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WorkSafe VICTORIA

Compliance code

Confined spaces

State Government Victoria

Contents

WorkSafe Victoria is a trading name of the Victorian WorkCover Authority.

Preface

This compliance code provides practical guidance to those who have duties under the *Occupational Health and Safety Act 2004* (the OHS Act) or the Occupational Health and Safety Regulations 2007 (the Regulations). It shows how to comply with those duties or obligations.

It was made under the OHS Act and was approved by The Hon. Tim Holding MP, Minister for Finance, WorkCover and the Transport Accident Commission, on 19 September 2008.

This compliance code was developed by WorkSafe Victoria. Representatives of employers, employees and government agencies were consulted during its preparation.

Employers, employees, self-employed persons and those with management and control of workplaces need to use the compliance code in conjunction with the OHS Act and Regulations.

This compliance code is not mandatory. A relevant duty holder who complies with the compliance code will – to the extent the compliance code deals with their duties or obligations under the OHS Act and Regulations – be considered to have complied with their duties and obligations.

If conditions at the workplace or the way work is done raise different or additional risks not covered by the compliance code, compliance needs to be achieved by another means.

WorkSafe publishes guidance to assist with this process at **worksafe.vic.gov.au**.

Evidence of a failure to observe a compliance code may be used as evidence in proceedings for an offence under the OHS Act or Regulations. However, a duty holder will not fail to meet their duty or obligation simply because of a failure to observe a compliance code.

A WorkSafe inspector may cite a compliance code in a direction or condition in an improvement notice or a prohibition notice as a means of achieving compliance.

A health and safety representative (HSR) may cite a compliance code in a provisional improvement notice when providing directions as to how to remedy an alleged contravention of the OHS Act or Regulations.

The approval of a compliance code may be varied or revoked by the Minister. To confirm that this compliance code is current and in force, go to **worksafe.vic.gov.au**.

Introduction

Purpose

1. The purpose of this compliance code is to provide practical guidance on how to meet the requirements of Part 3.4 – Confined Spaces – of the Occupational Health and Safety Regulations 2007 (the Regulations).

Scope

2. This compliance code covers the identification of hazards and control of risks associated with confined spaces in workplaces. Confined spaces include spaces such as those in a vat, tank, pit, pipe, duct, flue, oven, chimney, silo, reaction vessel, container, receptacle, underground sewer, well, shaft, trench, tunnel or other similar enclosed or partially enclosed structure, which meet certain conditions.
3. In this compliance code, it is not possible to deal with every situation that may confront a person having a duty under the Regulations or which may be found in the workplace. Therefore, the guidance in this compliance code or in publications recommended by this compliance code, needs to be considered with regard to the particular characteristics and circumstances of the workplace.

Application

4. This code applies to employers and designers and manufacturers of plant that includes a confined space.

Background

5. Confined spaces present a unique occupational health and safety (OHS) problem because their hazards may not be readily apparent. Confined spaces usually have poor ventilation and may be of small volume, so hazardous atmospheres can accumulate quickly. Work in confined spaces can increase the risk of injury or death by making employees work closer to hazards than they would otherwise or by creating additional hazards such as engulfment. Employees from many different occupations and industries may enter confined spaces to perform tasks unaware that they are entering a potentially hazardous work environment. Many hazards, such as toxic gases and vapours, can also be exacerbated in confined spaces.
6. Examples of incidents that illustrate some of the different hazards of confined spaces are provided in Appendix D. Whether an incident results in a near miss with no injuries or in a fatality often appears to be pure chance, and because of suspected under-reporting it appears that the occurrence of confined space incidents is significantly underestimated.

What is a confined space?

7. Confined spaces include spaces such as those in a vat, tank, pit, pipe, duct, flue, oven, chimney, silo, reaction vessel, container, receptacle, underground sewer, well, shaft, trench, tunnel or other similar enclosed or partially enclosed structure, which meet certain conditions.

8. A confined space is determined by the hazards associated with a set of defined circumstances (restricted entry or exit, hazardous atmospheres or risk of engulfment) and not just by the fact that work is performed in a physically restrictive location. The effect of physical or chemical agents may be exacerbated in a confined space.

9. 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
    - asphyxiation resulting from oxygen deficiency
    - asphyxiation resulting from engulfment by stored material, including grain, sand, flour or fertiliser.

    Examples of potential confined spaces include:

    - storage tanks, tank cars, process vessels, pressure vessels, silos and other tank-like compartments
    - pits and degreasers
    - pipes, sewers, sewer pump stations, wet and dry wells, shafts and tunnels
    - shipboard spaces entered through small hatchways or access points, cargo tanks, ballast or oil tanks, or void spaces.

10. However, many other types of structures may also meet the definition of a confined space provided in the Regulations (see Appendix B).

11. Some structures may become confined spaces when work that generates atmospheric contaminants is carried out or during their construction, fabrication or subsequent modification.

12. It is important to note that 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.

How to determine whether a space is a confined space

13. To determine whether a space is a confined space, apply the definition provided in Appendix B and ask the following questions:

    (A) **Is the space enclosed or partially enclosed?** The size of the space is not a factor when classifying a confined space.

    (B) **Is it likely to be entered and is it at normal atmospheric pressure?** Entry to a confined space is considered to have occurred when a part of the body enters the space and there is a risk the person may be overcome by the conditions within the space. This would generally occur if the person's head enters the confined space.

    (C) **Does the space have a limited or restricted entry or exit?** The entry or exit to the space may be restricted by the size of the opening and/or its location. Consideration needs to also be given to 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) **Is the space likely to contain:**

    i. an atmosphere that has a harmful level of contaminant (ie a level in excess of the relevant exposure standard, or if the contaminant does not have an exposure standard, the level where the contaminant is likely to have an adverse health effect)

    OR ii. an atmosphere that does not have a safe oxygen level (ie a safe oxygen level means an oxygen content in air of between 19.5% and 23.5%)

    OR iii. any substance that could cause engulfment (ie a solid, such as fly ash, grain, animal feed, sawdust and sand, that can flow and can form a temporary cavity or bridge, which may collapse and surround a person, cutting off their air supply)?

