metals capable of producing toxic fumes —exhaust fumes from engines used in the confined space —painting or moulding glass-reinforced plastics
Entry of natural contaminants such as groundwater and gases into the confined space from the surrounding land, soil or strata	—acid groundwater acting on limestone with potential to produce dangerous accumulations of carbon dioxide —methane released from groundwater and from decay of organic matter
Release of airborne contaminants	—when sludge, slurry or other deposits are disturbed or when scale is removed

Source	Examples
Manufacturing process	—residues left in tanks, vessels etc, or remaining on internal surfaces can evaporate into a gas or vapour
Entry and accumulation of gases and liquids from adjacent plant, installations, services or processes	—the contamination of underground confined spaces by substances from plant in the vicinity of the confined space —carbon monoxide from the exhaust of LPG-powered forklifts operating in or in the vicinity of the confined space

Unsafe oxygen level

The air we breathe normally contains 21% oxygen by volume, although oxygen levels of 19.5% — 23.5% by volume are considered to be safe.

Some situations can cause the level of oxygen to dramatically decrease, leading to an oxygen-deficient atmosphere and possible asphyxiation. This may occur for example if oxygen in the atmosphere is:

- displaced by gases produced during biological processes, such as methane in a sewer
- displaced during purging of a confined space with an inert gas to remove flammable or toxic fumes
- consumed and therefore depleted inside metal tanks and vessels through surface oxidation (e.g. when rust forms)
- consumed during combustion of flammable substances, or
- absorbed or reacts with grains, chemicals or soils in sealed silos.

Too much oxygen may also pose risks to health and safety. Oxygen-enriched atmospheres can increase the risk of fire or explosion. Oxygen-enriched atmospheres may occur if:

- chemical reactions cause the production of oxygen, for example certain reactions with hydrogen peroxide, or
- there is a leak of oxygen from an oxygen tank or fitting while using oxy-acetylene equipment.

Fire and explosion

A fire or explosion requires the presence of three elements: an ignition source, air and a fuel (gas, vapour or dust) capable of igniting. A flammable atmosphere is one in which the flammable gas, vapour or dust is likely to exceed 5% of its lower explosive limit (LEL).

Flammable atmospheres in confined spaces may result from the evaporation of a flammable residue, flammable materials used in the space, a chemical reaction (such as the formation of methane in sewers), or from the presence of combustible dust (such as that in flour silos).

If an ignition source, such as a sparking or electrical tool, including from static on a person is introduced into a space containing a flammable atmosphere, an explosion is likely to result.

Engulfment

Engulfment means to be swallowed up in or be immersed by material, which may result in asphyxiation. Examples of stored materials that may pose a risk of engulfment include plastics, sand, liquids, fertiliser, grain, coal, coal products, fly ash and animal feed. Stored materials such as sand and grain can form a crust or bridge when a container is emptied from below, leaving the top

layer in place. Workers walking on the bridge or working below the bridge on the floor of the container may be engulfed if a bridge collapses (see Figure 1).

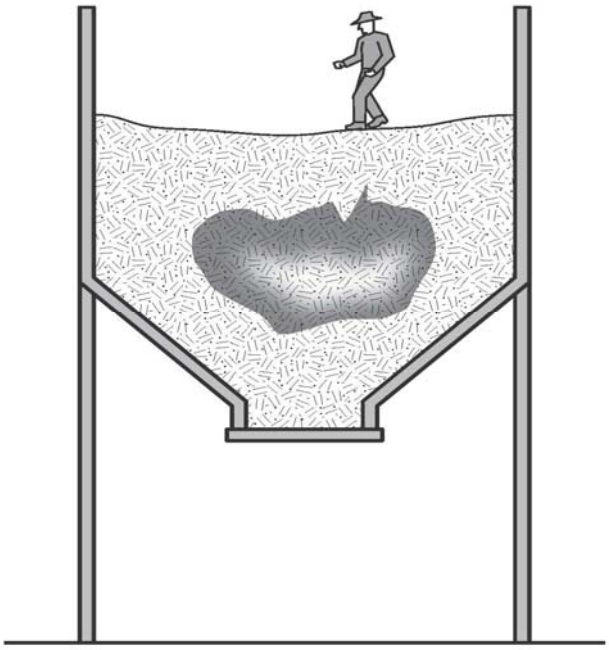


Figure 1: *Example of 'bridging' which may result in engulfment*

3.2 Other hazards

Uncontrolled introduction of substances
The uncontrolled introduction of substances such as steam, water or other liquids, gases or solids may result in drowning, being overcome by fumes or other harm depending on the nature of the substance.

Vehicles and LPG forklifts operating close to the opening of the confined space can cause a build-up of exhaust gases, including carbon monoxide, in the space.

Biological hazards
Contact with micro-organisms, such as viruses, bacteria or fungi, may result in infectious diseases, dermatitis or lung conditions such as hypersensitivity pneumonitis. Sewers, grain silos and manure pits are examples of confined spaces where biological hazards may be present.

Mechanical hazards
Exposure to mechanical hazards associated with plant may result in entanglement, crushing, cutting, piercing or shearing of parts of a person's body. Sources of mechanical hazards include plant such as augers, agitators, blenders, mixers and stirrers.

Electrical hazards
Electrical hazards may cause electrocution, shocks or burns, and can arise from cables, transformers, capacitors, relays, exposed terminals and wet surfaces where electrical circuit and electrically powered plant are used.

