RIIWHS202E
Enter and work in confined spaces

Student Manual

GetSkilled Australia

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Introduction

Confined spaces pose dangers because they are usually not designed to be areas where people work.

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

Confined space training is necessary to be able to identify a confined space and then follow the correct procedures to conduct the work safely.

Unfortunately, the multiple deaths that often occur within a confined space are those of the rescuers of the first casualty. For this reason, we urge you to take this training very seriously as do most sites within Australia where a breach of policy and procedure often leads to instant dismissal.

The risks of working in confined spaces include:

- loss of consciousness, impairment, 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
- asphyxiation resulting from oxygen deficiency or immersion in a free-flowing material, such as liquids, grain, sand, fertiliser or water.

Most of the source information in this manual is from AS/NSZ 2065:2009 and Confined Spaces Codes of Practice and must be used in conjunction with:

- Legislation
- Company policy and procedures
- Site policy and procedures
- Manufactures guidelines and instructions

Course Outcomes

Successful completion of this course will provide you with the skills and knowledge required to enter and work in confined spaces in the resources and infrastructure industries, including to:

- Plan and prepare for working in confined space,
- Working and maintaining communication in confined space,
- Exiting confined space, and
- Cleaning up and processing written records.

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 small space.

Regulation 5: A confined space means an enclosed or partially enclosed space that:

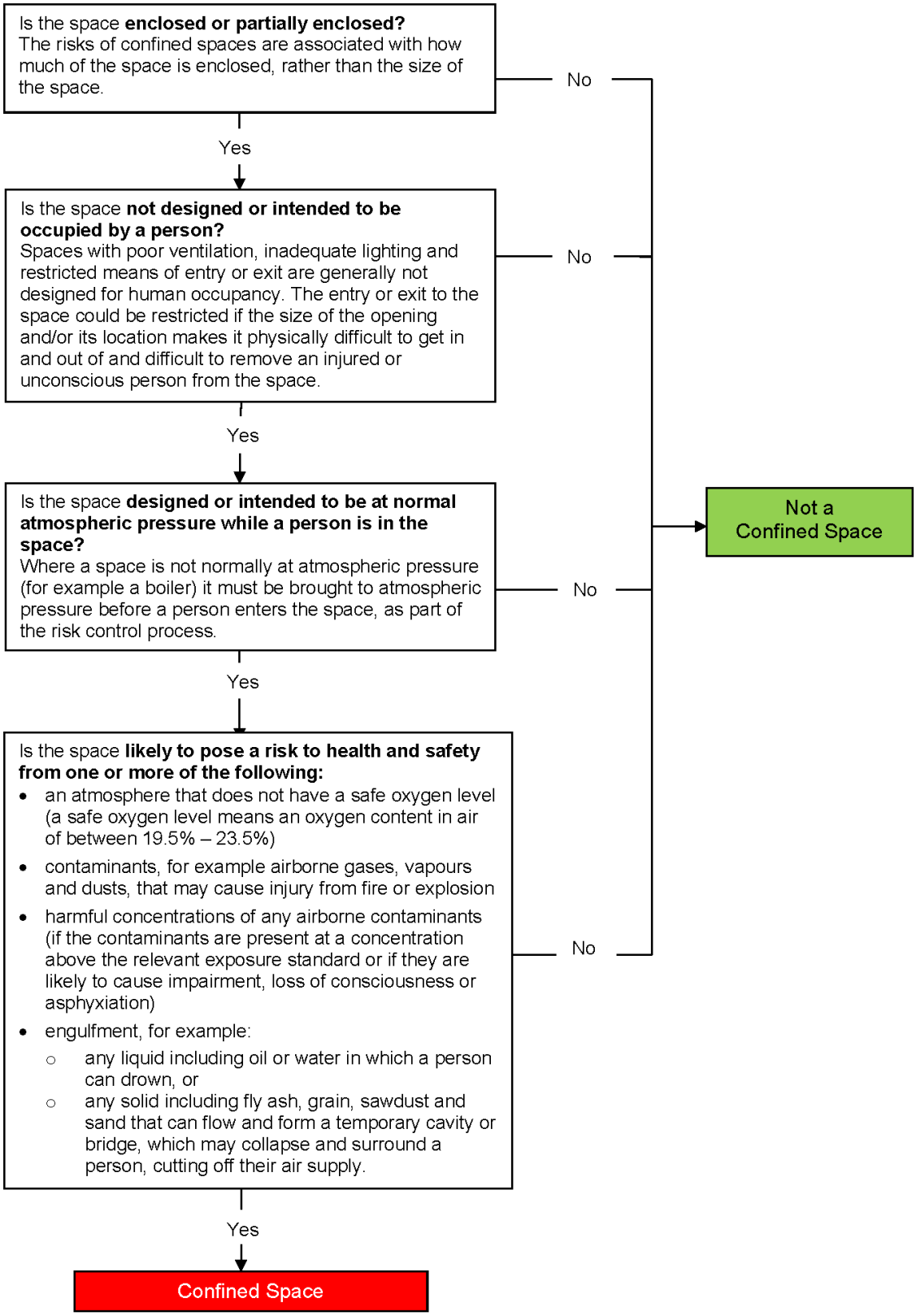
- *is not designed or intended primarily to be occupied by a person; and*
- *is, or is designed or intended to be, at normal atmospheric pressure while any person is in the space; and*
- *is, or is likely to be, a risk to health and safety from:*
  - *an atmosphere that does not have a safe oxygen level, 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 are commonly found in vats, tanks, pits, pipes, ducts, flues, chimneys, silos, containers, pressure vessels, underground sewers, wet or dry wells, shafts, trenches, tunnels or other similar enclosed or partially enclosed structures, when these examples meet the definition of a confined space in the WHS Regulation. Refer to the criteria presented below:

	Confined space criteria						Confined space?
Description of the space and activity	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 enclosed or partially enclosed	Is the space not designed or intended to be occupied by a person	Is the space designed or intended to be, at normal atmosp-heric pressure while any person is in the space	Does the space present a risk from:			
				Harmful airborne or flamm-able contam-inants	An unsafe oxygen level	Engulf-ment	
Sewer with access via a vertical ladder	✓	✓	✓	✓	✓	✓	Yes
Dislodging grain from a silo with sole access through a manhole at the top	✓	✓	✓	✓	x	✓	Yes
Cleaning spilled cadmium pigment powder in a shipping container	✓	✓	✓	✓	x	x	Yes
Inspecting a fuel tank in the wing of an aircraft	✓	✓	✓	✓	x	x	Yes
Dislodging a sludge blockage in a drain pit	✓	✓	✓	✓	✓	✓	Yes
Internal inspection of a new, clean tank prior to commissioning	✓	✓	✓	x	x	x	No
Internal inspection of an empty cement silo through a door at ground level	✓	x	✓	x	x	x	No
Stocktake using an LPG forklift in a fruit cool store	✓	x	✓	✓	x	x	No
Installing insulation in a roof cavity	✓	✓	✓	x	x	x	No

How to determine whether a space is a confined space

A confined space is determined by its structure and circumstance. The same structure may or may not be a confined space depending on the circumstances when the space is entered. Entry to a confined space is considered to have occurred when a person's head or upper body enters the space. The following flowchart will help to determine whether a space is a 'confined space' for purposes of the WHS Regulation.



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. For a confined space to be declassified as a non-confined space, it needs to have undergone sufficient changes in structure and use to eliminate all inherent hazards that define a confined space.

What is not a confined space for the purposes of the WHS Regulation?