14. If the answer to all four questions above (A, B, C and at least one part of D) is yes, then the space is a confined space and the Regulations apply. Note that if the space is not a confined space under the Regulations, it does not necessarily mean that the space is safe to enter. For example, using an LPG forklift in a cool room can be dangerous because of the presence of carbon monoxide gas, although it is not a confined space as it does not have a restricted means of entry or exit. In these circumstances, the general duties under the *Occupational Health and Safety Act 2004* (the OHS Act) apply.

15. It is important to understand that a confined space is determined by the structure and a specific set of circumstances. The same structure may or may not be a confined space depending on the circumstances when the space is entered. For example, a new road tanker that is clean and has never held any product, is not considered a confined space under the Regulations even if a person enters it. However, a road tanker that has previously held product and needs to be entered for maintenance purposes, needs to be treated as a potential confined space. The difference between the two scenarios is the possible presence of atmospheric contaminants.

16. The table on page 5 applies the confined space definition to various circumstances and provides examples of both confined spaces and spaces that are not confined spaces. The template in Appendix E can also be used to help determine whether the Regulations apply in each particular case.

Is the space a confined space?

Is the space a confined space?

Description of space	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 enclosed or partially enclosed?	Is it likely to be entered and is it at normal atmospheric pressure?	Does the space have a limited or restricted entry or exit?	Does the space contain, is it intended to contain, or is it likely to contain:			
				harmful level of atmospheric contaminants?	an unsafe oxygen level?	substances that could cause 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

(i) These examples are provided to illustrate the application of the confined spaces definition. They are general in nature. Each entry into a confined space presents a unique set of circumstances and needs to be assessed separately.
(ii) An answer of no to any of the four questions does not necessarily mean that the space is safe to enter. The general provisions of the *Occupational Health and Safety Act 2004* need to be applied.
(iii) Where there is uncertainty as to whether a criteria is met, then more information is required to remove the uncertainty, or the criteria should be deemed to be met and the confined spaces regulations applied.

Consultation

17. By law, so far as is reasonably practicable, employers must consult with HSRs and employees on a range of matters that directly affect (or are likely to directly affect) their health and safety. In relation to confined spaces examples would include consultation on:
    - identification of confined spaces hazards
    - operation of safe work procedures
    - selection of appropriate personal protective equipment (PPE).
18. For more information on the consultation provisions, see Appendix C.

Duties of designers and manufacturers of plant that includes a confined space

19. The design of plant that includes a confined space, such as a boiler, vat, tank or duct, is critical. Thoughtful design can prevent hazards and eliminate or reduce many of the risks associated with work in the confined space before it is introduced into the workplace. All phases of the life of plant, from design and use through to demolition and disposal, need to be considered when designing plant that includes a confined space. Modification of existing plant that includes a confined space is also covered under the Regulations.

Eliminating or reducing the need to enter the space

20. Under the Regulations, designers and manufacturers of plant that includes, or is intended to include, a confined space are required to eliminate the need to enter the space. If this is not reasonably practicable, the need to enter the space must be reduced so far as is reasonably practicable. Where relevant, the following features need to be incorporated at the design and installation 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.

Entry and exit

21. If it is not reasonably practicable to eliminate the need to enter, any risk associated with the means of entry to and exit from the space must be eliminated or if this is not reasonably practicable, reduced so far as is reasonably practicable. Entry to and exit from a confined space is safer when openings are large compared with the persons and equipment that have to pass through them.

22. Where relevant, the following features also need to be incorporated at the design, manufacture and installation stages:

    - Entrances and exits (including those within the confined space, through divisions, partitions or obstructions) that are 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. The designer or manufacturer needs to consider the guidance in AS 1657 *Fixed platforms, walkways, stairways and ladders – Design, construction and installation* on this matter.
    - Entrances and exits that are unobstructed by fittings or equipment, that could impede rescue. The means of entry to and exit from a confined space also needs to be kept free from any encumbrances during work in the confined space. Where things such as electrical cables, leads, hoses and ventilation ducts are required to pass through an access hole, a second access hole may be needed.
    - Enough entrances and exits to provide sufficient access to the confined space. 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.

Duties of employers

Hazard identification

23. Employers must ensure, so far as reasonably practicable, that all hazards associated with work in a confined space are identified before anyone enters the space.

24. The types of substances previously stored in the confined space (however briefly) will indicate the sorts of hazards that may be present, such as a lack of oxygen, atmospheric contaminants or flammable atmospheres. Other hazards may arise from processes, products and by-products, waste and work activities in or around the confined space.

25. There are many hazards that may be associated with work in a confined space, some of which are listed below.

Hazards that identify a regulated confined space

Restricted means of entry or exit

26. Small entrances and exits make it very difficult to rescue injured employees 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.

27. Consideration needs to be given to:

- the size, location and access to entrances and exits
- the nature of the work and the equipment required
- the physical environment, including obstructions and fittings
- equipment used to assist with safe entry and exit
- emergency and rescue requirements, including whether entrances and exits are adequate to enable employees to be rescued quickly.

Harmful atmospheric contaminants

28. Harmful atmospheres may arise from:

- The substance stored in the space or its by-products, for example:
  - the build-up of hydrogen sulphide in sewers and pits
  - the release of toxic substances, such as hydrogen sulphide, in a tank of decomposing organic material, especially when the material is disturbed.
- The work performed in the confined space, for example:
  - the 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 space
  - painting or moulding glass-reinforced plastics.
- The entry of natural contaminants such as groundwater and gases into the confined space from the surrounding land, soil or strata, for example:
  - acid groundwater acting on limestone can lead to dangerous accumulations of carbon dioxide
  - methane can be released from groundwater and from decay of organic matter.
- The release of atmospheric contaminants when sludge, slurry or other deposits are disturbed or when scale is removed.
- The manufacturing process, for example:
  - residues left in tanks, vessels etc, or remaining on internal surfaces, which can give off gas or vapour.
- The entry and accumulation of gases and liquids from adjacent plant, installations, services or processes, for example:
  - the contamination of underground confined spaces by substances from plant many metres away, and
  - carbon monoxide from the exhaust of LPG-powered forklifts operating in or close to the confined space.

Unsafe oxygen level

29. The air we breathe normally contains 21% oxygen. The 'safe' range of oxygen in air is between 19.5% and 23.5% (see Figure 1).