Skin contact with hazardous substances
The nature of a confined space could give rise to an increased likelihood of skin contact with surface contaminants. Skin contact with hazardous substances may result in immediate health effects such as burns, irritation or allergic dermatitis, or longer-term systemic effects.

Noise
Noise generated in a confined space from the use of plant, the work method or process may be amplified due to reflections off hard surfaces. Exposure to hazardous noise may result in hearing loss, tinnitus and other non-auditory health effects. Hazardous noise may also prevent workers hearing warning signals and distract workers from their work.

Further guidance is available in the *Code of Practice: Managing Noise and Preventing Hearing Loss at Work.*

Manual tasks
Hazards arising from manual tasks may be exacerbated by physical constraints associated with working in a confined space. Additional hazards may arise from the use of personal protective equipment that restricts movement, grip and mobility.

Further guidance is available in the *Code of Practice: Hazardous Manual Tasks.*

Radiation
The health effects associated with radiation depend on the type of radiation involved. Sources of radiation include radioactive sources, x-rays, lasers, welding flash, radio frequency and microwaves.

Environmental hazards
Environmental hazards associated with work in a confined space may cause or contribute to harm. Examples of environmental hazards include:

- heat or cold stress arising from the work, process or conditions
- slips, trips and falls arising from slippery surfaces or obstacles, and
- inadequate lighting.

Further guidance is available in the *Code of Practice: Managing the Work Environment and Facilities.*

Hazards outside the confined space
Where the confined space has a vertical opening, there is a risk that people could fall in. Persons at risk include those assisting the confined space entry (such as the standby person) and pedestrians.

Traffic hazards are a concern where confined space entrances or exits are located on footpaths or roads. There is the potential for workers entering or exiting the space to be struck and injured by vehicle traffic.

Work done outside the space, but near openings to it, can contaminate the atmosphere inside the space. A common example is the exhaust gases from an internal combustion engine. There may also be potential for fire or explosion where hot work is done in areas next to confined spaces that contain flammable atmospheres.

Additional physiological and psychological demands
Working in a confined space may impose additional physiological and psychological demands over and above those encountered in a normal working environment. Consideration should be given to your worker's:

- physical ability
- ability to work in a restrictive space (e.g. claustrophobia), and
- ability to wear the personal protective equipment required to do the work (e.g. respirators).

4. HOW TO ASSESS THE RISKS

A risk assessment involves considering what could happen if someone is exposed to a hazard and the likelihood of it happening. Assessing the risks will help you take the correct action to eliminate or minimise the risks.

The [draft] WHS Regulations requires a person conducting a business or undertaking to assess all health and safety risks associated with the identified hazards.

The risk assessment for a confined space must be documented and a copy kept for 2 years. A confined space entry permit may be used as a record of the risk assessment.

When undertaking a risk assessment to determine the risks requiring control, you should consider:

- the atmosphere in the confined space, including whether testing or monitoring is to be undertaken
- the risk of engulfment of a person
- all proposed work activities, particularly those that may cause a change to the conditions in the confined space.
- the number of persons occupying the space
- the soundness and security of the overall structure and the need for lighting and visibility
- the identity and nature of the substances last contained in the confined space
- any risk control measures needed to bring the confined space to atmospheric pressure
- the number of persons required outside the space:
    - to maintain equipment essential for the task being undertaken within the confined space
    - to provide continuous communication with the persons within the confined space, and
    - to properly initiate emergency response procedures
- risks associated with other hazards, such as noise or electricity
- arrangements for emergency response, e.g. first aid and resuscitation
- the physiological and psychological demands of the task and the competency of persons involved in the tasks or emergency response duties
- the adequate instruction of persons in any required procedure, particularly those which are unusual or non-typical, including the use and limitations of any personal protective equipment and other equipment to be used
- the availability and adequacy of appropriate personal protective equipment and emergency equipment for all persons likely to enter the confined space
- the need for additional risk control measures, including—
    - prohibiting hot work in adjacent areas
    - prohibiting smoking and naked flames within the confined space and adjacent areas
    - avoiding contamination of breathing air from operations or sources outside the confined space, e.g. from the exhaust of an internal combustion engine
    - prohibiting movement of equipment such as forklifts in adjacent areas, and

- prohibiting spark generating equipment, clothing and footwear

- whether purging or cleaning in the confined space is necessary
- whether hot work is necessary, and
- conditions that could impede entry and exit or the conduct of the tasks in the confined space, e.g. plant layout, dimensions, manual handling and ergonomic aspects of the task activity.

Atmospheric testing and monitoring

Testing and monitoring the atmosphere in a confined space is a routine part of determining appropriate risk controls.

Any atmospheric testing and monitoring in a confined space should be carried out by a competent person using a suitable, correctly calibrated gas detector. It may be necessary to test the atmosphere for:

- oxygen content
- airborne concentration of flammable contaminants, and
- airborne concentration of potentially harmful contaminants (e.g. hydrogen sulphide, carbon monoxide and methylene chloride).

A person's senses should never be used to determine if the air in a confined space is safe. Many toxic or flammable gases cannot be seen or smelt and the level of oxygen in the air cannot be determined using one's senses.

Initial testing should be done from outside the confined space by inserting a sample probe at appropriately selected access holes, nozzles and openings. Because contaminants can settle at different levels, the top, middle and bottom of the space should all be tested (see Figure 2).