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

The following kinds of workplaces are also generally not confined spaces for the purposes of the WHS Regulation:

- places that are intended for human occupancy and have adequate ventilation, lighting and safe means of entry and exit, such as offices and workshops
- some enclosed or partially enclosed spaces that at particular times have harmful airborne contaminants but are designed for a person to occupy, for example abrasive blasting or spray painting booths
- enclosed or partially enclosed spaces that are designed to be occasionally occupied by a person if the space has a readily and conveniently accessible means of entry and exit via a doorway at ground level, for example:
    - a cool store accessed by a LPG forklift to move stock – although the use of a LPG forklift in a cool store can be hazardous, the door at ground level means that once the alarm is raised, escape and rescue can happen quickly
    - a fumigated shipping container with a large ground level opening will facilitate easy escape and rescue.

Trenches are not considered confined spaces based on the risk of structural collapse alone, but will be confined spaces if they potentially contain concentrations of airborne contaminants that may cause impairment, loss of consciousness or asphyxiation.

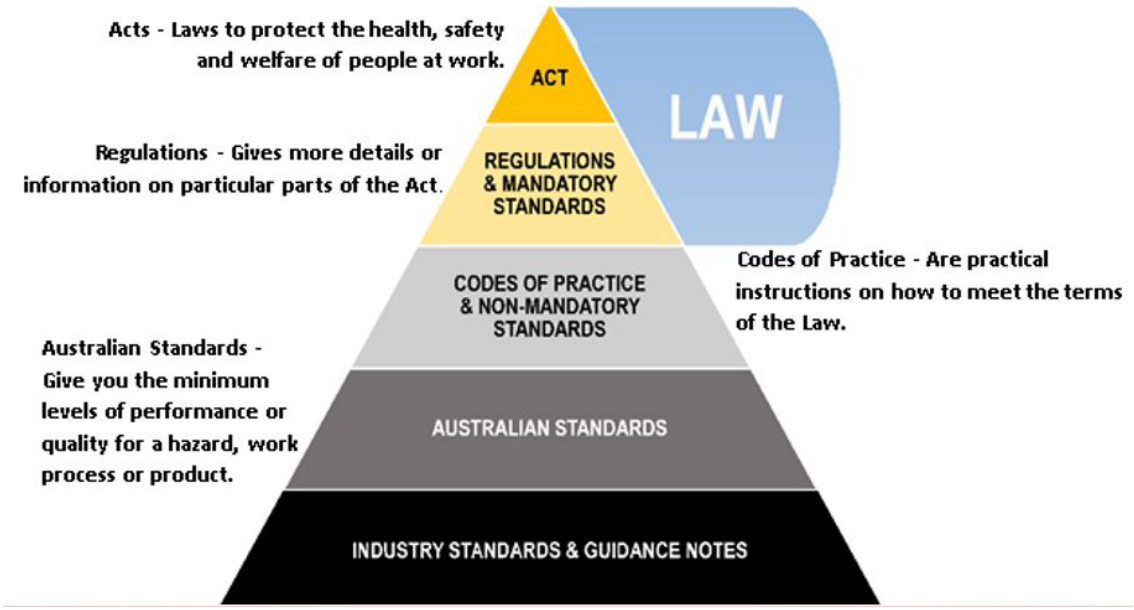
Legislation and Standards

Society has laws to ensure the health, safety and wellbeing of citizens and to protect land, the environment and property from loss or damage. Most people follow these laws because doing so makes our society a more civilised place to live in – now and for future generations. In addition, there are the penalties that apply when laws are broken.

In most cases laws are not broken deliberately. Instead, it is a usually because of a lack of knowledge or failing to take adequate care. Unfortunately, ignorance of the law or carelessness is not an acceptable defense in a court of law. Your best course of action is to be fully aware of the legislative requirements of your work and to use this knowledge when making decisions.

Legislation produces Acts of Parliament, e.g., WHS Act 2011 (Cwlth). From the Act, the Government then produces the **Regulations**, e.g., WHS Regulations 2011 (Cwlth). The Regulation performs the function of supporting the Act by providing the specific details of how the Act will be implemented in a day-to-day situation.

An approved **Code of Practice** is a practical guide to achieving the requirements of law (i.e. legislation and regulation). e.g., the model Code of Practice developed by Safework Australia, aims at achieving the standards under the WHS Act 2011 (Cwlth) and the WHS Regulations 2011 (Cwlth).

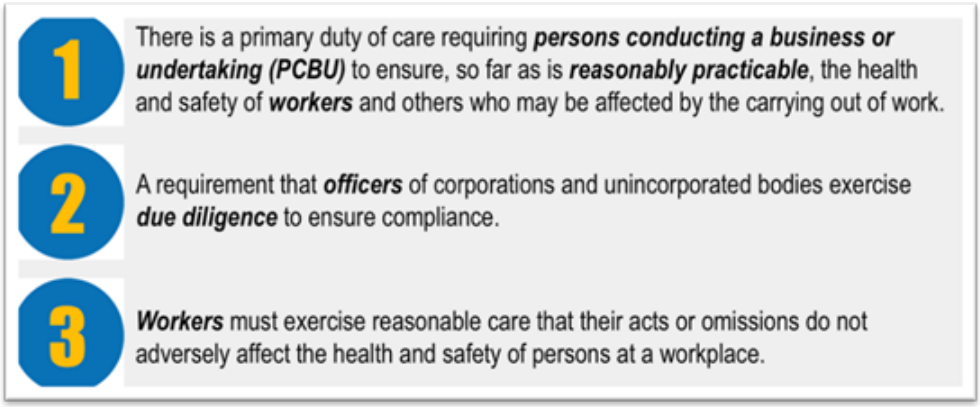


Australian Standards are published documents that are designed to provide guidance to help ensure safety, performance and reliability through the specifications of goods, services and systems.

For example:

- The Australian Standard **AS 2865-2009 Confined Spaces** provides a set of parameters which should be met, including training personnel working within confined spaces. The value of training cannot be underestimated as working safely in confined spaces requires a unique set of skills and knowledge.
- The Australian Standard **AS 1657 Fixed platforms, walkways, stairways and ladders – Design, construction and installation** describes how the safe means of access to and within the confined space related to fixed ladders, platforms and walkways should be provided.

Who has health and safety duties in relation to a confined space?



Designers, manufacturers and suppliers of plant or structures that include a space that is intended, or is likely to become, a confined space must eliminate the need for any person to enter a confined space and eliminate the risk of inadvertent entry 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.

Emergency service workers are not required to comply with some requirements (WHS Regulation 67 and 68) for entering confined spaces when either rescuing a person or providing first aid to a person in the space.

Employee/Contractors have a duty of care as an employee to work safely and not harm yourself or other workers.

- Follow all rules and procedures of your employer.
- Don't risk the health and safety of anyone by doing anything that you might think is unsafe.

Employer/Person Conducting a Business or Undertakings (PCBU) have a duty of care to supply a safe workplace for employees.

- Train/instruct employees to do their job safely and have a work safety plan in place.

Obligations Specific to Confined Space Work

Duties in relation to confined spaces specifically include:

- managing health and safety risks associated with a confined space, including risks when entering, working in, on or near a confined space, as well as the risk of inadvertent entry
- ensuring, so far as is reasonably practicable, that a worker does not enter a confined space until all the duties in relation to the confined space have been complied with, for example entry permit requirements
- establishing first aid and rescue procedures to be followed in the event of an emergency in the confined space.

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

Environmental Protection Requirements

All organisations play an important role in environmental practices, however the legislation that affects them directly differs depending on the activities they undertake.

Federal, state and local governments jointly administer the environmental protection legislation in Australia through bilateral agreements.

At the federal level, the *Environment Protection and Biodiversity Conservation Act 1999* covers the assessment and approval processes of national environmental and cultural concerns.

The EPBC Act is administered by the Department of Agriculture, Water and the Environment.