30. The following conditions are examples of situations that may result in an oxygen-deficient atmosphere and possible asphyxiation:

- oxygen displacement by gases produced during biological processes, such as methane in a sewer
- oxygen displacement during purging with an inert gas to remove flammable or toxic fumes
- oxygen depletion inside metal tanks and vessels through surface oxidation (eg when rust forms)
- combustion of flammable substances
- oxygen absorption by grains, chemicals or soils in sealed silos.

31. Oxygen-enriched atmospheres can be caused by oxygen leakage from poorly designed or maintained oxygen storage equipment, and can result in an increased risk of fire or explosion.

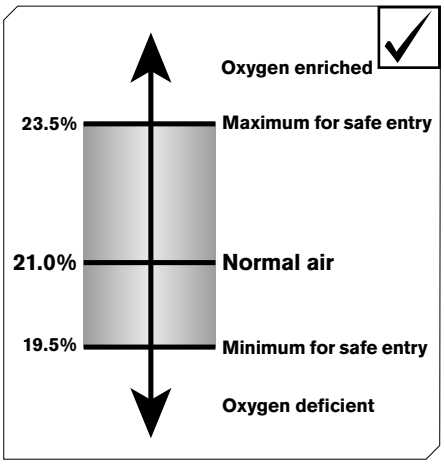


Figure 1: Regulated safe oxygen level.

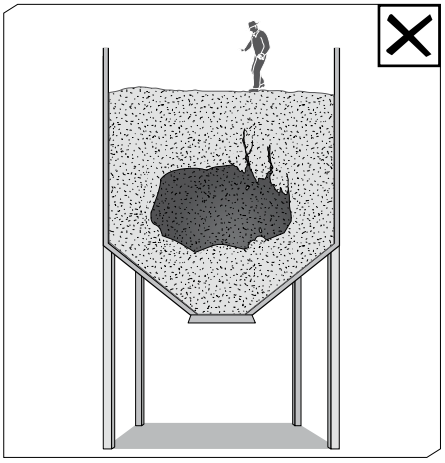


Figure 2: Example of 'bridging' which may result in engulfment.

Engulfment

32. 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, fertiliser, grain, coal, coal products, fly ash and animal feed.

33. These materials can form a crust or bridge when a container of stored material is emptied from below, leaving the top layer in place. Employees walking on the bridge or working below the bridge on the floor of the container may be engulfed if a bridge collapses (see Figure 2).

Other hazards associated with confined spaces

Uncontrolled introduction of substances

34. 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.

35. Plant such as 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.

Fire and explosion

36. 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 or vapour is likely to exceed 5% of its lower explosive limit (LEL).

37. Where a flammable atmosphere may exist in a confined space, 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
    - static electricity.

38. 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).

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

Biological hazards

40. 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

41. 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

42. 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

43. 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

44. 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 excessive noise may result in hearing loss, tinnitus and other non-auditory health effects. Excessive noise may also prevent employees hearing warning signals and distract employees from their work.

Manual handling

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

Radiation

46. 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

47. 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.

Hazards outside the confined space

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

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

Additional physiological and psychological demands of working in a confined space

50. Working in a confined space may impose additional physiological and psychological demands over and above those encountered in a normal working environment. Consideration needs to be given to the employee's:

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

Generic hazard identification

51. Where the employer is responsible for similar confined spaces in a number of different work areas or workplaces, a single (or generic) hazard identification may be undertaken. This will only be appropriate however, if all of the hazards for the work areas being covered are the same. Where a generic hazard identification is undertaken, it is the employer's responsibility to ensure that it is valid for each confined space to which it is applied. Individual hazard identifications must be performed where additional or different hazards may exist.

Risk assessment

52. Safe entry into confined spaces is dependent upon effective control of the set of circumstances present at the time of entry. When undertaking a risk assessment to determine the risks requiring control, the assessment will need to consider the following in most cases:

    - the hazards identified
    - the task
    - the working environment
    - work materials and tools
    - all permits associated with the work
    - the additional physiological and psychological demands of the task
    - arrangements for emergency rescue
    - training.

    Guidance on how to conduct a risk assessment is available in the WorkSafe Victoria publication *Controlling OHS hazards and risks – a handbook for workplaces*.

General risk control duty

53. There is a general duty under the Regulations to control any risk associated with work in confined spaces so far as reasonably practicable.

Eliminating the need to enter the space

54. The primary duty is to eliminate any risk associated with work in a confined space. The first question to ask is: can the work be done another way without entering the confined space?

55. The work could be done from outside the 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
    - using a hook, long-handled clasp or magnet on a string to retrieve an object dropped into space.

Controlling the risk

56. If entering a confined space cannot be avoided, then a safe system for working inside the space needs to be in place. The identified hazards will help determine what controls are needed to minimise any risk associated with work in the confined space. Under the Regulations, the following must be taken into account when controlling confined space risks.

The nature of the space

57. The nature of a confined space may contribute to the risks associated with it. For example, consideration needs to be given to:

- the temperature in the space so that it will not result in heat stress
- providing adequate lighting where there is poor visibility.

The level of oxygen and atmospheric contaminants

58. The level of oxygen or atmospheric contaminants are a significant contributor to the risk of working in a confined space. For example, ensure that:

- the level of oxygen is maintained at a safe level and any atmospheric contaminants in the space are minimised by ventilating prior to and/or during entry (see paragraphs 82 to 85)
- any changes that may occur to oxygen or atmospheric contaminants are determined by testing the atmosphere (see paragraphs 95 to 105)
- where the atmospheric conditions can not be maintained at a safe level, appropriate respiratory protective equipment is provided (see paragraphs 86 to 92).

The work and work method

59. Consideration needs to be given to whether the work or work method will introduce any new hazards or contribute to the risks of working in the confined space.

60. Select a work method that:

- does not introduce ignition sources into a space that contains a flammable atmosphere
- 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
- eliminates the risk of engulfment.

61. 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.

Work done outside the confined space

62. 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.

63. All work near a confined space needs to be assessed to determine if that work will increase the risk of entering and working in the space. If it is determined that this work might increase the risk, the work needs to cease or the risk controlled.

The means of entry and exit

64. In taking the means of entry and exit into account, consider:

- the number, size and location of entrances and exits
- entry and exit routes
- equipment to be used to gain entry and exit
- whether entrances and exits are adequate to enable the rapid exit and rescue of employees from the space.