For example, some gases (such as hydrogen sulfide) are heavier than air and in unventilated areas will settle to the bottom of the space, while other gases (such as methane) are lighter than air and will collect at the top of the space. You should test a sufficient number of points to accurately reflect areas of the space that are likely to be accessed.

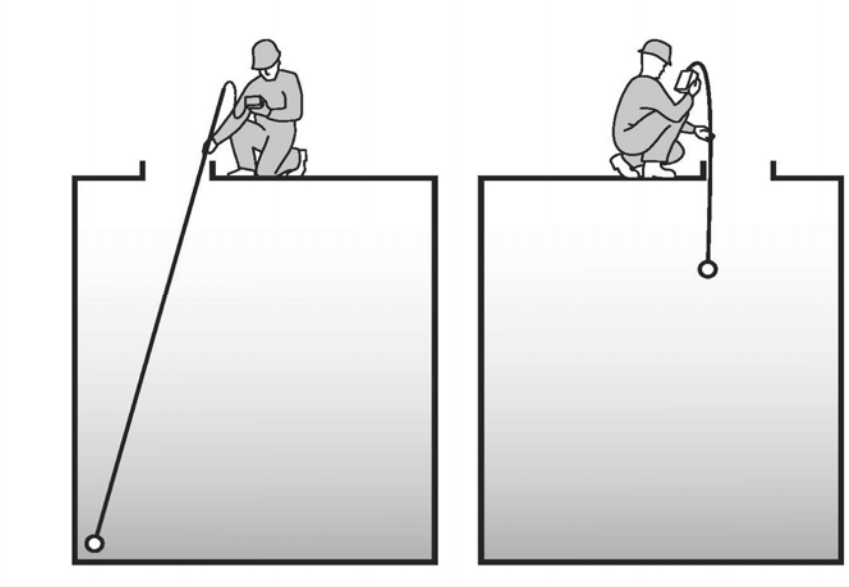


Figure 2: *Atmospheric testing of remote regions and different levels within the confined space.*

If it is necessary to enter the space to test remote regions away from entrances or access holes, then air-supplied respiratory equipment must be worn and the entry must be undertaken in accordance with the WHS Regulations using a confined space entry permit.

Generic risk assessment

If you are responsible for a class of confined spaces in a number of different work areas or workplaces and the confined spaces are the same, you may perform a single (or generic) risk assessment. This will only be appropriate if all of the hazards being covered are the same. You must carry out a risk assessment on individual confined spaces if there is any likelihood that a worker may be exposed to greater, additional or different risks.

5. HOW TO CONTROL THE RISKS

The most important step in the risk management process involves controlling risks by eliminating them so far as is reasonably practicable, or if that is not possible, by minimising the risks so far as is reasonably practicable.

The [draft] WHS Regulations require risks associated with working in a confined space to be eliminated. Where this is not reasonably practicable, the risks must be minimised. The Regulations require you to consider the following matters:

- the nature of a confined space
- if the hazard is associated with any airborne contaminant or unsafe level of oxygen
- the work to be carried out in the confined space, the range of methods by which the work can be carried out, and the proposed method
- the means of entry to and exit from the confined space, and
- the type of emergency procedures required.

5.1 Eliminate the need to enter a confined space

You must try to eliminate any risk associated with work in a confined space and therefore the first question you need to ask is: can the work be carried out without entering the confined space?

You could carry out work from outside the confined space by, for example:

- installing fixed or temporary cleaning devices such as spray balls using high-pressure hoses inserted through an access hatch to clean the inside of a tank
- using remote cameras or a mirror attached to a probe for internal inspection of vessels
- using remotely operated rotating flail devices, vibrators or air purgers to clear blockages in silos, or
- using a hook, long-handled clasp or magnet on a string to retrieve an object dropped into space.

5.2 Minimise the risks

If entering a confined space cannot be avoided, then a safe system for working inside the space must be implemented. The identified hazards will help determine what controls are needed to minimise any risk associated with work in the confined space. Under the WHS Regulations, you must consider the following matters:

The nature of the space

The nature of a confined space may contribute to the risks associated with it. For example, you should consider:

- the temperature of the space so that it will not cause heat stress, and
- providing adequate lighting if there is poor visibility.

The level of oxygen and airborne contaminants

The level of oxygen and airborne contaminants is a significant contributor to the risk of working in a confined space. You should ensure that:

- the level of oxygen is maintained at a safe level and any airborne contaminants in the space are minimised by ventilating prior to and/or during entry
- any changes that may occur to oxygen or airborne contaminants are determined by testing the atmosphere, and

- where the atmospheric conditions can not be maintained at a safe level, appropriate respiratory protective equipment is provided.

The work and work method
Consideration should be given to whether the proposed work or work process will introduce any new hazards or contribute to the risks of working in the confined space. Ignition sources must not be introduced into a space that contains a flammable atmosphere.

You should select a work process that:
- minimises the release of harmful atmospheric contaminants into the space
- reduces the time spent in the space or the number of people that have to enter the space, and
- eliminates the risk of engulfment.

You should consider any risks associated with the use of personal protective equipment (PPE) in a confined space. Using PPE may introduce new risks for those working in the space, such as the weight or discomfort of protective clothing and hearing protection.

Entry and exit
In taking the means of entry and exit into account, you should consider:
- the number, size and location of entrances and exits
- entry and exit routes
- equipment to be used to gain entry and exit, and
- whether entrances and exits are adequate to enable the rapid exit and rescue of workers from the space.