Organisational Documentation

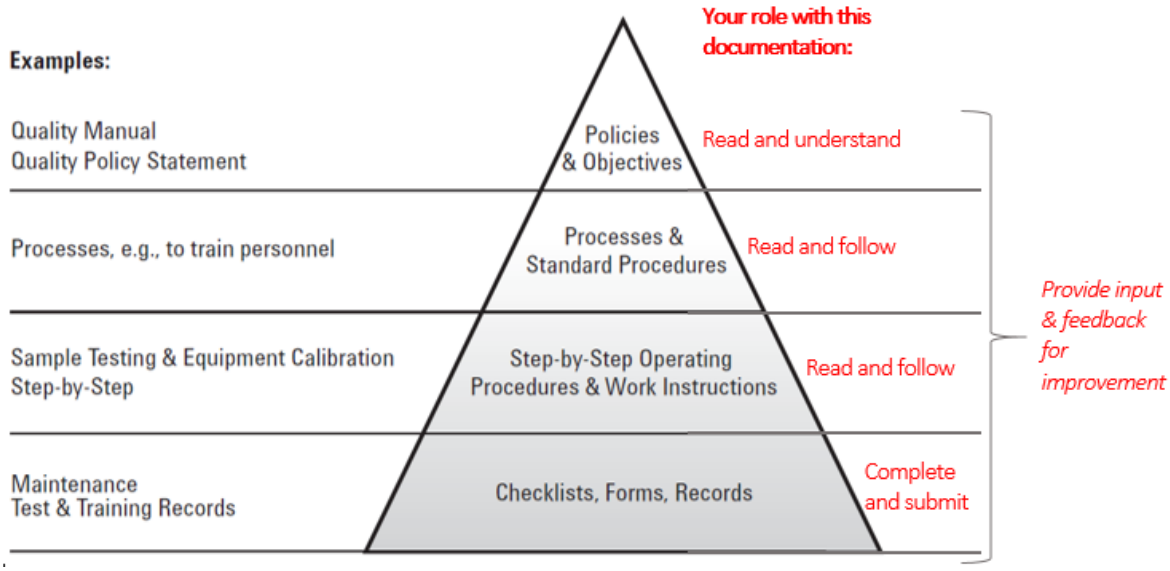
Before starting work, you will need to check any existing compliance documentation relevant to your role.

If you are to get your job done efficiently and safely while also meeting a range of legislative requirements, you need to be able to source, read, interpret and complete a range of site documents within your company's organisation system.

You will need to work on ensuring both your verbal and written communication skills to ensure they are effectively supporting you doing your job.

Scope of documentation

The following diagram provides the range of documents within your workplace which cover the site's Safety Management System, Plant and Equipment, Maintenance, Communications, Industrial Relations, Finances, Environment Protection, and so on.



You may have access to these documents through your supervisor or perhaps through an internal electronic document system. You would have been educated with the most important documents when you underwent your employment induction.

During your site induction you will be told how to access the documentation relevant to your site and duties.

When conducting confined space activities, the compliance documentation you will most be using will be related to risk assessments, entry permit, work instructions and safety information. Make sure you understand what these documents are asking you to do and if need be, check with your supervisor before starting work.

Follow all instructions given by these documents at all times – they are designed to keep you safe.

Compliance documents contain information, procedures or processes that must be complied with, and also 'best practice' information to be used as a guide for workplace tasks.

Applying Requirements and Procedures

As the compliance requirements can vary in different states, companies and jobs, you need to familiarise yourself with the documentation applicable to your work location and situation. Working safely and effectively is your responsibility and ensuring those around you are aware of the requirements is another way of increasing your own safety level.

The procedures for your work should be applied from the planning level all the way through to the completion of the work. These procedures will come from the legislation and regulations that apply

to your industry and type of work. It is your responsibility to make sure you know and apply the procedures effectively and maintain a duty of care towards those around you.

To apply any of the requirements from any level (acts, regulations etc.) you must understand them. You need to be able to apply what is written in a way relevant to your work. If you have any problems, difficulty or issues doing this, make sure you ask for assistance from appropriate personnel/your supervisor.

Work Instructions

You need to be clear about what work you will be doing. Make sure you have everything about the job written down before you start. This includes what you will be doing, how you will be doing it and what equipment you will be using.

Make sure you have all of the details about where you will be working. For example:

- **The Site** – Is there clear access for all equipment? Are there buildings, structures, facilities or trees in the way? What are the ground conditions like?
- **The Weather** – Is there wind, rain or other bad weather? Is it too dark?
- **Facilities and Services** – Are there power lines or other overhead or underground services to think about?
- **Traffic** – Are there people, vehicles or other equipment in the area that you need to think about? Do you need to get them moved out of the area? Do you need to set up barriers or signs?
- **Hazards** – Are there dangerous materials to work around or think about? Will you be working close to power lines or other people?

You also need to make sure you have all of the details about the kind of work you will be doing:

- **The Task** – What are you doing? How are you going to do it? Are there any special requirements?
- **Plant** – What type of plant will be used? How big is it? How much room does it need?
- **Attachments** – What equipment will you need? Is the equipment available?
- **Communications** – How are you going to communicate with other workers?
- **Procedures and Rules** – Do you need any special permits or licences? Are there site rules that affect the way you will do the work?

Safe Work Method Statements

A Safe Work Method Statement (SWMS) details how specific hazards and risks, related to the task being completed, will be managed and is developed by the employer/PCBU for their employees/workers.

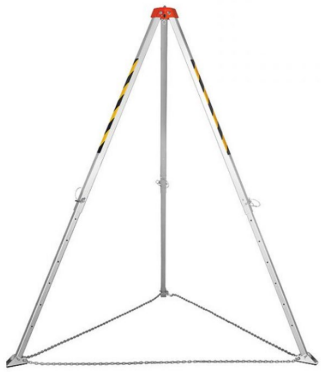
SWMSs fulfill a number of objectives:

- Legislative and regulatory requirements.
- They outline a safe method of work for a specific job.
- They provide an induction document that workers must read and understand before starting the job.
- They assist in meeting legal responsibilities for the risk management process, hazard identification, risk assessment and risk control.
- They assist in effectively coordinating the work, the materials required, the time required and the people involved to achieve a safe and efficient outcome.
- They are a quality assurance tool.

Confined space equipment

When work needs to be carried out in confined spaces, the correct confined space equipment is important to facilitate the work, minimise the risk of serious injury and provide means of rescue.

Confined Space Tripod – Used for lifting loads, assisting in access to confined spaces, as well as for securing and rescuing people.
The tripod is commonly used in conjunction with winch.



Winch is a lifting and lowering device, ideal for a range of applications including confined space work, rescue, positioning and personnel/material handling.

Inspection is required every 6 months by a competent height safety equipment inspector in accordance with manufacturers specifications and requirements of AS/NZS 1891.1

Davit Arm System – Provides a fixed anchorage point for access into confined spaces. The Davit arm system is designed principally around the lifting of personnel.

Retractable Type 3 Inertia Reel – Type 3 inertia reel includes rescue lifting device that is equipped with hand operated winch with automatic brake to prevent self-contained descent of a person

.

Confined Space & Rescue Harness – When there is a risk of falling whilst descending into or ascending out of the designated confined space, a confined space harness must be worn.

Spreader Bar – Designed for use with rescue winches, and confined space type harnesses with rescue loops on shoulders. Spreader bar is ideal for confined space entry/exit and rescue and retrieval applications.

Confined Space Kit – A simple all-in-one kit to meet the health and safety requirements for access to confined areas. The kit includes a tripod, rescue winch, retractable lanyard, multi-impact helmet, spreader bar and a PVC tripod bag.