The type of emergency procedures required

65. Guidance on emergency, rescue and first aid procedures and equipment is provided on page 25.

Specific risk control duties

66. The following specific risk controls are also required under the Regulations.

Isolation

67. Mechanical and electrical isolation of equipment is essential if it could be operated inadvertently. If gas, fumes or vapour could enter the confined space, pipework needs to be physically isolated. In all cases, a check needs to be made to ensure the isolation is effective.

68. 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
- the use of electrical equipment.

69. Isolation measures such as locking, tagging, closing and blanking (see Figure 3) need to be supervised or verified by the person in control of the confined space at the time of entry. Isolation measures need to be supported by systems to ensure that the isolation measures are not removed until all work is completed and all employees have left the space.

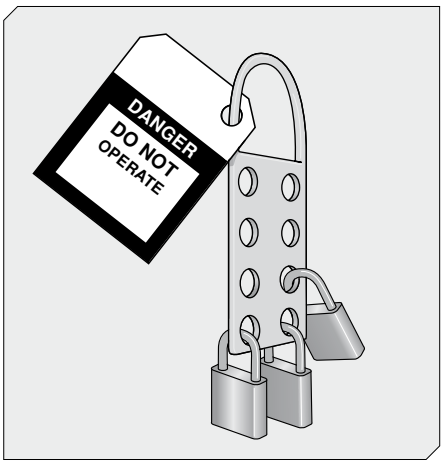


Figure 3: Example of tag and lockout with the padlocks of three employees.

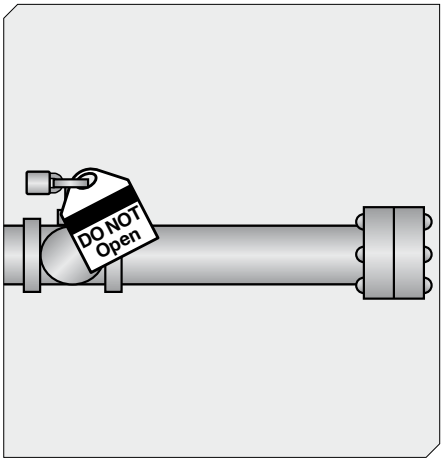


Figure 4: Open end of pipe capped. Nearest valve closed, locked and tagged.

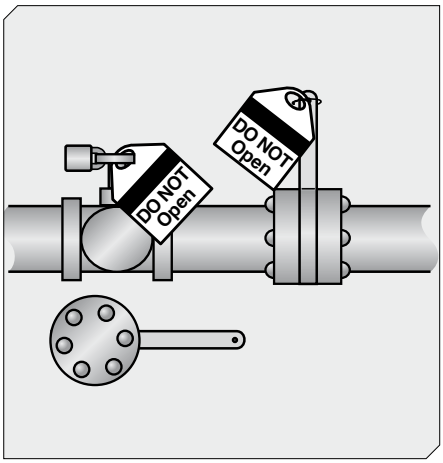


Figure 5: Insertion of full-pressure spade or blank. Nearest valve closed, locked and tagged. Spade is also tagged to indicate its purpose.

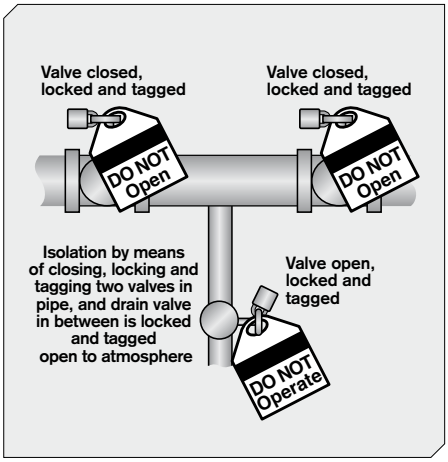


Figure 6: Closing, locking and tagging at least two valves in the piping leading to the confined space.

(i) Methods of isolation from materials, contaminants or conditions

70. Isolate 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 needs to be tagged to indicate its purpose. Blanks or caps need to be of a material that is compatible with the liquid, vapour or gas with which they are in contact. The material also needs to 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 needs to 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 also needs to be locked open to atmosphere as part of this method.

(ii) Methods of isolation from the activation or energising of plant or services

71. 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 employees are present, the possibility of movement needs to be prevented.

72. Equipment or devices with stored energy, including hydraulic, pneumatic, electrical, chemical, mechanical, thermal or other types of energy, need to be reduced to a zero energy condition. Where shafts, agitators, blades and other moving equipment are within the confined space, control measures such as chocking, wedging, chaining or removal of these parts needs to be considered.

73. Steps need to be taken to de-energise, lockout and tagout 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.

74. When a lock is used, the key needs to be kept in the possession of the person placing the lock. Spare keys should not be accessible except in emergencies. The tag needs to 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.

75. Examples where this procedure may be used include:

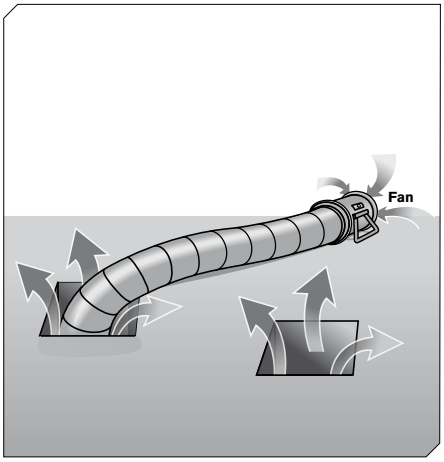
- an open circuit breaker or open isolating switch supplying electrical power to equipment with hazardous moving parts
- where a power source cannot be controlled readily or effectively, a belt or other mechanical linkage needs to be disconnected and tagged.

Atmosphere

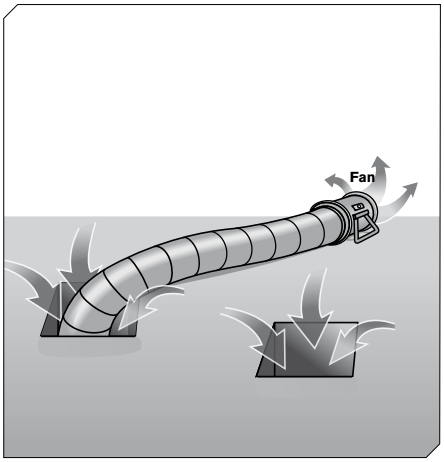
76. A safe atmosphere must be ensured, so far as is reasonably practicable, during work in a confined space. A safe atmosphere in a confined space is one that:
    - has a safe oxygen level
    - is free of atmospheric contaminants or contains atmospheric contaminants below their exposure standard (if any)
    - has any flammable gas or vapour in the atmosphere below 5% of its LEL.
77. Achieve a safe atmosphere within the confined space using methods such as cleaning, purging and ventilation.