Emergency procedures
When things go wrong in a confined space, people may be exposed to serious and immediate danger. Effective arrangements for raising the alarm and carrying out rescue operations in an emergency are essential (see chapter 6 of this code).

5.3 Entry permits

A confined space entry permit provides a formal check to ensure all elements of a safe system of work are in place before people are allowed to enter the confined space. It also provides a means of communication between site management, supervisors and those carrying out the work and ensures that the person conducting the business or undertaking has checked and authorised the entry to the confined space and it is safe to proceed.

The [draft] WHS Regulations state that a worker must not be allowed to enter a confined space unless a confined space entry permit is issued for the proposed work in the confined space.

The permit must be completed in writing by a competent person and:
- specify the confined space to which the permit relates
- record the names of persons permitted to work in or on the confined space and the period of time that the work will be carried out
- set out risk control measures, and
- allow for an acknowledgement that work in the confined space has been completed and all persons have left the space.

You must keep a copy of each entry permit for 2 years.

A competent person is one who has acquired through training, qualification or experience, the knowledge and skills to carry out this task.

You must ensure that a confined space entry permit is issued for each entry into the confined space. Each permit only applies to one confined space and allows one or more workers to enter that space.

A confined space entry permit is also required, where reasonably practicable, in relation to a person who enters a confined space in order to conduct the initial hazard identification or risk assessment.

The confined space entry permit must list:

Requirement	
Confined space to which the permit applies	The permit pro-forma should be designed and completed in such a way as to enable clear identification and recording of the space that each permit form applies to. A single permit can be used for multiple entries into a space and can be used where there is more than one access point into a single space.
Name of any worker permitted to enter the space	
Period of time that the permit is in operation	A permit may be valid for up to 24 hours, but it may be for a work shift or less. The permit should be re-validated if the person with direct control of work in the space changes, a break in work continuity occurs, changes are made to the work that introduce hazards not addressed by the current permit, or new risk controls are needed.
Measures to control the risk	List the control measures that need to be implemented before work commences, including the isolation of plant and services, purging, ventilation, atmospheric testing, cleaning and signage. List the control measures that need to be implemented or continued while work is being done in the space, such as ventilation, continuous monitoring, respiratory protective equipment and personal protective equipment. List any equipment to be taken into the confined space, including any exclusions such as ignition sources. List any specialist emergency rescue equipment required.

The entry permit must be used as a written record that all workers have exited the confined space on completion of the work. It should be displayed in a prominent place to facilitate signing and clearance. You must make sure each worker can understand the entry permit.

The information on the entry permit may be used as a suitable record of the risk assessment that has been carried out. An example of an entry permit is provided at *Appendix B.*

5.4 Isolation

You must ensure all potentially hazardous services are isolated prior to any person entering the confined space.

If gas, fumes or vapour could enter the confined space the pipe work needs to be physically isolated. In all cases, you should physically confirm that the isolation is effective.

Isolate to prevent:

- the introduction of contaminants or conditions through piping, ducts, vents, drains, conveyors, service pipes and fire protection equipment
- the activation or energising of machinery in the confined space
- the activation of plant or services outside the confined space that could adversely affect the space (such as heating or refrigerating methods)
- the release of any stored or potential energy in plant, and
- the inadvertent use of electrical equipment.

Isolation measures such as physically locking, tagging, closing and blanking (see Figure 3) should be supervised or checked at each isolation point. Isolation measures should be supported by systems to ensure that the isolation measures are not removed until all work is complete and all workers have left the space.

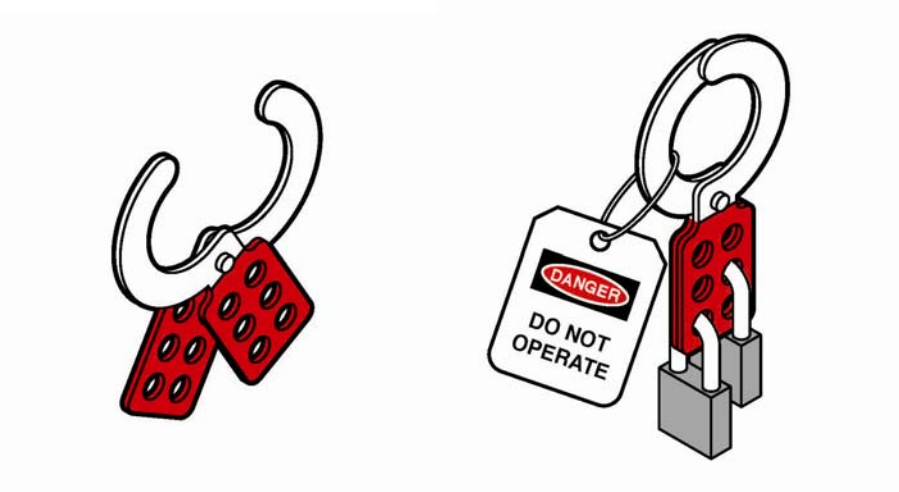


Figure 3: *Example of tag and lockout with the padlocks of two workers.*

Methods of isolation from materials, contaminants or conditions include isolating in accordance with one of the methods described below or by an alternative method ensuring at least an equivalent level of safety:

- Removing a valve, spool piece or expansion joint in piping leading to the confined space (as close as practicable to the space) and blanking or capping the open end of the piping (see Figure 4). The blank or cap should be tagged to indicate its purpose. Blanks or caps should be made of a material that is compatible with the liquid, vapour or gas with which they are in contact. The material should also have sufficient strength to withstand the maximum operating pressure, including surges, which can build up in the piping.
- Inserting a suitable full-pressure spade or blank in piping between the flanges as close as practicable to the confined space (see Figure 5). The full-pressure spade or blank should be tagged to indicate its purpose.
- Closing, locking and tagging at least two valves in the piping leading to the confined space (see Figure 6). A drain or vent valve between the two closed valves should be locked open to atmosphere as part of this method.