Hazard Identification and Risk Management

Duties in relation to confined spaces include:

- managing health and safety risks associated with a confined space, including risks when entering, working in, on or near a confined space, as well as the risk of inadvertent entry
- ensuring, so far as is reasonably practicable, that a worker does not enter a confined space until all the duties in relation to the confined space have been complied with, for example entry permit requirements
- establishing first aid and rescue procedures to be followed in the event of an emergency in the confined space.

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

> *Regulation 34-38: In order to manage risk under the WHS Regulation, a duty holder must:*
>
> - *identify reasonably foreseeable hazards that could give rise to the risk*
> - *eliminate the risk so far as is reasonably practicable*
> - *if it is not reasonably practicable to eliminate the risk – minimise the risk so far as is reasonably practicable by implementing control measures in accordance with the hierarchy of control*
> - *maintain the implemented control measure so that it remains effective*
> - *review, and if necessary revise, risk control measures so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.*

This Code includes guidance on how to manage the risks associated with a confined space by following a systematic process that involves:

- identifying hazards associated with confined spaces
- assessing the risks associated with these hazards
- implementing risk control measures – elimination of need to enter the confined space should be the first risk control considered
- reviewing risk control measures.

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

Consulting your workers

> *Section 47: 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.*

> *Section 48: If the workers are represented by a health and safety representative, the consultation must involve that representative.*

Consultation with 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, for example knowledge of:

- the particular confined space under assessment

- any work methods that will be used in or near the confined space
- confined space hazards and control measures

The people or groups involved with risk management could include:

- Workplace health and safety representatives/officers
- Occupational health and safety committees
- Supervisors
- 'Competent persons' (specialists)
- Other workers
- Emergency response teams (ERT)
- Councils or government bodies
- Service providers (gas, water, electricity, etc)

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

> *Section 46: If more than one person has a duty in relation to the same matter, each person with the duty must, so far as is reasonably practicable, 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.*

Sometimes more than one person conducting a business or undertaking will have the same duty in relation to a confined space. For example, a person who owns the plant or structure that contains the confined space will have management or control of the confined space. A contractor engaged to carry out work in the same space will also have management or control of the confined space at the time that work is being carried out. 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.

Further guidance is available in the *Code of Practice: Work Health and Safety Consultation, Co-operation and Co-ordination.*

Eliminating or minimising the need to enter a confined space

> *Regulation 64: A designer, manufacturer, importer or supplier of a plant or structure, and a person who installs or constructs a plant or structure must eliminate the need to enter a confined space and eliminate the risk of inadvertent entry. If this is not reasonably practicable, then:*
>
> - *the need for any person 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
- design of the structure and mechanical parts to provide for safe and easy maintenance, to reduce the need for persons to enter.

Hazard Identification

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.

> *Regulation 34: In managing the risks associated with a confined space, the person conducting the business or undertaking must identify reasonably foreseeable hazards that could give rise to the risk.*

What hazards are associated with a confined space?

Restricted entry or exit

Small entrances and exits make it difficult to rescue injured workers or to get equipment in or out of the confined space. In some cases, entrances and exits may be very large but their location can make them difficult to access. For example, accessing 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 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 e.g. 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 e.g. groundwater and gases into the confined space from the surrounding land, soil or strata	• acid groundwater acting on limestone with the 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
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

Air 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, for example, methane in a sewer

- displaced during purging of a confined space with an inert gas to remove flammable or toxic fumes
- depleted inside metal tanks and vessels through surface oxidation (for example, when rust forms)
- consumed during combustion of flammable substances
- absorbed or reacts with grains, wood chips, soil or chemicals in sealed silos.

Too much oxygen 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
- 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 mist) capable of igniting. A flammable atmosphere is one in which the flammable gas, vapour or mist 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 electrical tool or static on a person, is introduced into a space containing a flammable atmosphere, an explosion is likely to result. Therefore if a confined space has or is suspected of having a flammable atmosphere all equipment must meet the standard of being intrinsically safe. Often you will have to conduct a challenge test when starting up intrinsically safe equipment.

Engulfment

Engulfment means to be swallowed up in or be immersed by material, which may result in asphyxiation. Examples of materials that may pose a risk of engulfment include plastics, sand, liquids, fertiliser, grain, coal, coal products, fly ash, animal feed and sewage (see below illustrations relating to a grain storge bin).

From the time the engulfment starts, you have **2-3 seconds** to react.

In **4-5 seconds** you are trapped!

After **22 seconds**, you are completely covered.

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 below illustrations relating to a grain storge bin).

A dangerous situation created by a previous partial unloading of the bin.

As unloading begins, bridged grain falls into the air space and the worker is instantly trapped.

Before the grain flow can be stopped, the worker is covered. In seconds, suffocation occurs.

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 microorganisms, 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 Wor

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
- 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.

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 a worker's:

- physical ability
- ability to work in a restrictive space (for example claustrophobia)
- ability to wear the personal protective equipment required to do the work (for example respirators).

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.

A confined space risk assessment must be done when workers are going to enter a confined space as per company policy, site policy, and legislation to document the hazards from the confined space.

Regulation 66: A person conducting a business or undertaking must assess health and safety risks associated with the identified hazards of the confined space.

The risk assessment for a confined space must be undertaken by a competent person and be recorded in writing. The risk assessment must be reviewed and revised whenever any risks change.

Regulation 77: A copy must be kept for 28 days, or if a notifiable incident occurs in connection with the work to which the assessment relates, for 2 years after the incident occurs.

When undertaking a risk assessment to determine the risks requiring control the following factors should be considered:

- 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, for example 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 that 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, for example, from the exhaust of an internal combustion engine
  - prohibiting movement of equipment in adjacent areas, for example forklifts
  - prohibiting spark-generating equipment, clothing and footwear

- whether purging or cleaning in the confined space is necessary
- whether hot work is necessary
- conditions that could impede entry and exit or the conduct of the tasks in the confined space, for example, 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 control measures.

> *Regulation 50: A person conducting a business or undertaking must ensure that air monitoring is carried out to determine the airborne concentration of a substance or mixture to which an exposure standard applies if:*
>
> - *there is uncertainty whether or not the airborne concentration of the substance or mixture exceeds the relevant exposure standard, or*
> - *monitoring is necessary to determine whether there is a risk to health.*

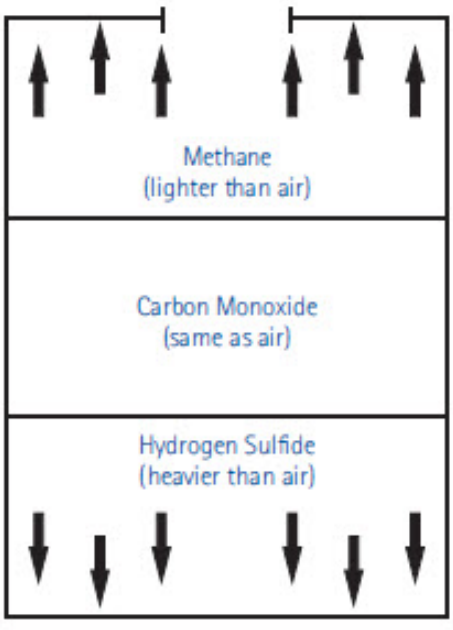
Any air monitoring in a confined space should be carried out by a competent person using a suitable, correctly calibrated gas detector. It may be necessary to test the atmosphere for:

- oxygen content
- airborne concentration of flammable contaminants
- airborne concentration of potentially harmful contaminants (for example, hydrogen sulphide and carbon monoxide).

A person's senses should never be used to determine if the air in a confined space is safe. Many toxic or flammable gases and unsafe oxygen levels cannot be detected using one's senses.

Initial testing should be done from outside the confined space by inserting a sample probe and/or portable gas detection device at appropriately selected access holes, nozzles and openings. A person is considered to have entered a confined space if their breathing zone enters the confined space. The breathing zone is 300mm from the centre of the face and anywhere from the shoulders up.