Purging

78. Purging is done using an inert gas, such as nitrogen, to clear flammable gases or vapours before work in the confined space begins.
79. After purging, the confined space needs to be adequately ventilated with sufficient fresh air to ensure that the inert gas is removed. Purging needs to 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.
80. When flammable contaminants are to be purged, purging and ventilation equipment designed for use in hazardous areas needs to be used. AS 2430.3.1 *Classification of hazardous areas – Examples of area classification – General* defines a hazardous area as an area in which an explosive atmosphere is present, or may be expected to be present, in quantities that require special precautions for the construction, installation and use of potential ignition sources.
81. The 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.



Dilution ventilation.



Local exhaust ventilation.

Figure 7: Examples of mechanical ventilation.

Ventilation

82. 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.

83. If the confined space has sufficient openings then natural ventilation may be adequate, but in most cases mechanical ventilation is likely to be needed (see Figure 7). Consideration also needs to 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.

84 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 (eg 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.

85. 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 needs to:

- 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.

Respiratory protective equipment

86. If it is not reasonably practicable to ensure the confined space contains a safe oxygen level, or safe levels of atmospheric contaminants, then appropriate respiratory protective equipment (RPE) needs to be provided.

87. RPE refers to a range of breathing equipment, including air-supplied and self-contained breathing apparatus. Employers need to determine the appropriate RPE based on the level and type of contaminants, and the work to be done. Whenever there is any doubt about the type of RPE required, a conservative approach needs to be adopted (ie use air-supplied RPE).

88. Employers need to consider the guidance in AS/NZS 1715 – *Selection, use and maintenance of respiratory protective devices* and ensure that the RPE fits properly and is safe to use.

89. Where a safe oxygen level cannot be established and maintained, an employer must ensure that suitable air-supplied RPE is used.

90. Where any contaminant in the space has an exposure standard, and it is not reasonably practicable to reduce the concentration of a contaminant to or below the exposure standard for that contaminant, an employer must ensure that employees use appropriate RPE (air-supplied or air purifying), having regard to the selection guidance AS/NZS 1715 *Selection, use and maintenance of respiratory protective equipment.*

91. Where there is uncertainty about the concentration of atmospheric 'contaminants' (due to inaccessibility, no appropriate testing methodology or the work activity generates atmospheric contaminants, such as cleaning processes), an employer needs to ensure that air-supplied RPE is used.

92. Where an atmospheric contaminant does not have an exposure standard, an employer needs to ensure that air-supplied RPE is used unless a lower level of protection will be adequate to ensure health and safety.

Fire and explosion

93. Where a flammable atmosphere may exist in a confined space, all reasonably practicable steps, including cleaning, purging and ventilation, need to be taken to achieve an atmosphere that is not likely to be flammable. If, after taking such steps, a flammable atmosphere is still present, then employees may only enter the space if the gas or vapour concentration is less than 10% of its LEL.

94. Further, if the concentration of flammable vapour is equal to or greater than 5%, but less than 10% of the LEL, then employees may only enter and remain in the space if a suitably calibrated flammable gas detector is used in the space to continuously monitor the flammable vapour concentration. If at any time the flammable vapour concentration reaches 10% or more of its LEL, the confined space must be immediately evacuated.

Testing the atmosphere

95. To effectively control the atmospheric hazards associated with work in confined spaces, it is necessary to quantify as far as possible, the level of oxygen, atmospheric contaminants and any flammable gas or vapour present in the space. Consequently, testing the atmosphere in a confined space is a routine part of determining appropriate risk controls.

96. Testing needs to be carried out by a competent person using a suitable, correctly calibrated gas detector.

97. Where relevant, the atmosphere in a confined space needs to be tested for:

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

98. 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.

(i) Where to test

99. Initial testing needs to be done from outside the confined space by inserting a sample probe at appropriately selected access holes, nozzles and openings. As it is possible for contaminants to settle at different levels, the top, middle and bottom of the space needs to be tested (see Figure 8). 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. Tests need to be made at a sufficient number of points to accurately reflect areas of the space that are likely to be accessed.

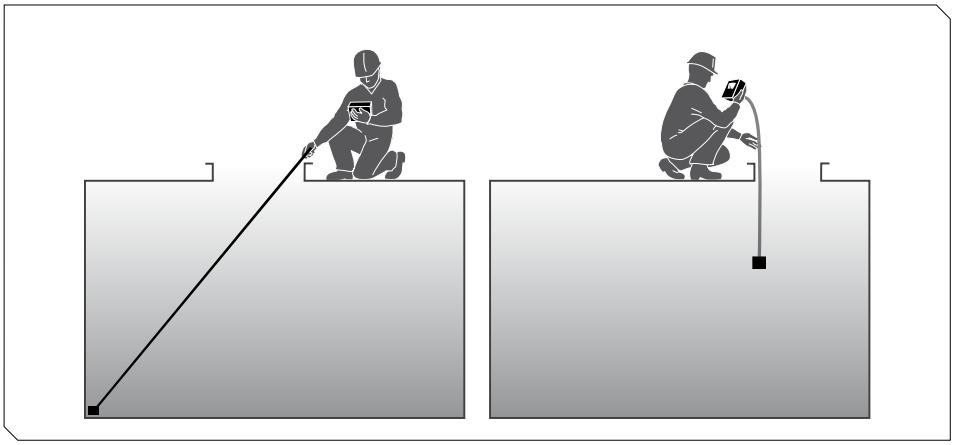


Figure 8: Atmospheric testing of remote regions and different levels within the confined space.

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

(ii) When to test

101. Testing needs to be done immediately prior to entry, before an entry permit is issued, and may need to be conducted at other times depending on the circumstances.

102. The results of the testing may indicate the need to purge or ventilate the space and re-test prior to entry.

103. Re-testing and continuous monitoring of the atmosphere may be necessary due to the work being done or the disturbance of hazardous material, such as sludge.