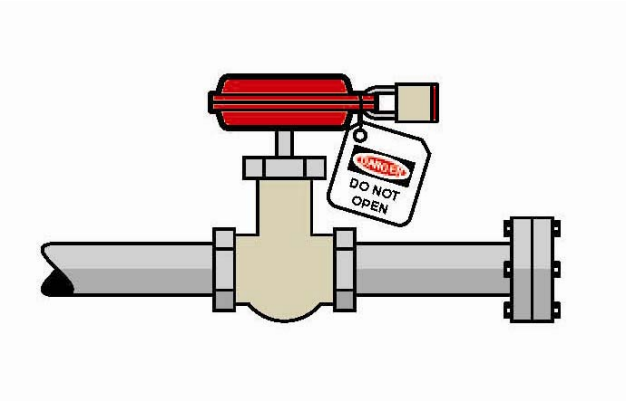


Figure 4: *Open end of pipe capped. Nearest valve closed locked and tagged.*

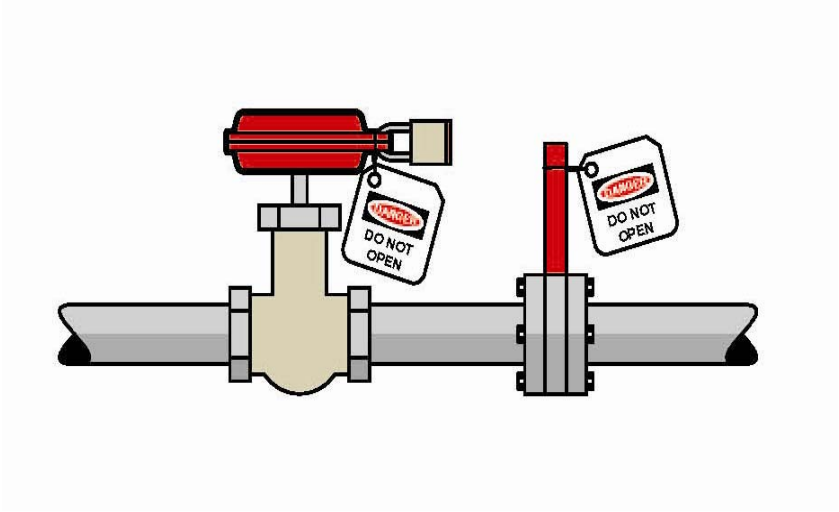


Figure 5: *Insertion of full pressure spade or blank. Nearest valve closed, locked and tagged. Spade is also tagged to indicate its purpose.*

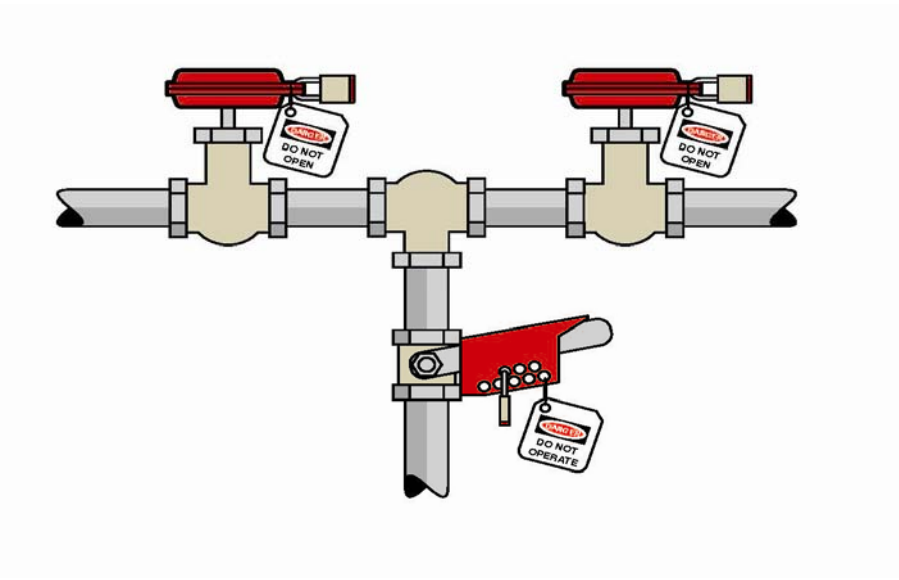


Figure 6: *Closing, locking and tagging at least two valves*

Before entry is permitted to any confined space that can move, or in which agitators, fans or other moving parts that may pose a risk to workers are present, the possibility of movement should eliminated.

Equipment or devices with stored energy, including hydraulic, pneumatic, electrical, chemical, mechanical, thermal or other types of energy, should be reduced to a zero energy condition so that no energy is left in devices and systems which could cause injury or illness.

If the confined space has agitators, blades and other moving equipment, you should consider chocking, wedging, chaining or removing these parts. Alternatively, you should de-energise, lockout and tag out machinery, mixers, agitators and other equipment containing moving parts in the confined space. This may require additional isolation, blocking or de-energising of the machinery itself to guard against the release of stored energy.