Because contaminants can settle at different levels, each part of the confined space should be tested – side-to-side and top to bottom (see Figure below).



For example, some gases (such as hydrogen sulphide) 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. Testing should be carried out on a sufficient number of points – generally 400mm increments - to accurately reflect areas of the space that is likely to be accessed.

Lighter gases may be vented into the breathing zone of the person conducting the tests. Some gases may be dissolved in liquids and released when the liquid is disturbed or a crust over the liquid is broken and it may therefore be necessary to agitate liquids before monitoring.

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

Re-testing and continuous monitoring of the air may be necessary if the risk assessment indicates that conditions may change due to the work being done or the disturbance of hazardous material in the confined space.

To ensure they are functioning correctly atmospheric monitors should be stored and operated as per manufactures specifications.

Generic risk assessment

A single (or generic) risk assessment may be carried out for a class of confined spaces in a number of different work areas or workplaces where the confined spaces are the same. This will only be appropriate if all of the hazards being covered are the same. A risk assessment must be carried out on individual confined spaces if there is any likelihood that a worker may be exposed to greater, additional or different risks. A confined space entry permit may be used as a record of the risk assessment.

How to Control the Risks

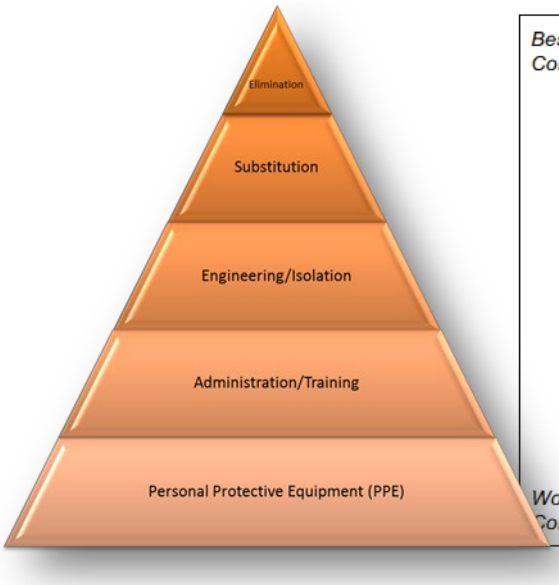
The most important step in the risk management process involves controlling risks by eliminating them so far as is reasonably practicable, or if that is not possible, by minimising the risks so far as is reasonably practicable.

The hierarchy of risk control

When looking at treatment options, we use the 'Hierarchy of Control' method to determine the most effective means of control.

Hierarchy of Control

The following order is recommended:



Best Control	**Elimination**	*Is it possible to eliminate the hazard altogether?*
	Substitution	*Is it possible to replace the substance or, equipment with something less hazardous?*
	Isolation	*Is it possible to stop persons from interacting with the hazard e.g. machine guarding, remote handling?*
	Engineering	*Where people have to interact with a hazard is it possible to engineer a less hazardous solution e.g. stairs instead of a ladder, ventilation devices, refuel machinery from the ground?*
	Administrative	*Is it possible to lessen the exposure of people through changing the way the job is done, rotating people through the job, administrative controls such as training, high risk permits?*
Worst Control	**PPE**	*Last resort – is PPE appropriate to the type, level of hazard and has it been selected correctly?*

In making judgments about the effectiveness of the controls, other questions to ask are:

- What types of controls are provided?
- Are they of adequate technical standard and quality?
- Are there enough of them?
- Does the combination of controls follow a precedence order to match the nature of the hazard?
- Are the controls maintained in working order at all times?
- What contingencies are provided to support and to back up the controls?

Remember: Controls such as elimination, substitution, design and isolation are stronger and more effective than human-oriented controls like education, procedures, and administration.

Eliminate the risk

The most effective control measure is to eliminate the risk, for example, by eliminating the need to enter a confined space.

Minimise the risk

If it is not reasonably practicable to eliminate the risk, you must minimise the risks so far as is reasonably practicable by:

- substituting the hazard giving rise to the risk with something that is safer
- isolating the hazard from any person exposed to it, or
- implementing engineering controls.

If there is a remaining risk, it must be minimised so far as is reasonably practicable by implementing administrative controls, and if a risk still remains, then suitable personal protective equipment must be provided and used. These two types of control measures, when used on their own, tend to be least effective in minimising risks because they rely on human behaviour and supervision.

Some risk control measures are mandatory for confined spaces.

> *Regulation 66: In managing risks associated with a confined space, all relevant matters must be considered, including:*
>
> - *whether the work can be carried out without the need to enter the confined space*
> - *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 type of emergency procedures required.*

Eliminate the need to enter a confined space

Risks associated with work in a confined space must be eliminated so far as is reasonably practicable, and therefore the first question is: can the work be carried out without entering the confined space?

Work could be carried out from outside the confined space by:

- installing fixed or temporary cleaning devices for example 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

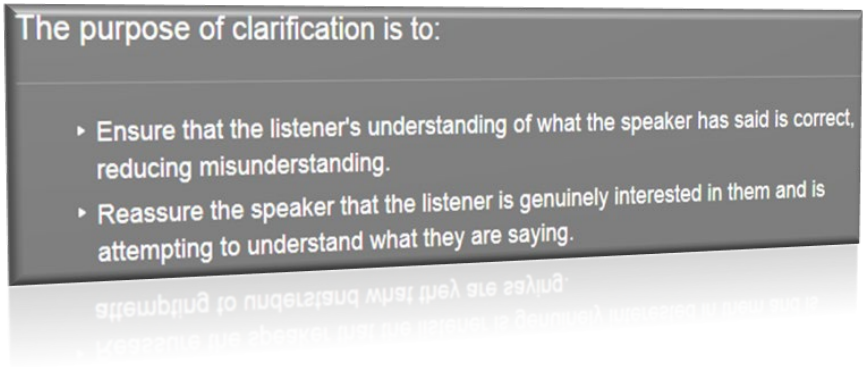
- using a hook, long-handled clasp or magnet on a string to retrieve an object dropped into a confined space.

Receiving instructions

Being able to effectively receive instructions is a core skill that every worker requires. In the fast-paced work environment within the resources and infrastructure industry, you and your co-workers need to know that you can rely on each other to carry out instructions correctly.

In your workplace you may find that there are times when instructions are given to you that are clear and simple to follow. At other times you may feel totally confused when asked to complete a task.

If clarification is required, don't be afraid.



Below are some hints if you are not sure about a task you've been assigned:

- Admit if you are unsure about what the speaker means.
- Ask for repetition.
- State what the speaker has said as you understand it, and check whether this is what they really said.
- Ask for specific examples.
- Use open questions - if appropriate.
- Ask if you have got it right and be prepared to be corrected.

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 Regulation, the following matters must be considered:

The nature of the space

The nature of a confined space may contribute to the risks associated with it, for example:

- whether the number, size and location of entrances and exits are adequate to enable the rapid exit and rescue of workers from the space
- the temperature of the space so that it will not cause heat stress
- adequate lighting, if there is poor visibility.

The concentration of oxygen or airborne contaminants

The level of oxygen and airborne contaminants is a significant contributor to the risk of working in a confined space, therefore:

- the level of oxygen should be 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
- where the atmospheric conditions cannot be maintained at a safe level, appropriate respiratory protective equipment must be 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.

Work processes should:

- minimise the release of harmful airborne contaminants into the space
- reduce the time spent in the space or the number of people that have to enter the space
- eliminate the risk of engulfment.

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, for example the weight or discomfort of protective clothing and hearing protection.

Hazard controls must be implemented before work begins within the confined space and must be suitable to minimise the risk/hazard as much as possible.