104. The space must be continually monitored where the concentration of flammable gas or vapour in the space is equal to or greater than 5% but less than 10% of its LEL – see page 21.

(iii) Recording of test results

105. Test results need to be recorded on the written entry permit.

Figure 9: Typical confined space sign.

Signage

106. Signs need to 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. See Figure 9 for a typical example of an appropriate sign.

107. 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.

108. All reasonable steps need to be taken to prevent unauthorised entry to a potential confined space by using fixed barriers, locks or other suitable security devices. Signposting alone should not be relied on to prevent unauthorised entry.

Confined space entry permit

109. Employers must ensure that employees do not enter a confined space unless they have been issued with a confined space entry permit for the space.

110. 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 a responsible person has checked and authorised the entry to the confined space and it is safe to proceed.

111. Employers must ensure that a confined space entry permit is issued for each confined space entry. Each permit only applies to one confined space and allows one or more employees to enter that space.

112. The confined space entry permit **must** list:
    - The 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.
    - The measures to control the risk:
        - List the control measures that need to be implemented before work commences. These need to include 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. These need to include ventilation, continuous monitoring, RPE and PPE.
        - 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 name of any employee permitted to enter the space
    - The name of any standby person assigned to the space
    - The 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 needs to 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.

113. The entry permit needs to be displayed in a prominent place to facilitate signing and clearance. A copy of the entry permit is normally displayed at the entry point where the standby person is stationed.

114. Each confined space entry permit must be kept for 30 days after its expiry date.

Entry to and exit from the confined space

115. For the entire period that the confined space entry permit is valid, employers must have procedures to ensure that they know when any employee is in the space. Appropriate systems to indicate when employees are in the space include the use of tags, a system of signing in and out, or having a standby person record who is in the space.

116. Employers must also have a written record that all employees have exited the confined space on completion of the work. One option could be to integrate a system so that employees working in the space sign in and out on the entry permit.

Communication and initiation of emergency procedures

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

118. Employers can comply with this regulation by assigning an appropriately trained person to act as a standby person. A standby person continuously monitors the wellbeing of those inside the space, and initiates appropriate emergency procedures when necessary.

119. However, employers can use alternative means to comply with the requirement of maintaining continuous communication, provided that all the elements below are met.

What must be achieved

Continuous communication

120. Continuous communication is necessary to:

- monitor the status of employees entering the confined space under the entry permit
- alert employees in the space of the need to evacuate
- initiate emergency procedures in a timely manner.

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

Ability to initiate appropriate emergency procedures

122. The standby person needs to be trained and rehearsed in all aspects of emergency procedures, including how, when and what procedures will be initiated.

123. While people's first instinct in an emergency may be to enter the confined space to help the injured person, the standby person should never enter the space to attempt rescue.

124. The standby person needs to have the authority to order employees to exit the space should any hazardous situation be identified. The standby person needs to have a means of calling for assistance.

125. Where appropriate, the standby person needs to be able to operate and monitor plant used to control risk including:

    - atmospheric monitoring equipment
    - ventilation devices
    - other equipment, such as fall protection or retrieval apparatus, air-supplied respirator
    - air lines and air compressors.

Emergency procedures

126. 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.

127. Suitable emergency procedures will depend on the nature of the confined space, the risks identified and the likely nature of an emergency rescue.

Planning, establishment and rehearsal of emergency, rescue and first aid procedures

128. Employers must establish procedures for the control and management of an emergency in a confined space, including procedures for:

    - the rescue of any person from the confined space
    - first aid to be provided to any person in the confined space and after rescue.

    When establishing emergency procedures, employers must take into account:

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

129. Consideration also needs to be given to:

- **The location of the confined space** – The geographic location of the space, its accessibility in an emergency and the distance to appropriate medical facilities all need to be taken into account.
- **Communications** – How can employees 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** – The provision of suitable rescue and resuscitation equipment will depend on the potential emergencies identified. Training in the correct operation of rescue equipment is essential where such equipment is provided. Selected rescue equipment needs to be in close proximity to the confined space and able to be used immediately.
- **Capabilities of rescuers** – Rescuers need to be properly trained, sufficiently fit to carry out their task and capable of using any equipment provided for rescue (eg breathing apparatus, lifelines and fire-fighting equipment). Rescuers also need to be protected against the cause of the emergency.
- **First aid procedures** – Trained first aiders need to be available to make proper use of any necessary first aid equipment provided.
- **Local emergency services** – If local emergency services are to be relied upon for rescue:
  a. how will the local emergency services (eg fire brigade) be notified of an incident?
  b. what information about the particular dangers in the confined space will be given to them on their arrival?
  c. 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?
- **Rehearsal** – The emergency procedures must be rehearsed with relevant employees to demonstrate that the specific rescue plan for the space is effective.

Respiratory protective equipment

130. Where a person inside a confined space has been overcome, it needs to be assumed that entry for rescue is unsafe without breathing apparatus.

131. Employers must ensure that employees performing rescue work wear air-supplied RPE 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 level of any contaminant.

Entrance and exit size to enable rescue

132. Potential problems with the size of entrances and exits need to 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 needs to be increased, or if this is not practicable alternative safe means of entry and exit need to be provided.

Maintenance of plant

133. Employers must ensure that emergency equipment is maintained so that it is fit for its purpose. This may include cleaning, inspection for any defects, testing, and repair or replacement of worn or defective parts.

Reviewing risk controls

134. It is important to monitor risk controls to ensure they remain effective. Employers must review and if necessary revise their risk-control measures:

- when changed circumstances indicate that the measures may no longer be adequate to control the risks (such as when new equipment is used or an incident occurs), or
- after having received a request based on reasonable grounds from an HSR.

135. 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. Examples of control measures include:

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

Information, instruction and training

136. Employers need to provide employees and their supervisors with the skills and knowledge they need to understand the hazards associated with working in the confined space, follow safety procedures, and use the control measures implemented for their protection.

137. Training needs to be given to employees who:

- enter or work in confined spaces
- undertake hazard identification and risk control in relation to confined spaces
- are on standby
- are involved in rescue and first aid procedures for confined spaces
- issue entry permits
- manage or supervise people working in or near confined spaces, including any contractors
- maintain equipment used in relation to work in confined spaces
- wear and maintain PPE for use in confined spaces.