When a lock is used, the key should be kept in the possession of the person placing the lock. Spare keys should not be accessible except in emergencies. The tag should indicate that a person is in the confined space and that such isolation should not be removed until all people have left the confined space.

Examples where this procedure may be used include:

- an open circuit breaker or open isolating switch supplying electrical power to equipment with hazardous moving parts
- where a power source cannot be controlled readily or effectively, a belt or other mechanical linkage needs to be disconnected and tagged.

5.5 Atmosphere

A safe atmosphere must be ensured, as far as is reasonably practicable, during work in a confined space. A safe atmosphere in a confined space is one that:

- has a safe oxygen level
- is free of airborne contaminants or any airborne contaminants are in concentrations below their allowable exposure standard (if any), and
- any flammable gas or vapour in the atmosphere is at concentrations below 5% of its LEL.

You can achieve a safe atmosphere within the confined space using methods such as cleaning, purging and ventilation.

Flammable gases and vapours

Where a flammable atmosphere may exist in a confined space, you should take all reasonably practicable steps, including cleaning, purging and ventilation to achieve an atmosphere that is not likely to be flammable.

A worker must not enter a confined space if the concentration of flammable contaminants in the atmosphere is 5% of its lower explosive limit (LEL) or more or the oxygen content of the atmosphere exceeds 23.5%.

If the worker has already entered or is already working in the confined space and the concentration is between 5% and 10% of LEL, the worker must leave the confined space unless the space is being continuously monitored with a suitably calibrated flammable gas detector. If at any time the flammable vapour concentration reaches 10% or more of its LEL, the confined space must be immediately evacuated.

Where a flammable atmosphere may exist in a confined space and there is a risk of fire and explosion, all ignition sources in the vicinity must be eliminated.

Examples of potential ignition sources, both inside and outside the space, include:

- open flames and hot surfaces
- electrical equipment
- internal combustion engines
- metal tools striking metal surfaces
- spark-producing equipment such as grinding wheels, and
- static electricity.

Purging

Purging is done using an inert gas, such as nitrogen, to clear flammable gases or vapours before work in the confined space begins.

After purging, the confined space needs to be adequately ventilated with sufficient fresh air to ensure that the inert gas is removed. Purging should be done in a way that ensures any contaminants removed from the confined space are expelled to a location where they present no further risk.

When flammable contaminants are to be purged, purging and ventilation equipment designed for use in hazardous areas needs to be used. A hazardous area is an area in which an explosive atmosphere is present, or may be expected to be present, in quantities that may require special precautions for the construction, installation and use of potential ignition sources.

The WHS Regulations prohibit pure oxygen or gas mixtures with oxygen in concentration greater than 21% by volume being used for purging or ventilating a confined space because of the risk of increased flammability.

You must ensure the space is purged where a risk assessment identifies the potential for the confined space to contain an unacceptable level of contaminants. .

Ventilation

Ventilation of a confined space with fresh air, by natural, forced or mechanical means, may be necessary to establish and maintain a safe atmosphere. Ventilation needs to be continued for as long as anyone is in the confined space.

If the confined space has sufficient openings then natural ventilation may be adequate, but in most cases mechanical ventilation is likely to be needed.

Consideration should also be given to where the fresh air is drawn from and where the exhaust air is finally vented to, so that the fresh air is not contaminated either by exhaust air or by other pollutants, and the exhaust air does not cause other risks.

Mechanical ventilation may be either local exhaust ventilation (LEV) or dilution ventilation. LEV is effective where the source of contaminant generation is localised, the extraction point can be located close to the source and adequate make-up air is available (e.g. capture or extraction of welding fume).

Where dilution ventilation is used, air needs to be introduced in a way that will ensure effective circulation throughout the confined space, taking account of the configuration of the space, the position of the openings and the properties of the contaminants.

During operations likely to generate contaminants, mechanical ventilation equipment may not be adequate or sufficiently reliable to maintain contaminants at acceptable levels or to ensure a safe oxygen level. Where mechanical ventilation equipment is likely to be necessary to maintain acceptable contaminant levels in a confined space, the equipment should:

- be monitored to ensure continuous operation while the confined space is occupied, and
- have the controls (including any remote power supply) clearly identified, tagged and protected to guard against unauthorised interference.

Respiratory protective equipment

If it is not reasonably practicable to ensure the confined space contains a safe oxygen level, or safe levels of airborne contaminants, then appropriate respiratory protective equipment must be provided.

Respiratory protective equipment refers to a range of breathing equipment, including air-supplied and self-contained breathing apparatus. You should determine the appropriate respiratory protective equipment based on the level and type of contaminants, and the work to be done. Whenever there is any doubt about the type of respiratory protective equipment required, a conservative approach should be adopted (i.e. use air-supplied respiratory equipment).

There are specific requirements under the [draft] WHS Regulations if air-supplied respiratory equipment is provided, including that the equipment is maintained so that it supplies air:

- at a pressure of at least 170L/min
- with an oxygen level that is not less than 19.5% and not more than 22%.

5.6 Communication and safety monitoring

A communication system is needed to enable communication between people inside and outside the confined space and to summon help in an emergency.

Depending on the conditions in the confined space, communication can be achieved by voice, radio, hand signals or other suitable methods.

Before a worker enters a confined space, you must assign a standby person to continuously monitor the wellbeing of those inside the space, observe the work being carried out and initiate appropriate emergency procedures when necessary. The standby person should never enter the space to attempt rescue and should have the authority to order workers to exit the space if any hazardous situation arises.