Role of Designers, Manufacturers and Suppliers

The design, manufacture or modification of any plant or structure that includes a confined space can significantly affect the risks associated with confined spaces. Thoughtful design can eliminate the need to enter a confined space or eliminate the risk of inadvertent entry. The design stage should consider the whole life cycle of the plant or structure, from manufacture and use through to demolition and disposal.

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.

Entry permits

A confined space entry permit must be completed when workers will be entering a confined space as per company policy, site policy, and legislation.

It 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.

If work that is undertaken is not specifically mentioned or detailed in the work permit then workers should stop work immediately, ensure the work area is safe and leave the confined space until a correct permit is obtained. This must be continuously monitored as it is easy to accidently continue with extra tasks which are in the work area but not on the entry permit.

> *Regulation 67: A person conducting a business or undertaking must not allow or direct a worker to enter a confined space to carry out work unless the person has issued a confined space entry permit for the work.*
>
> *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 enter the confined space and the period of time that the work will be carried out*
> - *set out risk control measures based on the risk assessment, and*
> - *contain space for an acknowledgement that work in the confined space has been completed and all persons have left the space.*

> *Regulation 77: The permit must be kept until the work is completed, or if a notifiable incident occurs, for at least 2 years after the confined space work to which the permit relates is completed.*

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

A confined space entry permit must be 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 competent person who directs and supervises the work should be nominated and authorised to issue the permit on behalf of the business or undertaking.

Legislation, standards, company policy and the permit itself may all give guidance as to how long the permit documentation must be kept for. This may be subject to circumstances such as:

- Investigations
- Work cover claims
- Court proceedings
- Medical reason

A confined space entry permit is also required

when a person enters a confined space to conduct the initial hazard identification or risk assessment. The permit may need to be revised after the risk assessment is completed. The confined space entry permit must list the following:

Requirement	
Confined space to which the permit applies	• The permit form should be designed and completed in such a way as to enable clear identification and recording of the space that each permit 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	• Ensure they are trained for working in confined spaces
Period of time that the permit is in operation	• A permit may be required for varying periods of time depending on the time required to complete the work being carried out in a confined space. If the permit time period expires it must be re-validated with a time extension before work can continue. • 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 controls measures are needed.
Measures to control the risk	• List the control measures that must be implemented before work commences, for example the isolation of plant and services, purging, ventilation, atmospheric testing, cleaning and signage. • List the control measures that must be implemented or continued while work is being done in the space, e.g. 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. Each worker must be able to understand the entry permit. Before the permit is removed you must check the following:

- The person directly in control is aware of the status of the work
- All personas and equipment have been accounted for
- Equipment has been checked and either stored or sent for repairs if necessary
- Confined space must be returned to operational service
- Any occupational stress must be reported
- Any isolation points used for entry must be de-isolated
- Written authority must be signed by the person in direct control of the work

The entry permit also serves as a written record of atmospheric monitoring results. 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 A.

Hot Work Permit

Generally hot works require a required a separate 'Hot work permit' and cannot be done with just a confined space entry permit.

Because sources of ignition can be very dangerous within a confined space and many hot work types have more inherent hazards the follow must be implemented before any hot work can be done within a confined space:

- How work permit must be obtained
- Fire protection equipment must be available to use and suitable for the task
- 0% Lower explosive limit (LEL) of any flammable fuel in atmosphere
- Continuous communication between worker and standby person
- Adequate ventilation

Isolation

All potentially hazardous services should be isolated prior to any person entering the confined space.

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 (for example heating or refrigerating methods)
- the release of any stored or potential energy in plant
- the inadvertent use of electrical equipment.

If liquids, gases or vapours could enter the confined space the pipe work should be physically isolated.

Isolation Methods

To select the appropriate isolation method you should talk to relevant people and refer to relevant documentation such as:

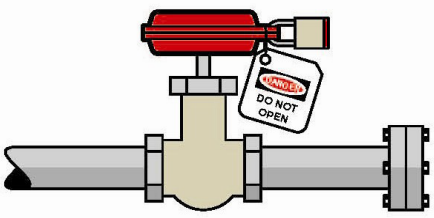
- Supervisor
- Safety Officer
- Other competent or qualified persons
- Service technicians
- Manufactures specifications and instructions
- JSA
- SWMS
- Risk assessments

Isolation measures, for example physically locking, tagging, closing and blanking 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.

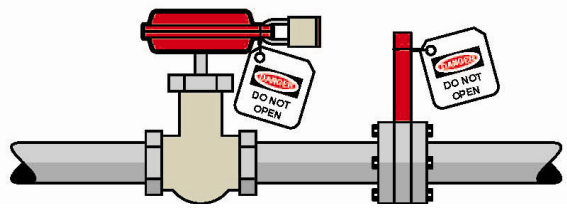
Methods of isolation from materials, contaminants or conditions include isolating in accordance with one of the methods described below or by an alternative method ensuring at least an equivalent level of safety:

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). 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, for example surges, which can build up in the piping.



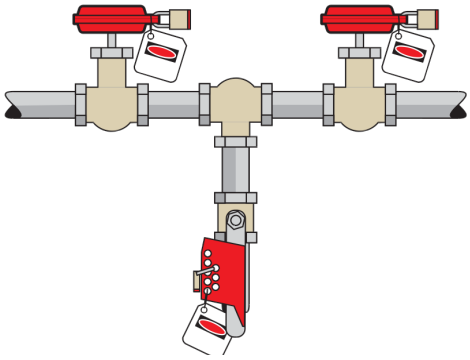
Open end of pipe capped. Nearest valve closed locked and tagged.



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

Inserting a suitable full-pressure spade or blank in piping between the flanges as close as practicable to the confined space. 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). A drain or vent valve between the two closed valves should be locked open to atmosphere as part of this method.



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 be 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 that could cause injury or illness.

If the confined space has agitators, blades and other moving equipment, consider chocking, wedging, chaining or removing these parts. Alternatively de-energise the equipment, 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, requiring a belt or other mechanical linkage to be disconnected and tagged.

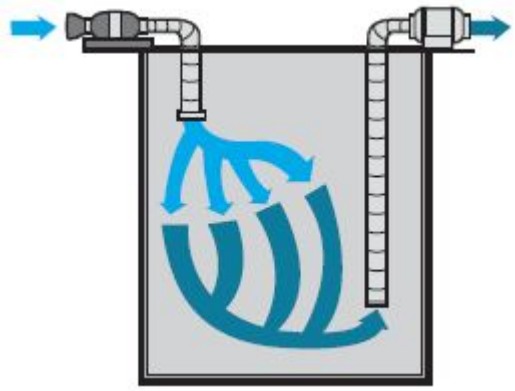
Atmosphere

A safe atmosphere must be ensured, so 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)
- any flammable gas or vapour in the atmosphere is at concentrations below 5% of its LEL. A safe atmosphere can be achieved within the confined space using methods such as cleaning, purging and ventilation. If the LEL is above 5% you cannot enter the confined space except in case of emergency. If the LEL is above 10% you cannot stay inside the confined space even to effect a rescue.

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 should 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. Atmospheric testing should be carried out before entry to check that the ventilation has been effective.

When flammable contaminants are to be purged, purging and ventilation equipment designed for use in hazardous areas must 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.

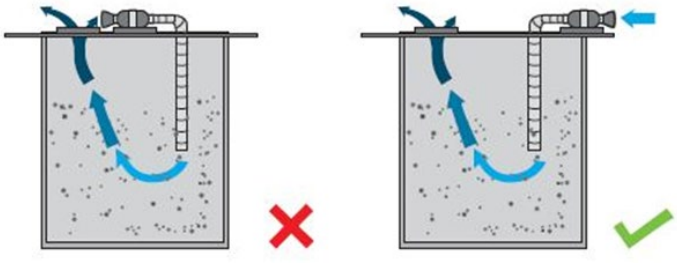
The WHS Regulation prohibits pure oxygen or gas mixtures with oxygen in concentration greater than 21% by volume being used for purging or ventilating a confined space because of the risk of increased flammability.