Training must cover:

- the nature of any hazards and risks associated with the confined space
- the need for and proper use of measures to control risk
- the selection, use, fit, testing and storage of any PPE
- the content of any relevant confined space entry permit
- the emergency procedures.

Retraining or refresher training should be provided as appropriate for a particular workplace. The frequency of this training should be determined having regard to the above dot points and the frequency with which employees are required to carry out tasks associated with entry to or work in confined spaces.

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The compliance framework

Appendix B
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Appendix C
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Appendix D
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Appendix E
Confined spaces definition template

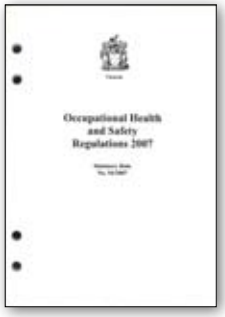
Appendices

Appendix A – The compliance framework

Occupational Health and Safety Act 2004

Act No. 107/2004

The ***Occupational Health and Safety Act 2004*** (the OHS Act) sets out the key principles, duties and rights in relation to occupational health and safety (OHS).



Occupational Health and Safety Regulations 2007

Statutory Rule No. 54/2007

The **Occupational Health and Safety Regulations 2007** (the Regulations) specify the way in which a duty imposed by the OHS Act must be performed, or prescribe procedural or administrative matters to support the OHS Act (eg requiring licences for specific activities, the keeping of records or giving notice).

Compliance codes provide practical guidance to duty holders. If a person complies with a provision of a compliance code, they are deemed to comply with the OHS Act or Regulation duty covered by the code provision. However, compliance codes are not mandatory and a duty holder may choose to use some other way to achieve compliance.

WorkSafe Positions are guidelines made under section 12 of the OHS Act that state how WorkSafe will apply the OHS Act or Regulations or exercise discretion under a provision of the OHS Act or Regulations. WorkSafe Positions are intended to provide certainty to duty holders and other affected parties.

Non-statutory guidance includes information published by WorkSafe aimed at building people's knowledge and awareness of OHS issues, risks to health and safety, and the disciplines and techniques that can be applied to manage and control risks. Non-statutory guidance is not mandatory, nor does it provide any 'deemed to comply' outcomes for duty holders. This guidance does, however, form part of the 'state of knowledge' about OHS.

Appendix B – Definitions

Air-supplied respiratory protective equipment

A device that supplies air to the wearer from a source other than the ambient atmosphere.

Atmospheric monitoring

A procedure whereby air is sampled within the breathing zone of a person to evaluate the person's exposure to airborne contaminants.

Breathing zone

A hemisphere of 300mm radius extending in front of a person's face measured from the mid-point of an imaginary straight line joining the ears.

Confined space

A space in any vat, tank, pit, pipe, duct, flue, oven, chimney, silo, reaction vessel, container, receptacle, underground sewer or well, or any shaft, trench or tunnel or other similar enclosed or partially enclosed structure, if the space:

(a) is, or is intended to be, or is likely to be, entered by any person; and

(b) has a limited or restricted means for entry or exit that makes it physically difficult for a person to enter or exit the space; and

(c) is, or is intended to be, at normal atmospheric pressure while any person is in the space; and

(d) contains, is intended to contain, or is likely to contain –

  (i) an atmosphere that has a harmful level of any contaminant; or

  (ii) an atmosphere that does not have a safe oxygen level; or

  (iii) any stored substance, except liquids, that could cause engulfment –

but does not include a shaft, trench or tunnel that is a mine or is part of the workings of a mine.

Confined space entry permit

A confined space entry permit issued by an employer in accordance with regulation 3.4.15 (employer to retain entry permits).

Contaminant

Any substance that may be harmful to health or safety.

Emergency procedures

The procedures established by an employer under regulation 3.4.21 (emergency procedures – personal protective equipment).

Emergency service

(a) Country Fire Authority

(b) Metropolitan Fire and Emergency Services Board

(c) Metropolitan Ambulance Service

(d) Rural Ambulance Victoria

(e) Victoria State Emergency Service, or

(f) Victoria Police.

Emergency service employee

(a) an officer or member of a metropolitan fire brigade

(b) an officer or member of an urban fire brigade or rural fire brigade within the meaning of the Country Fire Authority Act 1958

(c) an employee of the Metropolitan Ambulance Service

(d) an employee of Rural Ambulance Victoria

(e) a member of the Victoria State Emergency Service, or

(f) an officer or other member of Victoria Police –

but does not include a volunteer.

Exposure standard

An airborne concentration of a particular substance in a person's breathing zone, as set out in the Hazardous Substances Information System (HSIS) published by the Australian Safety and Compensation Council (ASCC).

Lower explosive limit (LEL)

The concentration of a flammable gas or vapour in air below which the propagation of a flame does not occur on contact with an ignition source.

Personal protective equipment (PPE)

Includes respiratory protective equipment and personal protective clothing.

Purging

The method by which any contaminant is displaced from a confined space.

Relevant employee

(a) any employee required to enter a confined space

(b) any employee who has any function in relation to work in a confined space or the emergency procedures established under regulation 3.4.21 (Emergency procedures – personal protective equipment) but who is not required to enter the space, or

(c) any person supervising any employee referred to in paragraph (a) or (b).

Respiratory protective equipment (RPE)

A range of breathing equipment, including air-supplied and self-contained breathing apparatus.

Safe oxygen level

An oxygen content in air under normal atmospheric pressure that:

(a) is equal to or greater than 19.5% by volume (equivalent to a partial pressure of oxygen of 19.8 kPa), but

(b) is equal to or less than 23.5% by volume (equivalent to a partial pressure of oxygen of 23.9 kPa).

Work in a confined space

Work in a confined space by an employee and includes entry to and exit from a confined space by an employee.

Appendix C – Consultation

By law, employers must consult with employees on a range of matters that directly affect (or are likely to directly affect) their health and safety, so far as is reasonably practicable.

Consultation must involve sharing information with employees, giving the employees a reasonable opportunity to express their views and taking those views into account.

Where employees are represented by HSRs, these representatives must be involved in the consultation, so far as reasonably practicable.

The law sets out specific requirements on how HSRs are to be involved in consultation. These are as follows:

- Provide HSRs with all the information about the matter that the employer provides, or intends to provide, to employees. If it is reasonably practicable, the information must be provided to the HSRs a reasonable time before it is provided to employees.
- Invite the HSRs to meet with the employer to consult on the matter or meet with the HSRs at their request.
- Give the HSRs a reasonable opportunity to express their views on the matter and take those views into account.