The [draft] WHS Regulations require the person conducting a business or undertaking to ensure that a system of work is provided for:

- continuous communication with the worker from outside the confined space, and
- monitoring conditions within the confined space by a standby person who is in the vicinity of the confined space, and if practicable, observing the work being carried out.

5.7 Entry and exit procedures

For the entire period that the confined space entry permit is valid, you should have procedures to ensure that you know when any worker is in the space. Appropriate systems to indicate when workers are in the space include the use of tags, a system of signing in and out on the entry permit, or having a standby person record who is in the space.

5.8 Signs and barricades

Before any work in relation to a confined space starts, you must ensure signs are erected to prevent entry of persons not involved in the work.

Signs must warn against entry by people other than those who are listed on the confined space entry permit, and must be placed at each entrance to the confined space. Signs must be in place while the confined space is accessible, including when preparing to work in the space, during work in the space and when packing up on completion of the work.

Signposting alone should not be relied on to prevent unauthorised entry to a potential confined space. Security devices such as locks and fixed barriers should be installed.

5.9 Information, instruction and training

The [draft] WHS Regulations requires a person conducting a business or undertaking to provide relevant workers with suitable and adequate information, training and instruction.

You must keep a copy of all training provided to your workers for a period of 6 months or for the duration of the worker's engagement, whichever is longer.

You must provide workers and their supervisors with the skills and knowledge they need to understand the hazards associated with working in the confined space, the contents of any confined space entry permit, and the control measures implemented for their protection.

Training must be provided to workers who:

- enter or work in confined spaces
- work in the vicinity of an entry to a confined space
- undertake hazard identification or risk assessment in relation to a confined space
- implement risk control measures
- issue entry permits
- manage or supervise people working in or near confined spaces, including any contractors
- act as a standby person or communicate with workers in a confined space
- monitor conditions while work is being carried out, and
- design or lay out a work area that includes a confined space.

The training provided to workers must cover:

- the nature of all hazards associated with a confined space
- the need for and appropriate use of risk control measures
- the contents of any relevant confined space entry permit
- the emergency procedures, and
- the selection, use, fit, testing and storage of any personal protective equipment.

Retraining or refresher training should be provided as appropriate for a particular workplace. The frequency of this training should depend on how often workers are required to carry out tasks associated with entry to or work in confined spaces.

5.10 Maintenance of control measures

Proper maintenance of control measures is an integral part of any safe system of work. Maintenance may involve visual checks, inspections, testing of equipment, preventative maintenance and remedial work. Equipment that should be regularly inspected includes:

- atmospheric testing and sampling equipment
- personal protective equipment including respirators
- ventilation equipment
- safety harness and lines, and
- emergency rescue equipment.

6. EMERGENCY PROCEDURES

The [draft] WHS Regulations require a person conducting a business or undertaking to establish first aid and rescue procedures and ensure those procedures are practiced as necessary to ensure that they are efficient and effective.

The person conducting a business or undertaking must also ensure that openings for entry and exit are a sufficient size to allow emergency access; openings are not obstructed; and any plant, equipment and personal protective equipment that is provided for first aid or emergency rescue is maintained so that it is fit for purpose.

When establishing emergency procedures, you should take into account:

- the nature of the confined space
- all hazards associated with the concentration (or any change in the concentration) of oxygen and/or airborne contaminants
- work to be done in the confined space and the work method
- work done outside the confined space, and
- means of entry and exit

Consideration should also be given to:

Relevant considerations	Questions
Location of the confined space	What is the geographic location of the space, how accessible is it in an emergency and how far away is it from appropriate medical facilities?
Communications	How can workers working inside the space communicate to people outside in an emergency? Exactly how will the alarm be raised and by whom? Planning needs to ensure that rescue and emergency personnel can access the workplace during night shift, weekends and holiday periods.
Rescue and resuscitation equipment	What kinds of emergencies are contemplated? The provision of suitable rescue and resuscitation equipment will depend on the potential emergencies identified. Selected rescue equipment should be kept in close proximity to the confined space so that it can be used immediately.
Capabilities of rescuers	Are rescuers properly trained, sufficiently fit to carry out their task and capable of using any equipment provided for rescue (e.g. breathing apparatus, lifelines and fire-fighting equipment)? How will rescuers be protected during the emergency operation?
First aid	Is appropriate first aid available for immediate use? Are trained first aiders available to make proper use of any necessary first aid equipment?

Relevant considerations	Questions
Local emergency services—if they are to be relied on for rescue	How will the local emergency services (e.g. fire brigade) be notified of an incident? What information about the particular dangers in the confined space will be given to them on their arrival? Have prior arrangements been made with local emergency services to ensure they are able to respond in a reasonable time, and have the specialist confined space retrieval equipment readily available?

You must ensure that first aid and rescue procedures are implemented as soon as reasonably practicable in the event of an emergency.

Workers performing rescue must be provided with and wear air-supplied respiratory protective equipment if they enter a confined space in an emergency or carry out emergency procedures in a confined space arising from an unsafe oxygen level or an atmosphere that has a harmful concentration of any airborne contaminant.

If a person inside a confined space has been overcome by lack of oxygen or airborne contaminants, entry for rescue should always be assumed to be unsafe without the use air-supplied respiratory protective equipment.