The space must be 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 and temperature 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 (for example, 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
- have the controls (including any remote power supply) clearly identified, tagged and protected to guard against unauthorised interference.

Flammable gases and vapours

> *Regulation 72: A person conducting a business or undertaking must, while work is being carried out in a confined space, ensure that the concentration any flammable gas, vapour or mist in the atmosphere of the space is less than 5% of its LEL, so far as is reasonably practicable.*
>
> *If it is not reasonably practicable, and the concentration of any flammable gas, vapour or mist in the atmosphere of the confined space:*
>
> - *is equal to or greater than 5% but less than 10% of its LEL—the person must ensure that any worker is immediately removed from the space unless a suitably calibrated, continuous-monitoring flammable gas detector is used in the space; or*
> - *is equal to or greater than 10% of its LEL—the person must ensure that any worker is immediately removed from the space.*

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 for example grinding wheels
- static electricity

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. The respiratory protective equipment should be provided and worn in situations where there is no exposure standard for a substance, or where the substance is present in an unknown concentration.

Respiratory protective equipment refers to a range of breathing equipment, including air-supplied and self-contained breathing apparatus. The appropriate respiratory protective equipment should be 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 (for instance, use air-supplied respiratory equipment).

Further guidance is available in AS/NZS 1715: Selection, use and maintenance of respiratory protective devices.

Entering and Working in a Confined Space

Communication and Safety Monitoring

Regulation 69: The person conducting a business or undertaking must ensure that a system of work is provided that includes:

- *continuous communication with the worker from outside the confined space*
- *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.*

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, a standby person must be assigned to continuously monitor the wellbeing of those inside the space, if practicable observe the work being carried out and initiate appropriate emergency procedures when necessary.

The standby person should:

- understand the nature of the hazards inside the particular confined space and be able to recognise signs and symptoms that workers in the confined space may experience
- remain outside the confined space and do no other work which may interfere with their primary role of monitoring the workers inside the space
- have all required rescue equipment (for example, safety harnesses, lifting equipment, a lifeline) immediately available
- have the authority to order workers to exit the space if any hazardous situation arises
- never enter the space to attempt rescue.

Entry and exit

If it is not reasonably practicable to eliminate the need to enter the confined space or the risk of inadvertent entry, 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 and located in a position that allows for persons and equipment to pass easily through them.

For the entire period the confined space entry permit is valid, procedures should be in place to indicate when any worker is in the space, for example by using tags, a system of signing in and out on the entry permit, or having a standby person record who is in the space.

Signs and barricades

Before any work in relation to a confined space starts, signs must be 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, for example locks and fixed barriers, should be installed.

Information, instruction and training

Workers and their supervisors must have the skills and knowledge 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 should be provided to workers who:

- enter or work in confined spaces
- undertake hazard identification or risk assessment in relation to a confined space
- implement risk control measures
- issue entry permits
- act as a standby person or communicate with workers in a confined space
- monitor conditions while work is being carried out
- purchase equipment for confined space work
- design or lay out a work area that includes a confined space.

Regulation 76: The training provided to relevant workers must cover:

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

Re-training 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.

Records of all training provided to workers in relation to confined space work must be kept for 2 years.

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
- emergency rescue equipment.

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.

> *Regulation 74: A person conducting a business or undertaking must establish first aid and rescue procedures to be followed in an emergency and ensure those procedures are practised as necessary to ensure that they are efficient and effective. First aid and rescue procedures must be initiated from outside the confined space as soon as practicable in an emergency.*

The person conducting a business or undertaking must also ensure that openings for entry and exit are of a sufficient size to allow emergency access; openings are not obstructed; and any plant, equipment and personal protective equipment provided for first aid or emergency rescue are maintained in good working order.

The rescue plan must be site specific and must be altered to suit each individual confined space work/rescue situation.

Rescue Plan Considerations

When establishing emergency procedures, the following factors must be taken into account to manage risks associated with confined spaces:

- whether the work can be carried out without the need to enter the confined space
- the nature of the confined space
- any changes in hazards associated with the concentration of oxygen or the concentration of airborne contaminants in the confined space
- 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 of working
- the type of emergency and rescue procedures required. Consideration should also be given to the following:

Relevant Considerations	Questions
Location of the confined space and access to it	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? Is the access point suitable for rescue?
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 and understanding of roles and responsibilities	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 aid personnel available to make proper use of any necessary first aid equipment?
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?

First aid and rescue procedures must be rehearsed with relevant workers to ensure that they are efficient and effective.

Documents that will specify a site's recue procedures, first aid policy and PPE requirements include:

- Site inductions
- Risk assessments
- Work permits
- JSA, SWMS, etc
- Work contracts

Incident

Any situation where emergency rescue must be affected from a confined space is considered an incident and is therefore subject to further action. Other situations such as near misses, injuries, harm or damage are also incidents.

Information regarding actions required from individuals and management can be found within the following documentation:

- Company documentation
- Australian standards
- Workplace Health and Safety legislation
- Various government websites
- Site induction
- Risk assessment
- Work permit
- JSA, SWMS, etc
- Work contracts

The process for handling all incidents is generally:

- Stop, resolve the issue if possible
- Seek advice and assistance if required
- Report the incident as required by policy and legislation

Conducting the Rescue Operation

To assist with conducting the rescue in a safe and timely manner the following information should be made available to incoming rescue teams:

- Risk assessment
- JSA, SWMS, etc
- Work permit
- Rescue plan
- What happened
- What has already been implemented or tried
- Who has been notified
- What resources are en-route and what are available
- How many people are involved along with their names, last known condition and location
- Any changes or variations in condition, atmosphere or work area since incident occurred
- How long since incident occurred

Rescue should be performed from outside the confined space, if possible. Workers performing rescue must be adequately trained.

Rescuers must be specifically trained and provided with and wear appropriate respiratory protective equipment if they enter a confined space in an emergency.

Generally the standby person never enters the confined space, however if they are going conduct rescue operations within the confined space the following requirements must be met:

- They must be replaced by another competent and qualified standby person
- There is no danger to themselves, the casualty or the surrounding area
- They are specifically trained in and have rehearsed rescue procedures
- It is part of their work description

If a person inside a confined space has been overcome by lack of oxygen or airborne contaminants, it should always be assumed that entry for rescue is unsafe unless air-supplied respiratory protective equipment is used.

Potential problems with the size of entrances and exits must be addressed when developing emergency and rescue procedures. Where openings are found to be inadequate, their size should be increased, or an alternative safe means of entry and exit should be provided.

How to review Control Measures

Control measures that have been implemented must be continuously reviewed, and if necessary, revised to make sure they work as planned and to maintain, so far as is reasonably practicable, a work environment that is without risks to health and safety.

Regulation 38: A person conducting a business or undertaking must review and as necessary revise risk control measures:

- *when the control measure does not minimise the risk so far as is reasonably practicable*
- *before a change at the workplace that is likely to give rise to a new or different health and safety risk that the control measure may not effectively control*
- *if a new hazard or risk is identified*
- *if the results of consultation indicate that a review is necessary*
- *if a health and safety representative requests a review.*

Control measures may be reviewed using the same methods as the initial hazard identification step.