The employer must include independent contractors and their employees in the consultation, so far as is reasonably practicable, if the employer has, or should have, control of a relevant matter that affects their health and safety.

Consultation is required when:

- identifying or assessing hazards or risks
- making decisions on how to control risks
- making decisions about the adequacy of facilities for employee welfare (such as dining facilities, change rooms, toilets or first aid)
- making decisions about procedures to:
  - resolve health and safety issues
  - consult with employees on health and safety
  - monitor employee health and workplace conditions
  - provide information and training
- determining the membership of any health and safety committee in the workplace
- proposing changes that may affect employee health and safety, such as changes to:
  - the workplace
  - plant, substances or other things used in the workplace
  - the work performed at the workplace
- doing any other thing prescribed by the Regulations.

In practice, this means that when planning to implement measures identified in this compliance code, or when making decisions to implement alternative measures to those specified in this compliance code, consultation must take place.

Appendix D – Examples of confined space incidents

Some confined space incidents that have occurred in Australia and overseas are described below.

Fatality in LPG tank from oxygen deficiency

A worker collapsed in an LPG storage tank at a service station due to lack of oxygen. The tank had been purged with nitrogen several times and left to stand for an hour. The supervisor then put his head in the opening of the tank and sniffed the atmosphere but did not detect the smell of LPG. An employee then entered the tank without any safety equipment. Shortly afterwards he collapsed. A second person then entered the tank to attempt a rescue and also collapsed. The supervisor then introduced pure oxygen instead of air into the tank (this was dangerous as it added to the risk of explosion). The service station employee survived, although there was a delay during the rescue process due to difficulties of access. The first man to collapse in the tank was rescued, but died nine months later in hospital from bronchopneumonia and brain damage as a result of the accident.

Brothers die as a result of carbon monoxide poisoning

Two brothers died of carbon monoxide poisoning in an underground water tank on their father's farm. They had been using two petrol-driven pumps over two days to pump the water out. On the second day, when the water level was lower, it became apparent that neither of the pumps was fitted with a hose long enough to reach the bottom of the tank. To overcome the problem, one pump was lowered about a metre into the tank and secured by ropes. One brother got into the tank when it was nearly empty. He collapsed and the other brother and a friend quickly climbed in and attempted to rescue him. The second brother collapsed. The friend attempted to rescue the two brothers, but he was also affected by fumes and had to get out of the tank. Neighbours pulled the two brothers from the tank, but both were dead on arrival at the local hospital.

Tests later revealed that the petrol-driven pump was discharging a very high level of carbon monoxide from its exhaust. Calculations confirmed that a lethal concentration of carbon monoxide would be generated in quite a short period of time after lowering the pump into the tank.

Hazardous atmosphere and oxygen deficiency fatality in sewer

A water board employee was working to clear a blocked sewer. The equipment the employee was using to unblock the sewer became caught and the employee entered the sewer to free the equipment. The clearing of the blockage produced a gush of water and released sewerage gases, and the employee collapsed as he was about to climb out of the access hole. A boy on work experience with the employee attempted to pull him out but was unsuccessful. The employee fell back into the sewer and the boy went to get help. The employee was unable to be resuscitated after being pulled from the sewer.

Employees overcome

Two employees suffered carbon monoxide poisoning after they were overcome by smoke while in a silo that contained smoking wood chips. The silo had a side door opening onto a landing about three metres above the floor, and access was provided by a steel ladder. A fire erupted in the silo, which was extinguished by employees from outside the silo. After about 30–45 minutes, three employees entered the silo to shovel out the burnt wood chips. As a result of exposure to the atmosphere in the silo, one employee became dizzy, and had to be given oxygen and taken to hospital. Work then continued in the silo until another employee became dizzy and also had to be given oxygen and hospitalised.

Lucky escape

Two contractors were inside a tank applying glue to sheets of rubber, which were then attached to the walls of the tank. The walls of the tank also had glue applied to them. The two employees were overcome by fumes generated by the glue – one collapsed and the other became disorientated after he removed his face mask to help his co-worker. One of the employees had to be helped from the tank, while the other was dragged out. A similar incident had occurred the previous week.

Engulfment incident

A large bin used by a poultry feed processing firm to load poultry feed into a weighing hopper became blocked. A worker wearing a safety harness entered the bin to clear the blockage. While clearing the blockage the worker fell, went through approximately three metres of feed, and dropped out into the weighing hopper below. A standby person opened the weighing hopper to empty it of feed, and the worker was then winched back out of the bin. Subsequently, the firm formulated a different feed to reduce the number of bin blockages, considered safer methods of clearing blockages to reduce the need to enter the space and put in place risk-control measures for further entries into the bins.

Degreasing fatality

A partner in a metal finishing firm was found collapsed inside a degreasing tank containing trichloroethylene. The tank measured approximately 0.7m x 2m x 2m. The partner had apparently decided to empty and de-sludge the tank alone. He entered the tank without breathing apparatus (none was available) and without leaving the tank to ventilate. The tank had not been emptied in six months. The partner subsequently died.

Welding incident

While welding inside a tank, a man vomited, experienced dizziness and had difficulty breathing. WorkSafe's investigation found that procedures dealing specifically with welding in the confined space of the tanks were not in place, and a hazard identification or risk assessment had not been done. There was only one ventilation point (the point of entry), supervision was inadequate, there had been no induction and the injured man was not wearing protective personal equipment (PPE). Procedures were put in place after the incident to control the risks of working in confined spaces.

Appendix E – Confined spaces definition template

Is the space a confined space?

Description of space	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 enclosed or partially enclosed?	Is it likely to be entered and is it at normal atmospheric pressure?	Does the space have a limited or restricted entry or exit?	Does the space contain, is it intended to contain, or is it likely to contain:			
				harmful level of atmospheric contaminants?	an unsafe oxygen level?	substances that could cause engulfment?	

(i) An answer of no to any of the four questions does not necessarily mean that the space is safe to enter. The general provisions of the *Occupational Health and Safety Act 2004* need to be applied.

(ii) Where there is uncertainty as to whether a criteria is met, then more information is required to remove the uncertainty, or the criteria should be deemed to be met and the Confined Spaces Regulations applied.

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