Potential problems with the size of entrances and exits must be identified and assessed during the hazard identification and risk-control process, and addressed in the development of emergency and rescue procedures. Where openings are found to be inadequate, their size should be increased, or if this is not practicable alternative safe means of entry and exit should be provided.

You must ensure the emergency procedures are practiced with relevant workers to demonstrate that the specific rescue plan for the space is effective.

7. HOW TO REVIEW CONTROL MEASURES

It is important to monitor risks and check the control measures to ensure they remain effective. A review of the risk management steps must be undertaken whenever there are any changes associated with the confined space or the work procedures.

The [draft] WHS Regulations require the person conducting a business or undertaking to review, and as necessary revise a risk assessment and associated control measures if:

- before any change is made to a thing or system of work that may affect the health and safety of a worker carrying out work in a confined space
- a new hazard associated with the work in a confined space is identified or new or additional information about a known hazard becomes available
- a notifiable incident occurs in relation to a confined space
- a risk control measure does not control the risk, or
- a health and safety representative at the workplace requests a review.

In undertaking the review, you should consult the workers involved in the confined space work and their health and safety representatives and consider the following questions:

- Are the control measures working effectively in both their design and operation?
- How effective is the risk assessment process? Are all hazards being identified?
- Are workers actively involved in the risk management process? Are they openly raising health and safety concerns and reporting problems promptly?
- Have new work methods or new equipment made the job safer?
- Are safety procedures being followed?
- Has instruction and training provided to workers been successful?
- If new legislation or new information becomes available, does it indicate current controls may no longer be the most effective?

If problems are found, go back to any point in the risk management process, review your information and revise your decisions about risk controls.

APPENDIX A – CONFINED SPACE CRITERIA

Description of the space and activity	Confined space criteria						Confined space?
	A	B	C	D			If the answer to A, B, C and at least one of D is yes, then the space is a confined space.
	Is the space intended to be entered by a person, enclosed or partially enclosed?	Is it likely to be entered and is it at normal atmospheric pressure?	Does the space have a restricted entry or exit?	Does the space present a risk from:			
				Harmful airborne, flammable contaminants	An unsafe oxygen level	Engulfment	
Sewer with access via a vertical ladder	✓	✓	✓	✓	✓	✓	Yes
Dislodging grain from a silo with sole access through a manhole at the top of the silo	✓	✓	✓	✗	✗	✓	Yes
Stocktake using LPG forklifts in a fruit cool store	✓	✓	✗	✓	✗	✗	No
Cleaning spilled cadmium pigment powder in a shipping container	✓	✓	✗	✗	✗	✗	No
Inspecting a fuel tank in the wing of an aircraft	✓	✓	✓	✓	✗	✗	Yes
Dislodging a sludge blockage in a drain pit	✓	✓	✓	✓	✓	✗	Yes
Internal inspection of a new clean tank prior to commissioning	✓	✓	✓	✗	✗	✗	No
Internal inspection of an empty cement silo through a door at ground level	✓	✓	✗	✗	✗	✗	No
Blood pit with access via a vertical ladder	✓	✓	✓	✓	✓	✗	Yes

Confined space entry permit

General

Location of work _____

Description of work _____

_____

_____

Control measures

Isolation

Space needs to be isolated from: _____

	Location/method
Water/gas/steam/chemicals	
Mechanical/electrical drives	
Auto fire extinguishing systems	
Hydraulic/electric/gas/power	
Sludge/deposits/wastes	

Locks and/or tags have been affixed to isolation points Yes ❑ No ❑

Atmosphere:

The atmosphere in the confined space has been tested:

Result of test:

Oxygen	_____	% LEL	
Flammable gases	_____	% LEL	
		% LEL	
Other gases			
	_____	ppm (less than	ppm)
	_____	ppm (less than	ppm)

Other airborne contaminants: _____

_____

_____

SAMPLE ONLY

The conditions for entry are as marked below:

1. With supplied air breathing apparatus Yes ❑ No ❑
2. Without respiratory protection Yes ❑ No ❑
3. With escape unit Yes ❑ No ❑

Hot work

Area clear of all combustibles including atmosphere	Yes ❑	No ❑
Type of appropriate fire prevention equipment available:		
Suitable access and exit	Yes ❑	No ❑
Hot work is permitted	Yes ❑	No ❑

Personal protective equipment

The following safety equipment must be worn:

	Type
Respiratory protection	
Harness/lifelines	
Eye protection	
Hand protection	
Footwear	
Protective clothing	
Hearing protection	
Safety helmet	
Communication equipment	
Other	

Other precautions

Warning notices/barricades	Yes ❑	No ❑
All persons have been trained	Yes ❑	No ❑
Ventilation requirements		

Emergency response

Procedures/Equipment

Standby person

Standby person personnel/requirements:

Authority to enter

The control measures and precautions appropriate for the safe entry and execution of the work in the confined space have been implemented and persons required to work in the confined space have been advised of and understand the requirements of this written authority.

Signed (*person in direct control*): _____

Date: _____ Time: _____

This written authority is valid until: _____

Date: _____ Time: _____

Persons required to enter confined space

I have been advised of and understand the control measures and precautions to be observed with the entry and work in the confined space.

Entry			Exit		
Name	**Date**	**Time**	**Name**	**Date**	**Time**

Withdrawal of written authority

All persons and equipment accounted for Yes ❑ No ❑

Equipment checked and restored correctly Yes ❑ No ❑

Signed (*person in direct control*): _____

Date: _____ Time: _____

Remarks or comments about the work: _____