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

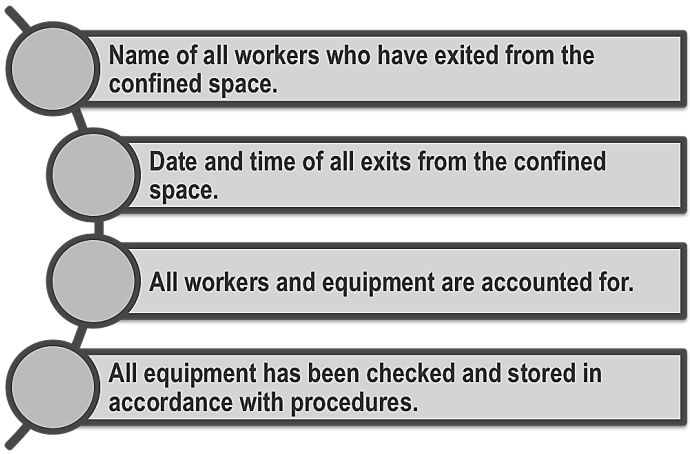
- Are the control measures working effectively in both their design and operation?
- How effective is the risk assessment process? Are all hazards being identified?
- Are workers actively involved in the risk management process? Are they openly raising health and safety concerns and reporting problems 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?
- Is any change planned to any plant or structure that may create a confined space or change the nature of an existing confined space?
- Has an incident occurred as a result of work carried out in a confined space?

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

Recording and Reporting

Withdrawing the Confined Space Permit

Only once the job is complete, and all people are out of the confined space and have signed off the permit, is the permit signed off.
Generally, the withdrawal from a confined space operation requires the following information to be signed off:



This information may be tracked on a tally board or the entry permit in line with entry control procedures.
The person in direct control of the confined space operation will need to make the final sign-off of the withdrawal of written authority (confined spaces work permit) once all of the above information has been confirmed.

Re-issuing the permit

Requirements for re-authorisation/reissue of permits are required by one or more of the following situations:

- there is any change to work scope or method,
- the work situation/workplace conditions changes,
- there are deviations from permit conditions,
- there is a gap in work continuity, or
- other site rules require it.

Keeping Records

Records must be kept for the following minimum durations:

- training records – two years
- risk assessment - 28 days after the work to which it relates is completed
- confined space entry permit - until the work to which it relates is completed
- notifiable incident - all records must be kept for two years after the incident.

All these records must be made available to the regulator and any worker upon request.

Clean-Up

Tools and Equipment

Tools, equipment and materials should be cleaned, checked, maintained and stored in accordance with manufacturers' recommendations and standard work practices.

After using tools and equipment, it is important to ensure they are:

- Cleaned by removing all dirt, mud moisture or other contaminants, in accordance with manufacturers' specifications.
- Checked for any damage – If anything is wrong, apply tagging and lock-out procedures and report it to your supervisor.
- Maintained in line with manufacturers' recommendations or your worksite procedures/standard work practices, e.g. greasing of metal surfaces or lubricating moving parts.
- Stored correctly in the appropriate location – Most equipment will have designated storage instructions to ensure the items are kept free from damage and can be easily found the next time they are needed.

The procedures for cleaning, maintenance and storage should be followed regardless of the type of equipment and tools being used.

Keeping them in the best possible condition prolongs their working life and ensures they are safe to use.

Post-Operational Inspection and Maintenance of Gas Testing Equipment

Check the manufacturer's operating manual for maintenance instructions.

This could include cleaning, replacement of components or re-calibration.

Each unit may require different maintenance procedures. Incorrect procedures may lead to equipment failure.

Some gas detectors require routine replacement of cartridges and equipment calibration to keep them in proper working order. Batteries may need to be recharged or replaced.

IR (infra-red) gas detectors may need to have the lens cleaned if it becomes dirty. Refer to the manufacturer's operating manual for instructions on maintaining gas testing equipment.

If any parts need to be replaced refer to the manufacturer's operating manual.

Gas testing equipment should be stored in a dry clean area within the temperature limits outlined by the manufacturer.

Reporting Defective Equipment

If you find any monitoring or safety equipment to be defective or faulty, you must isolate it from service and report the defect in accordance with workplace procedures.

This may include completing an equipment log or fault report.

Appendix A: Confined Space Entry Permit Template Example

Confined Space Location/Description/ID Number **Date:**

_____

Purpose of Entry

_____

_____

Time In: _____ **Permit Canceled Time:** _____
Time Out: _____ **Reason Permit Canceled:** _____

Supervisor: _____

Rescue and Emergency Services-

Hazards of Confined Space	Yes	No	Special Requirements	Yes	No
Oxygen deficiency			Hot Work Permit Required		
Combustible gas/vapor			Lockout/Tagout		
Combustible dust			Lines broken, capped, or blanked		
Carbon Monoxide			Purge-flush and vent		
Hydrogen Sulfide			Secure Area-Post and Flag		
Toxic gas/vapor			Ventilation		
Toxic fumes			Other- List:		
Skin- chemical hazards			**Special Equipment**		
Electrical hazard			Breathing apparatus- respirator		
Mechanical hazard			Escape harness required		
Engulfment hazard			Tripod emergency escape unit		
Entrapment hazard			Lifelines		
Thermal hazard			Lighting (explosive proof/low voltage)		
Slip or fall hazard			PPE- goggles, gloves, clothing, etc.		
			Fire Extinguisher		

Communication Procedures:

_____

DO NOT ENTER IF PERMISSABLE ENTRY LEVELS ARE EXCEEDED		**Test Start and Stop Time:** **Start**	**Stop**
	Permissable Entry Level		
% of Oxygen	19.5 % to 23.5 %		
% of LEL	Less than 10%		
Carbon Monoxide	35 PPM (8 hr.)		
Hydrogen Sulfide	10 PPM (8 hr.)		
Other			

Name(s) or Person(s) testing: _____

Test Instrument(s) used- Include Name, Model, Serial Number and Date Last Calibrated:

CFM-Ventilation	Size-Cubic Feet	Pre Entry Time	❑ Central Notified Before Entrance	Time Notified:
			❑ Central Notified After Entrance	Time Notified:

Authorized Entrants

_____
_____
_____

Authorized Attendants

_____
_____
_____

PERMIT AUTHORIZATION **I Certify that all actions and conditions necessary for safe entry have been performed.**	
Name-Print:	
Signature:	
Date:	Time:

Entry Procedure Checklist: Complete the following steps before, during, and after a confined space entry:

Step 1
Obtain a Permit-Confined Space Entry Form from Program Coordinator.

Step 2
Notify Supervisor before the **Confined Space Entry**

Step 3
Verify Confined Space Meter has been calibrated and is in working order

Step 4
Complete the top portion of the Permit-Confined Space Entry Form

Step 5
Ensure all rescue equipment (e.g. tripod, body-belt, lanyard) is in place prior to entry

Step 6
Monitor the confined space with the MSA 4-Gas Detector prior to entry. The entrant and attendant should sign the permit authorization section on the bottom of the permit to ensure all actions and conditions necessary for safe entry have been performed.

Step 7
Employee entering the confined space should wear the 4-Gas Detector after the pre-atmosphere test. The employee should also have a full body harness and lanyard attached to the rescue tripod. Employee shall have a radio and any other necessary personal protective equipment.

Step 8
Employee can enter the confined once Step 7 is completed. The entrant and attendant should complete the Hazards of Confined Spaces and Special Requirements Section of the Permit-Confined Space Entry Form once the employee is within the confined space. The entrant should also gather the % Oxygen, % Explosive Gases, Carbon Monoxide, and Hydrogen Sulfide readings and communicate them to the attendant to place on the Permit Form.

Step 9
The attendant should maintain constant communication with the entrant until the entrant has exited the confined space.

Step 10
The attendant should contact Supervisor once the entrant has exited the confined space.

Step 11
The Permit-Confined Space Entry Form should be given to program coordinator, to file in the Confined Space Records.